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**PLENARY SESSION – KEYNOTE SPEAKERS**



# The European Dairy Sector in a new Era

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**Annotation:** While milk output in the EU has been constrained by milk quotas for 31 years, the quota system ceased as a constraint in April 2015. The paper describes the motivations for the removal of the milk quota system. The new era of milk output without quota constraints will result in both opportunities and challenges for the EU dairy industry. The opportunities will arise from the expanding global dairy market. The challenges will involve the ability of the EU dairy industry to achieve international competitiveness in servicing the increased global demand for dairy products. The paper examines these challenges and opportunities in detail. This paper will explore these issues with a primary focus on the prospects for the EU dairy industry over the next decade.

**Key words:** Milk production, milk consumption, milk quotas, dairy sector

**JEL classification:** O13, Q13, Q18

## 1 Introduction

Following a number of years of gradual production increases, the European Union (EU) allowed the milk quota system to expire on April 1<sup>st</sup> 2015. The EU dairy sector today is very different to that which existed when milk quotas were introduced in 1984. Since then, the EU has enlarged considerably to include most of the Nordic region, as well as much of Central and Eastern Europe. Across the EU there has been a decrease in cow numbers at the MS level, the number of dairy producers has fallen due to farm consolidation and there has been an associated increase in average dairy farm output.

Few milk producers welcomed the milk quota system at the time of its introduction (Adams, 2015). Dairy farmers had benefitted from rising dairy prices and rapid expansion in production through the 1970s and early 1980s. Farm investments had been undertaken with further expansion in mind and suddenly this ground to a halt with the imposition of the quota system. But the dairy policy at the time could not continue. Milk prices were running at artificially high and unsustainable levels, propped up by increasingly expensive expenditure on intervention and disposal measures in the dairy sector, paid for from the budget of the Common Agricultural Policy (CAP) As a result, EU dairy farmers faced either the possibility of severe milk price reductions or the imposition of a milk quota (Donnellan et al; 2015).

The introduction of production quotas were part of a wider range of market management tools used in the EU dairy sector. For much of the milk quota era the system protected the milk prices and incomes of EU dairy farmers, but it also limited the potential for expansion and opportunities for new entrants.

Despite their initial opposition, many EU dairy farmers would become advocates of the quota system in the 1980s and into the 1990s, since it offered stable prices in an era when production costs were actually falling, while others would remain opposed (Elgström and

Jönsson, 2005). With technology adoption, farmers could drive down their costs and increase their income. However, input prices began to rise in the 1990s leading to the so called price cost squeeze. While production was profitable, margins per litre were falling and the quota policy made it difficult to offset lower profit per litre through increased production.

While the EU's share of the international dairy market declined, attention was increasingly turning to New Zealand and the rapid expansion in milk production and dairy product exports that it had achieved since milk quotas had been introduced in the EU (Muirhead, 2014). Comparisons were made between the dynamic developments in the New Zealand dairy sector and the static milk production and growing income problems in dairy farming in the EU. Low milk prices in New Zealand required a vigorous drive to limit production costs. But low profit per litre in New Zealand was offset by increasing scale and importantly scale was not constrained by quotas.

Historically the EU has produced more milk than it could consume and therefore third country exports, generally to lower priced markets, were necessary. Over the years, the EU dairy market has been increasingly influenced by international supply and demand conditions and milk price volatility at the farm level has become an increasing concern for the EU's dairy farmers (Thiele et al, 2013; O'Connor et al, 2015).

By the middle of the 2000s global economic growth has introduced dairy products into the diet of a growing middle class in developing countries, which do not have a strong tradition in dairy production. With increasing international demand for dairy products, there are now more export opportunities for the EU dairy sector. With rising international dairy prices over the last ten years, the gap between dairy prices in the EU and on the world market has closed considerably. Against this background, EU dairy farmers began to question the virtues of the retention of the milk quota system. A view began to emerge that much of the EU dairy sector would benefit from milk quota elimination.

Studies (Chantreuil et al, 2008; Réquillart et al, 2008; IPTS, 2009) indicated that the removal of the milk quota system would have little impact on the EU dairy sector, with only a minor change in EU dairy production envisaged. Ultimately, it was agreed that the milk quota system should be abolished. Through a series of small quota increases a so called soft-landing solution designed to provide a smooth transition to a post milk quota dairy sector was developed.

In spite of the enthusiasm for milk quota removal, dairy farmers across the EU will not look back at 2015 with pleasant memories. Milk prices have fallen substantially and profitability in the sector in many EU member states (MS) is at its lowest since 2009. Is the current predicament a short term phenomenon? Can it be linked to the removal of the milk quota system or are other factors at play? Looking more generally at prospects for the EU dairy sector over the next 10 years, can we be confident about future prospects? Is the dairy sector in some MS likely to do better than elsewhere and if so why? Using expert knowledge developed from commodity sector modelling and the results of a survey of market experts, this paper explores likely developments in the dairy sector across the EU, including the challenges and opportunities that are likely to emerge. Section 2 considers background developments in the EU dairy sector, while Section 3 considers how the sector may develop over the next decade or so. Section 4 draws summary conclusions.

## 2 Materials and Methods

### 2.1 Heterogeneity in the EU dairy sector

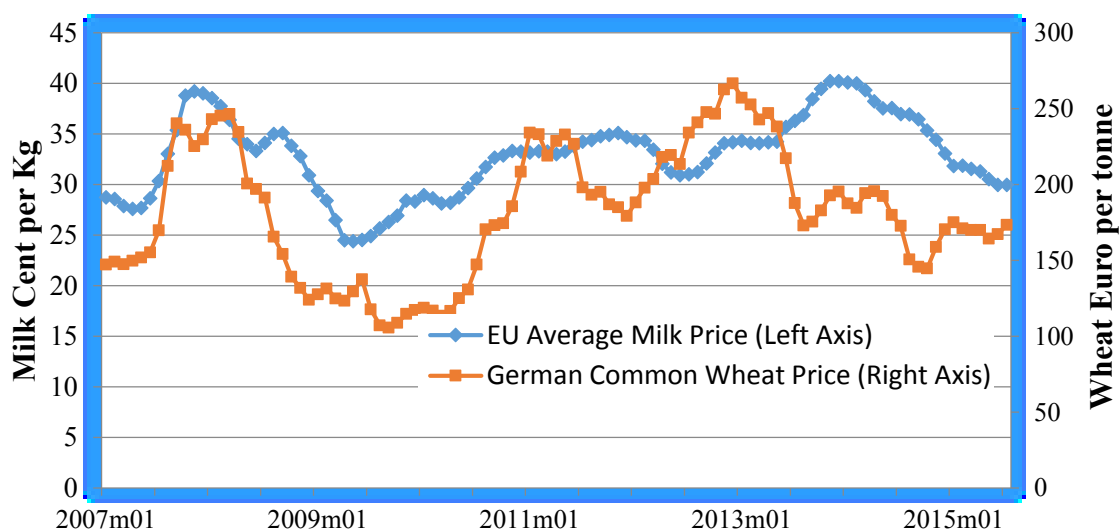
The global dairy market has been subject to strong consumption growth in recent years, driven by a growing world population, rising real incomes and consumer trends in developing countries which favour the increased consumption of dairy products. Dairy products also have a relatively limited number of less expensive substitutes, which means that higher prices do not destroy demand growth.

Consumption growth is strongest in regions globally where dairy production is not traditional and producers in these regions have been unable to expand production at a rate that is in line with the growth in local demand. This has created increased international export opportunities for dairy products and has led to an increase in international dairy product prices over the last decade. Regions of the world with a surplus in milk production such as the EU, US and Oceania have benefitted from these export opportunities, albeit in the case of the EU relatively static production surplus has limited the capacity to exploit these opportunities.

EU farm milk and feed prices are presented in Figure 1. Since early 2014 EU and international farm milk prices have fallen sharply from a record price peak. A favorable milk to feed price ratio in 2013/2014, combined with favorable weather led to a strong increase in milk production in key export regions, such as New Zealand. There was also a substantial increase in much of the EU, with annual milk production up by close to 5 percent in 2014. This increase came from a combination of production growth in Member States (MS) where the quota has not been binding and production in excess of quota in MS where the milk quota was normally binding.

The removal of the milk quota in 2015 has been greeted with mixed sentiment across the EU. It is regarded as a growth opportunity by some MS and is considered a threat to domestic production in other MS. Quota elimination is occurring against a backdrop of international market volatility, with considerable year to year variations in dairy product, farm milk prices and farm production costs. There is therefore also some concern that quota elimination will exacerbate milk price volatility within the EU over the medium term.

Fig. 1. Milk price and feed cost volatility in the EU



Source: European Commission 2015a; 2015b

EU milk production has grown while the EU has expanded over the last decade. MS milk quotas have been increased annually in the run up to elimination in 2015. However, for much of the last decade milk production levels have been static or declining in some MS, notably, Bulgaria, Greece, Hungary, Portugal, Romania, Slovakia, Slovenia, Sweden and the United Kingdom. The strong milk prices of 2014 have reversed this trend, but this is likely to be only temporary. This failure to fill the milk quota at the MS level is due to exits, a lack of new entrants, and limited production growth from the remaining producers.

At the processing level dairy product portfolios also differ between the MS, with considerable volumes of milk devoted to higher value added and specialized dairy products in parts of the EU15 and production directed more towards generic dairy commodities elsewhere. In general the EU15 has more modern, larger scale, more efficient milk processing facilities than that rest of the EU28.

Variations in farm scale across the EU are detailed in Table 1. Farms in the traditional EU15 are much larger on average and have higher yields than in the EU10 (the 10 Member States that joined in 2004), and EU2 (Bulgaria and Romania). In 2011, the average specialist dairy farm in the EU15 had about 54 dairy cows, with a milk yield of 7,337 kg/cow. Overall, many differences exist across the MS on both the production and consumption side. All of these factors suggest that quota elimination will not have a uniform impact across the EU.

**Table 1.** Herd size, milk yield and average milk production per farm in the EU in 2011

	Average Herd Size	Average Milk Yield	Average Production
	cows	kg	litres
EU15	54	7,337	380,000
EU10	19	5,665	105,000
EU2 (Bulgaria & Romania)	< 5	3,445	15,000

Source: European Commission 2013

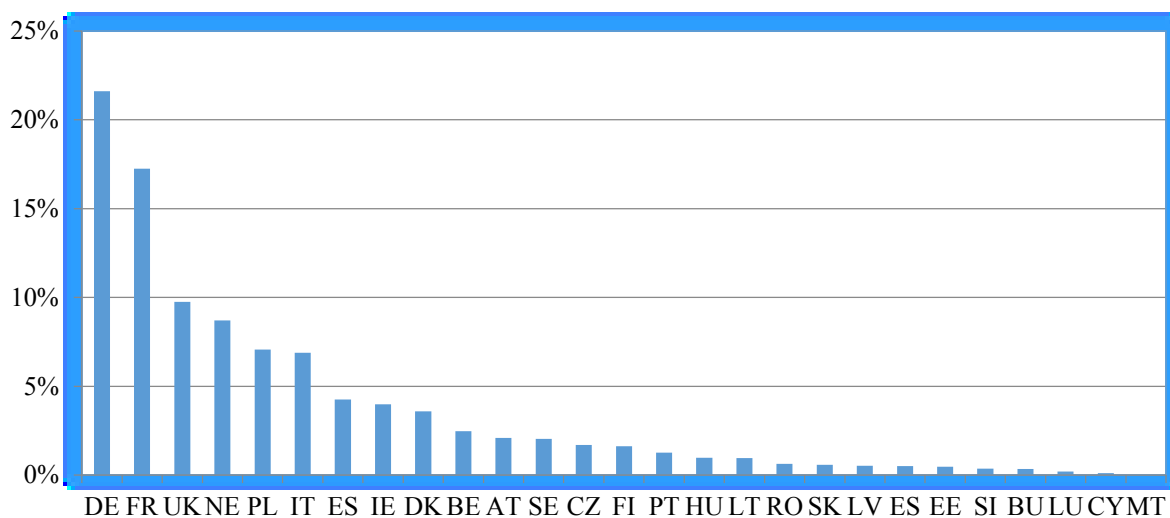
## 2.2 Distribution of EU milk production

The distribution of milk production across the EU27 is not uniform, with larger MS and MS located along a central latitude, with a climate that favors grass production, typically having a higher share of EU milk production. As illustrated in Figure 2, over 70 percent of milk production is produced in six MS; Germany, France, United Kingdom, Netherlands, Poland and Italy.

Most EU milk production is strongly dependent on concentrate feed, with cows housed for much or even all of the year. But there are also EU regions where grass represents the main portion of the diet. Such regions typically have lower production costs, since grass is a cheaper feed than concentrates. Production is likely to expand where costs of production are lower i.e. regions that favour grass production. The milk price farmers receive is also a critical consideration in determining competitiveness. There is a large range in farm milk prices across MS, with for example average prices in recent years typically ranging from 25 to 40 cent/kg, as illustrated in Figure 3.

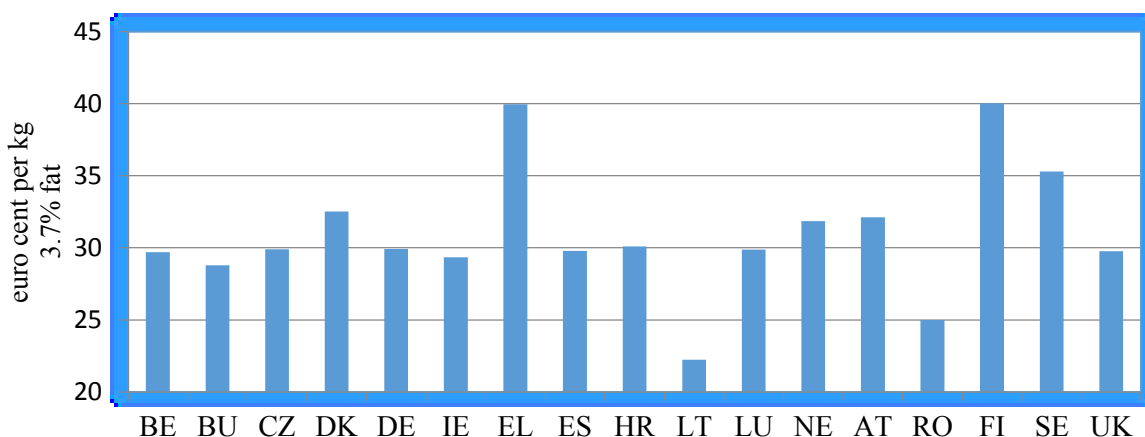


Fig. 2. Share of EU27 milk production 2013



Source: Eurostat 2014

Fig. 3. Farm milk prices - 5 year average for selected member states (2009-2013)



Source: European Commission (2014)

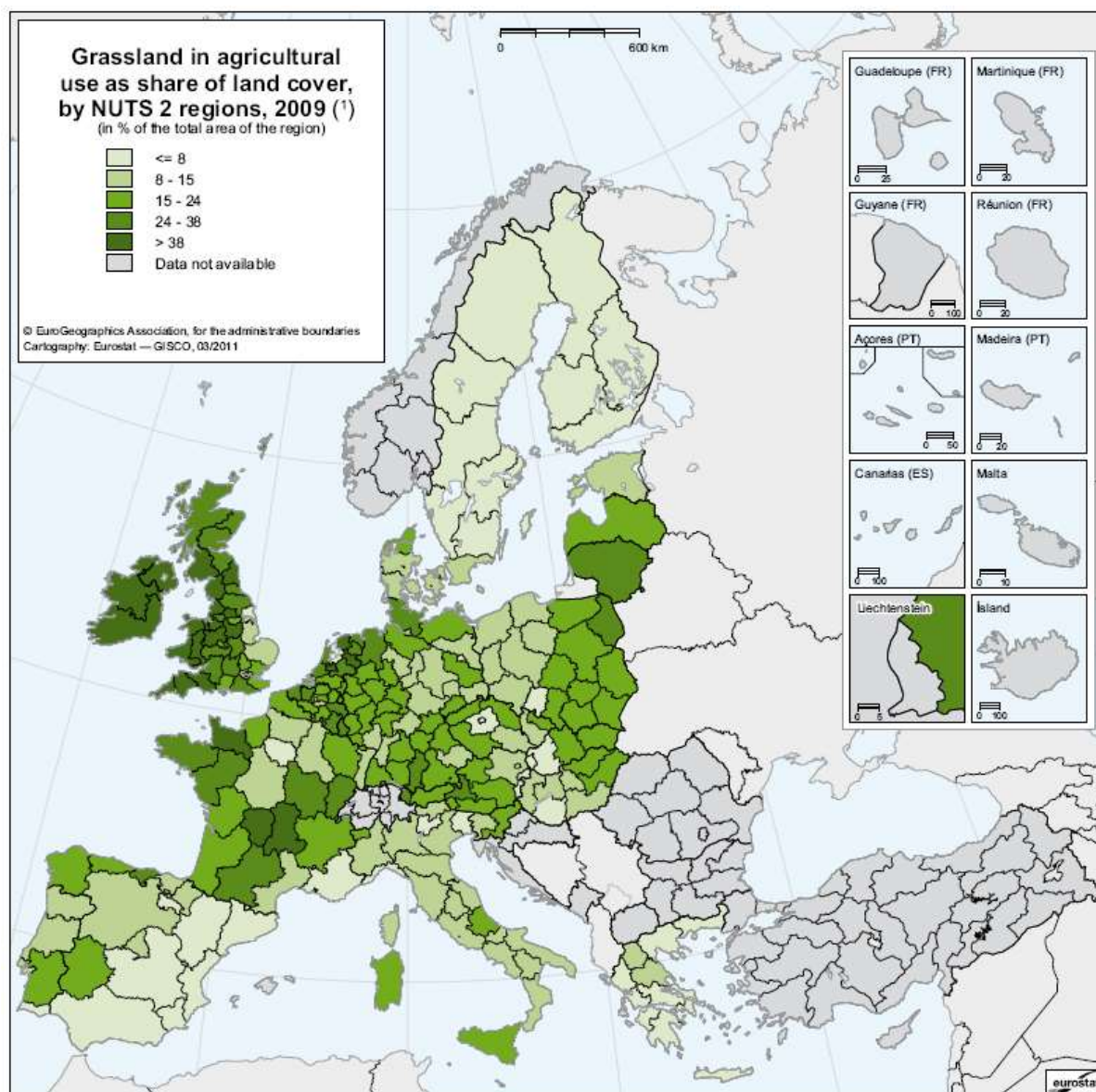
Europe's grasslands are mainly concentrated in regions with less fertile soils and across the Atlantic seaboard of northwestern Europe, with high concentrations of grassland in Ireland, the United Kingdom, parts of France and Denmark, the Low Countries, Austria and parts of Poland (see Figure 4). In these regions, typically there is high rainfall throughout the year and a mild winter. Harsher climate conditions in northern and southern Europe are less suited to grassland as the climate is either too arid or too cold.

There is a considerable variation in margin per hectare in dairy farming across the EU. Evidence from the Farm Accountancy Data Network (FADN) indicates that the best performing regions have either:

- high levels of coupled support (e.g. Finland which domestically funds additional support to the dairy sector),
- higher average milk prices than elsewhere in the EU (e.g. Italy)

- a favorable milk price/production cost combination (e.g. Spain and Ireland)

Fig. 4. Grassland in agricultural use as a share of land cover by NUTS2 regions 2009



Source: Eurostat 2011

### 3 Results and Discussion

In assessing the likely future prospects for EU milk production, both in aggregate terms and at the MS level, a small scale survey of market dairy experts in leading milk producing countries was undertaken.

#### 3.1 General observations on the future of the EU dairy sector

Other things being equal, limited production growth alongside strong international demand will give rise to higher international dairy prices which will benefit EU dairy farmers. If EU processors can increase the value added of their dairy products, this may further improve farm milk prices. The costs of milk production will be influenced by the type of production system,

in particular the feeding regime and the choice between concentrate (grain) feed and grass based feeding. Cost of production will also be influenced by the rate of technology adoption by dairy farmers which in turn will be influenced by a range of factors such as existing profitability, farmer age and education and the strength of the agricultural extension system in the MS. Farm size, as measured by milk production volume, will also be an important factor and small farms will remain under competitive pressures.

The milk processing industry in the MS will also play a determining role in the future of MS milk production. More modern processing plants can process milk at lower costs. But whether farmers benefit from such processing industry investments will depend on the ownership structure of the processing industry i.e. whether it is farmer owned or controlled or whether it is in private hands. This can make the difference between higher farm milk prices versus additional profits for the processor.

The economic performance of the dairy sector relative to other agricultural sectors and the wider economy will be important. In some regions the dairy sector will face competition for land from other agricultural sectors while it will also face competition for labour from other sectors of the wider economy. The dairy sector will persist in some higher cost regions due to the fact that no other agricultural or non-agricultural opportunities may exist.

Environmental constraints will be an issue in some regions. For example the intensification of production may be limited due to policies relating to greenhouse gases or nitrate levels

The increased volatility in EU milk prices, production costs and farm margins that has been observed over the last decade is likely to continue. This volatility will be driven by global supply and demand conditions. On the supply side production in some of the key exporting regions is strongly influenced by weather which affects grass growth conditions and feed availability. Another fundamental problem on the supply side is the issue of the biological lag. High profitability may lead to the farm level decision to increase production through the addition of a cow to the herd. A cow is a relatively long term investment, since ideally it will be retained for several lactations. However, profitability may decline subsequently while the cow remains in the production system. This contributes to a mismatch between production and prices, with production continuing to increase in times of oversupply even though farm milk prices have begun to fall and vice versa.

On the demand side dairy buyers observe the high level of price volatility which can then create uncertainty in terms of the optimal time to make a purchase. It can also create doubt as to what would represent a sensible forward price for future delivery of dairy products. Paying over the odds for inputs can completely counteract efficiencies achieved elsewhere in the production chain. Buyers may therefore enter or depart the market suddenly, based on their assessment of the optimal time to buy. These uncertainties contribute further to the volatility in dairy markets as a belief that prices will fall can lead to self-fulfilling actions that result in lower prices, with the reverse also being true.

Milk quota elimination will have relatively minor market implications at the EU28 level where EU milk production is expected to grow, but at a slow pace. However, at the MS level and at the regional level within MS, impacts could be more appreciable. Milk production will be reoriented towards regions with production advantages. This will see a movement of milk production to latitudes which have mild, short winters, with longer grass growing seasons.

Consequently, over the next 5 to 10 years across the EU we should see a contraction in milk production in high cost regions. Expansion should take place in lower cost regions, not constrained by environmental factors or competition from other sectors of agriculture for land and labour. A dramatic increase in overall EU milk production appears unlikely, but the EU's self-sufficiency in dairy products should increase. Expansion is likely in Ireland, Austria, Belgium, Denmark, Germany, France, the Netherlands and Poland, with a contraction likely in most MS in Southern and Eastern Europe. This is discussed further in section 3.2

The expansion in milk production will need to be managed. The milk quota will be replaced by other limiting factors which will include issues at the farm level and beyond the farm. Difficulties will emerge such as access to additional land, labor and capital and these will impede expansion for some producers.

Further along the chain there may be challenges with regard to processing capacity, storage, distribution and marketing, all of which need considerable forward planning and investment. For example, it is reasonable to consider that a three year time horizon is required to commission, design and build a new processing plant. There will be a need to secure new markets for additional products, so that additional milk can achieve prices comparable with those for existing milk production.

In some regions in the EU milk quota elimination may generate increased competition for milk between different processors, especially if production growth rate differs in neighbouring processor catchment regions, or even neighbouring countries. Therefore milk quota elimination may have implications for not alone dairy product trade, but also milk trade between countries. Processors may find more milk locally, reducing milk or dairy product import requirements thereby increasing their milk or dairy production export capacity or the reverse may be the case.

Processors in some MS may move up the value chain. This reflects the fact that the EU dairy market is mature. Growth potential is limited to cheese, fresh products and specialist dairy products (e.g. infant formula, athlete performance drinks). Exporters must therefore seek opportunities outside of the EU. Traditionally commodity products were regarded as a bargain basement activity but it should be noted that demand for commodities is strong in developing countries.

### **3.2 The future of the EU dairy sector: a member state focus**

This section focuses on a selection member states, giving emphasis to those with larger existing levels of milk production and/or milk export capacity. These country summaries are based on official data and opinion gathered through a small survey of market experts.

#### **Germany**

The German dairy sector is the largest in the EU with annual milk production of 30 million tonnes, delivered by 80,000 milk producers and over 4 million dairy cows. Milk yields currently average around 7,000 litres per cow per annum. Production is concentrated in the North West and in Bavaria in the south. In the North West production is more focused on bulk commodity type products and associated with this, milk prices tend to be lower. However, fixed costs in this region are also low. There is a growing trend towards housing cows and away from grazing systems. By contrast in Bavaria, dairy products are more specialized and farm milk prices are higher. The largest dairy herds are to be found in the eastern states of Germany where typically herds of 150 to 200 cows are common.

Around two thirds of the milk delivered in Germany is processed by co-operatives. Consolidation in the German dairy processing industry has been considerable and has been driven by mergers.

German dairy cow numbers have increased in 2014 to their highest level in 10 years. Over the medium term expectations are that German milk production can increase by about 1 per cent per year, with stronger rates of expansion anticipated in coastal regions and in the lower Rhine and in mountain areas.

### **France**

France is the EU's second largest milk producer with annual production of 24 million tonnes produced by close to 4 million dairy cows and 70,000 dairy farmers. About 40 percent of French milk production is exported. France has a strong tradition of mixed farms and the average dairy herd size is not large by EU15 standards. However, there is a drive to increase farm size, particularly at the upper end, with the number of herds of over 100 cows increasingly rapidly. On French dairy farms locally produced forage remains a significant source of feed and this limits the sector's dependency on purchased feed.

Milk production has been in decline in more marginal farming regions and is becoming more concentrated in regions with higher human populations. Profitability levels suggest that expansion is possible in some regions, but competition from the crop sector for land is also a challenge for the dairy sector. The provision of coupled support under the new CAP should assist marginal milk producers to stay in production.

The ownership structure of some parts of the processing sector may militate against expansion. France has five multi-national dairy groups. In contrast to farmer owned co-operatives, multinational businesses may not encourage the expansion of domestic milk production, taking the view that there are no growth opportunities in the domestic market. This means they may be unwilling to invest in additional milk processing capacity in France, preferring instead to source additional milk for processing internationally and possibly closer to the intended export market.

Dairy expansion should lead to an increase in French milk production, aimed at the export market, with milk powders for the infant formula industry an area that is attracting investment. French dairy exports to China have already increased considerably over the last five years.

It remains to be seen whether France will expand its milk production following quota elimination. Increased production in the northwest, which has the best climate for grass production, may be offset by lower production elsewhere in France, leaving aggregate French production unchanged. Expert assessment is that expansion of 1% per annum, and possibly more, seems feasible.

### **United Kingdom**

The UK is the EU's third largest milk producer with deliveries in recent years of about 13.5 million tonnes, about 10 percent below the UK milk quota, although production was much closer to the quota level in 2013/14. The dairy sector in the UK has seen a rapid reduction in the number of dairy farms over the last decade, falling from 23,000 in 2003 to a little over 13,000 in 2013. The average herd size in the UK is now 126 cows, with average milk yields of about 7,500 litres per cow per annum.

Production systems vary by region, with grazing dominating in Northern Ireland and in western coastal regions of England and Wales, but with more feed intensive housing operations becoming increasingly common elsewhere. The UK's liberal quota trading regime facilitated the intensification of the UK dairy sector at the farm level in the 1990s and 2000s. Low milk prices relative to much of the rest of the EU15 caused producers to chase scale to maintain profitability. As farm milk output increased over time, many producers increasingly found themselves land constrained and increasingly dependent on feed supplementation in their grazing system. Higher stocking rates have led to increasing use of concentrate feed and this has led to an increase in production costs and falling dairy farm incomes.

Over the medium term milk prices are expected to average lower than they have been in recent years. However, these lower milk prices are expected to be offset by lower input prices. Expectations therefore are that UK dairy margins will remain flat in the period to 2020.

The liquid milk market absorbs about half of the UK's milk production and liquid milk prices therefore remain an important determinant of profitability in the sector. Some UK milk producers now have contracts to directly supply supermarkets at prices determined on a margin over cost basis. In general these farmers achieve better prices for their milk. However, about 60 percent of producers continue to supply their milk to the processing industry, obtaining lower prices than producers who have direct contracts with supermarkets. Those without direct supermarket contracts are vulnerable in times of weak market conditions when their prices can fall to very low levels. Consequently, in December 2014 there was an almost 12 pence price gap between the lowest and highest milk prices received by UK dairy farmers. This latter group of producers who receive very low prices, seem poorly placed to undertake any expansion in the medium term. Over the summer of 2015 there have been wide scale farmer protests and a very prominent media campaign to secure better prices for UK dairy farmers, though an extension of the supermarket contract pricing system for liquid milk.

In comparison to 2014, UK milk production is expected to decline slightly by 2020, mainly arising from the contraction in producer numbers taking place in 2015 in response to the low level of profitability that has emerged due to the sharp fall in UK milk prices. However, there is also a contrary view that UK milk production can stabilize or even expand slightly in the medium term. In spite of the challenging environment, confidence among many UK dairy farmers over the medium term remains strong, with over one third of producers planning to expand milk production post quota removal.

### **Netherlands**

The Netherlands is the EU's fourth largest milk producer with annual production of about 12 million tonnes. Relative to much of the EU dairy sector, Dutch dairy farming is quite intensive on a per hectare basis. The Netherlands has about 18,000 dairy farmers and has a dairy cow population of about 1.5 million head. Dairy cow milk yields are among the highest in the EU at just over 8,000 litres per cow per annum. About 70 percent of production in the Netherlands is currently exported. In 2013/14 the Netherlands had a milk quota overshoot of 4 percent and farmers faced a super levy of over €130m.

High productivity and low feed prices contribute to high gross margins in the Dutch dairy system. On the flip side fixed costs in the Netherlands are comparatively high. While cows are

grazed in the Netherlands, the system is gradually moving away from grazing and towards housing.

Friesland Campina processes about 75 per cent of the country's milk production and is keen to process additional milk, now that the milk quota system has expired. Expansion would be profitable for Dutch dairy farmers but they face some significant constraints. Land prices are high and are anything from €50,000 to €100,000 per hectare in some regions. At such prices establishing a greenfield dairy operation would be prohibitive. Existing dairy operations have expansion potential but also face environmental constraints due to the need to process manure. In the past the Netherlands has been creative in dealing with environmental challenges, but phosphate levels are likely to impede plans for intensification of production. In the period to 2020 it is anticipated that the Netherlands will expand by about 1 to 2 percent per year.

### **Poland**

Poland is the EU's 5<sup>th</sup> largest milk producer and among the MS that have joined the EU since 2004, Poland is by some distance the largest milk producer. Annual deliveries amount to 10 million tonnes, accounting for more than 8 percent of EU milk production. Milk yields are low by EU15 standards. The structure of production is still at a relatively small scale with 2.5 million dairy cows spread across 153,000 dairy farms. At just 16 cows, average herd size is therefore extremely small, but the sector is now developing quickly and seems to have the capacity to compete internationally. The proportion of milk that is produced which is delivered for processing has increased steadily since Poland joined to EU and is now considerably higher than at the time of EU accession.

In 2004 the Polish milk quota was set at 7.5 million tonnes whereas production (a large share of which was not delivered for processing) was estimated at close to 12 million tonnes. It was argued that the quota allocation granted to Poland would seriously limit the development of the Polish dairy sector, but Poland now exports 30 percent of its milk production. Nevertheless, Poland had lobbied for the retention of the quota system until at least 2020, arguing that delaying abolition would allow more time for global demand to grow sufficiently to absorb increased EU milk production.

Due to mergers and closures there has been considerable consolidation in the dairy processing industry in the decade since Poland joined the EU, improving the processing sector's international competitiveness. Farmer and industry sentiment is quite positive in Poland. Production in the 2014/15 milk quota year increased by 5% relative to 2013/14 milk quota year. At price levels consistent with the average over the period 2009 to 2014 expectations are that production could increase by 1 to 2 percent per annum in the period to 2020. If future prices average at 2013 or 2014 levels, then expansion rates of up to 4 percent per annum are anticipated. With decreasing farm consumption and feed use, deliveries to dairies should increase at a faster rate than the increase in production. Estimates of the level of farm consumption vary from 18 to 23 percent at present.

### **Ireland**

Ireland is the 7<sup>th</sup> largest milk producer in the EU with production of about 5.5 million tonnes prior to quota elimination. The dairy cow population is approximately 1.1 million cows and milk yields are low by the standards of the EU15 due to the grass based production system. There has been considerable consolidation of dairy farming over the last 20 years. Even over

the last 10 years dairy farm numbers have continued to drop by 2 to 3 percent per annum, but have now stabilized at about 17,000 at the time of milk quota removal.

Ireland is highly self-sufficient in dairy products. With production of more than 1.2 tonnes of milk per head of population, Ireland has a considerable dairy export capacity and dairy exports make up 80 to 90% of total milk production. Irish milk prices tend to be close to the average for EU milk prices. Given its low cost base focused on grass as the main feed, this allows the sector to be relatively profitable. Indeed, the dairy sector is by some distance the most profitable mainstream farming enterprise in Ireland.

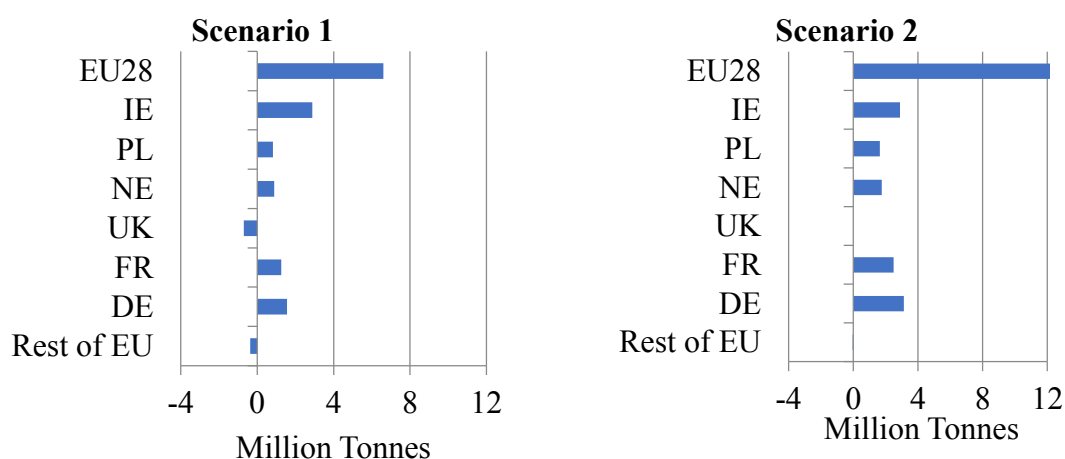
For much of the milk quota era, Ireland operated a relatively restrictive milk quota transfer system which only became market based in the last decade. This means that dairy farms have remained relatively unspecialized and therefore the removal of the quota system should allow farms to fully specialize in milk production. Dairy farms comprise only about 25 percent of the grassland area which means that there is also the potential for conversion of beef farms to dairy production, particularly larger beef farms to dairy farms.

Dairy cow numbers in Ireland have been increasing since 2012 in anticipation of milk quota removal. The dairy industry has a target to increase milk production by close to 40% above the 2014 levels by 2020. For 2015 indications are that an increase in milk production of more than 10% will occur relative to 2014, despite the decline in profitability. It remain to be seen by how much milk production can increase over the next decade, but by 2025 volume growth of 60 to 80% on the 2014 level may be feasible depending on the level of future profitability.

#### Other EU Member States

The MS covered in detail above account for approximately 70 percent of EU production at present. Across the rest of the EU, production at the MS level is likely to either remain static or to decline further. Many of these MS joined the EU in the more recent enlargements and most have not fully availed of their milk quota allocation. This suggests that quota elimination will have relatively little implication for the future trend of milk production in these MS. While production is unlikely to increase in MS which historically have not filled their quota, there is the possibility that production could decline further due to competition from dairy exports elsewhere in the EU and due to falling domestic dairy demand associated with a static to declining population.

Fig. 5. Possible evolution of EU milk production to 2020



Source: Own analysis



Bringing together the responses to the survey it is possible to set out two growth scenarios for the EU dairy sector in the period to 2020, depending on the level of future profitability, with Scenario 1 reflecting a lower rate of growth and Scenario 2 a higher rate of growth. In Figure 5 the changes in the level of milk production by the MS are shown in absolute terms and are also aggregated to represent the overall change in EU28 milk production.

### 3.3 Quota removal and the decline in international dairy prices

The removal of the EU milk quota regime has coincided with a steep decline in international dairy prices in 2015. It is tempting to infer some causation given the correlation of these two events, but to do so would be to ignore some more significant factors what have occurred and which have had an impact on international dairy market supply and demand conditions. Overall, 2014 was an excellent year in terms of weather conditions for agriculture in many parts of the world. This favorable weather in combination with high dairy prices and falling production costs, led to a strong increase in global milk production. Alongside this growth in production the international dairy market had to deal with the emergence of two major developments which have damaged international demand for dairy products, namely the Russian embargo on EU agricultural imports which began in 2014 and the pronounced decline in Chinese purchases of milk powders from the world market in 2015. To some extent the stronger than anticipated growth in EU milk production in the run up to quota removal has also been a factor negatively affecting milk prices in the EU. Together these developments have created a perfect storm which has resulted in a sharp fall in dairy commodity prices which looks like it will persist right through 2015 and into 2016.

It may take a further year for the global dairy market to return to normal, but the longer term prospects for the dairy sector remain positive. Expansion in the lowest cost milk production regions, such as New Zealand, should slow down as land becomes scarce, providing opportunities for dairy production in some parts of the EU to develop and satisfy the continuing growth in international demand. One area of concern perhaps is whether EU dairy processors have put all of their eggs in one basket in expecting China to be the key driver of the continuing growth in global dairy demand. If growth in the Chinese economy slows down rapidly then this may lead to a less optimistic outlook for the global dairy sector.

## 4 Conclusion

At the time when milk quotas were introduced, the EU dairy sector had come through a period of very high profitability and unsustainable production growth driven by the CAP rather than by market supply and demand conditions. In such circumstances either a milk quota system or a reduction in price supports was inevitable.

The imposition of milk quotas reduced the need for the processing industry to engage in further investment in processing capacity and arguably reduced the pressure to source new dairy markets for EU dairy products. The quota system placed greater emphasis on adding value to the fixed EU milk pool as a means to drive profit in the sector. Milk quotas also led EU based milk processors to expand processing capacity in markets beyond the EU.

The milk quota system was not the straitjacket on farm level dairy expansion which it is sometimes characterized to have been. Many EU farmers have expanded milk production and increased income levels throughout the quota period at milk prices higher than would have prevailed otherwise. Milk quotas served a purpose in an era when the EU produced

an excess of dairy products for which there was little unsubsidized domestic or third country demand. That era is now over.

The future of the dairy sector in the EU looks brighter in some regions than others. A reorientation of production will see milk production increasingly concentrated at latitudes where summers are mild, winters are short and where land is less well suited to grain production, allowing grass based production systems to dominate. While the sector faces many challenges, those challenges are relatively transparent for both producers and processors. Those best organized to deal with those challenges will be best placed to succeed.

## Acknowledgements

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## The challenges posed by price volatility in the EU dairy sector

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**Annotation:** It is now accepted that the significant increase in the level of price volatility experienced by the EU dairy sector in recent years is expected to persist, and perhaps even increase, as EU dairy policy continues to become more market focused. The specific challenges which volatility present are numerous. This increase in volatility translates to increased risk for all participants in the dairy supply chain. The identification and adoption of suitable risk management tools will help to ensure that the sector remains competitive and profitable in an uncertain future. In this paper the increased levels of volatility are quantified while the challenges associated with these increased levels are presented and possible tools to manage this issue are presented and analysed.

**Keywords:** Volatility, Risk Management, Dairy Futures, Common Agricultural Policy

**JEL classification:** Q13, Q14 and Q18

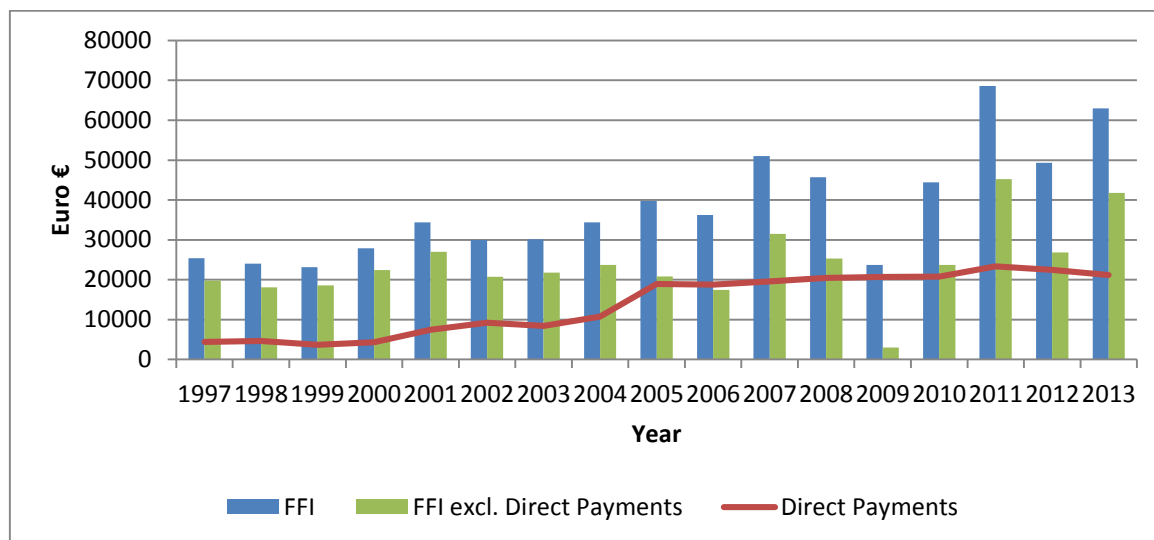
### 1 Introduction

Providing an acceptable definition of price volatility is not easy. Most people associate increased volatility with increased risk. However risk is subjective, so while one person might consider an investment to be high risk their neighbour may consider it low risk and likewise with volatility. In term of a working definition the following by Gilbert and Morgan (2010) is useful. "Price volatility is a directionless measure of the extent of the variability of a price". The inclusion of directionless is crucial as it counters the myopic view of sellers that volatility only occurs when prices are falling and low and that of buyers that it only occurs when prices are rising and high. Likewise it should be acknowledged that sustained periods of high or low prices do not constitute volatility, it is the speed and degree of change in prices which constitute volatility. Furthermore it should be noted that price volatility is just one of a number of risks which all members of the dairy supply chain face. Other risks include financial, asset (fire, theft etc.), policy, legal, currency risk and market risk to name some.

Price variation to some degree is both desirable and inevitable in all free markets as it reflects the changing needs and preferences of customers and the changing cost and competitive positions of participants at all stages in the supply chain and these price variations act as signals to reallocate resources efficiently. While this element of changing prices may be regarded as normal and desirable in free markets, the emergence of exceptional price volatility in dairy and food markets in recent years is creating many problems for processors, farmers and other supply chain participants. Over the last eight years wholesale skim milk powder (SMP) prices in the EU have varied from a peak month of over €3,800 in 2007 to a low of less than €1,650 in 2009, then rising to €3,310 in early 2014 before falling to €1,815 by mid-2015. This dramatic price variation, when combined with similar variation in prices for other dairy products, has resulted in farmgate milk prices at EU level varying with equal magnitude. This dramatic change in farmgate milk prices has resulted in dramatic variation in dairy farm income

levels. Taking Ireland as an example, dairy farm incomes have varied from a low of about €25,000 in 2009 to a peak of between €60,000 and €70,000 in 2011 and 2013 (Fig. 1). This variation in incomes takes account of the income stabilization provided by the EU single payment and is even more dramatic if that payment is excluded.

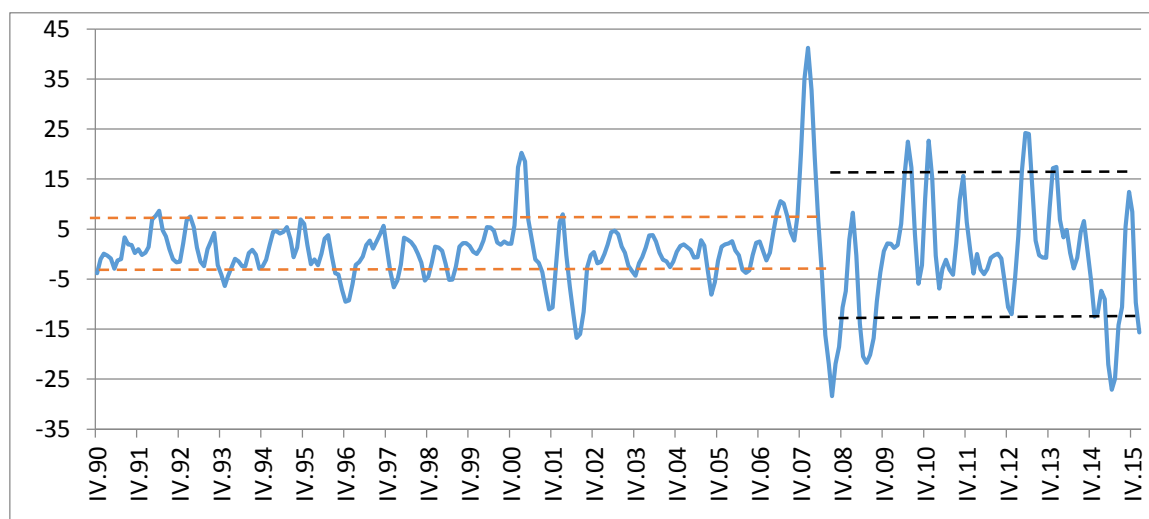
Fig. 1. Family farm income (€/farm) on specialist dairy farms in Ireland 1997 to 2013



Source: Teagasc National Farm Survey

Fig. 2 clearly displays how volatility has increased dramatically in EU SMP wholesale prices since 2007. This graph shows the percentage change in prices relative to the price three months previously. Prior to 2007 prices rarely changed by more than 5% over any three month period (red dashed line) while post 2007 changes of 15% or more are not uncommon (black dashed line).

Fig. 2. Three month percentage price change in EU SMP prices



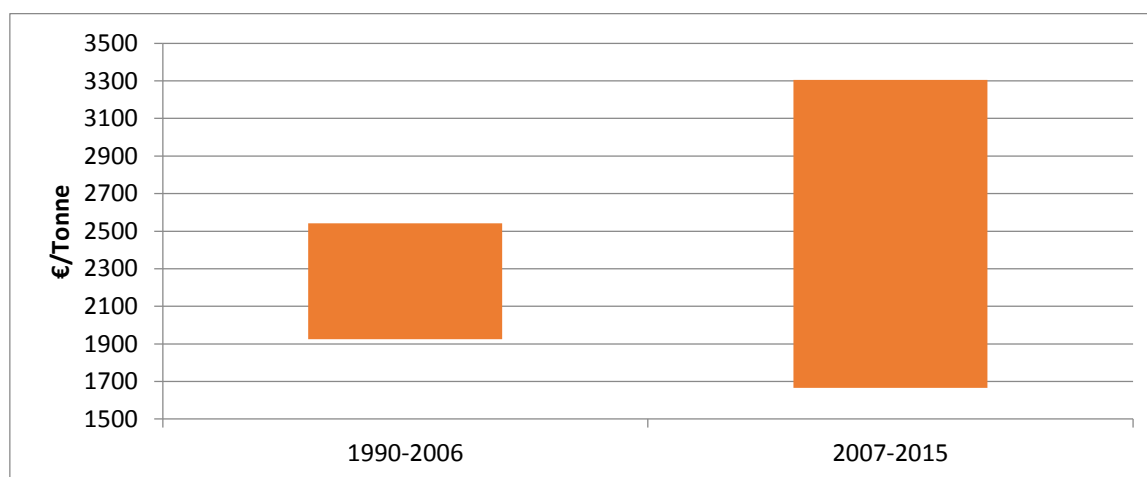
Source: Own Calculations

As discussed later the objective of more recent Common Agricultural Policy (CAP) reform was to align EU dairy prices more closely with world prices. This greater alignment of prices has also seen an alignment of price volatility. From an industry perspective this has created a twin

problem in so far as the range within which prices now fluctuate is far wider as seen in Fig. 3. This chart shows the range within which the mid 90% of SMP wholesale prices fluctuated prior to and post 2007. In this chart the largest and smallest 5% of prices in each period are truncated, so for example on 5% of occasions prices would have fallen below €1,925 or above €2,542 in the earlier period. Comparable figures for the second period are €1,665 and €3,305.

A further point to consider is that the nature of EU farm gate prices would appear to have changed in recent times. Bergmann et al (2015) decomposed German, Irish and an average EU farm gate milk price time series into trend, seasonal and cyclical components using structural time series models. Their analysis showed that in the recent decade most of the price variation was attributed to the cycle component along with the seasonal to a lesser degree. The authors then concluded that price volatility for this period seemed to be endemic to the dairy industry and to some degree predictable and best addressed using countercyclical measures. Nicholson and Stephenson (2014) arrive at similar results and conclusion when considering US data.

Fig. 3. Mid 90% range of EU SMP wholesale prices



Source: EEX

## 2 Materials and Methods

### 2.1 Causes and Consequences of Price Volatility

The causes of extreme price volatility in dairy commodity markets are very well established in economics literature and they relate primarily to a combination of the somewhat unique characteristics of the demand for food (inelastic demand) combined with unanticipated variation in supply due to weather, disease, etc., whereby even small changes in supply can cause very large changes in price (O Connor and Keane 2009). This has been further accentuated by low dairy inventory levels in more recent years. In an EU dairying context major policy changes over recent years have also resulted in greatly increased volatility. Finally it should be noted that while it is possible to reduce or increase milk production modestly in the short run, substantial production changes in particular takes a considerable time in dairying.

With regard to consequences, extremely low dairy product prices cause many financial problems for dairies and farmers (e.g. low margins, cashflow management, and financing)

and ultimately threaten solvency, while extremely high prices result in product substitution which can subsequently be difficult or impossible to reverse. Dairy product buyers also suffer from volatility as they much prefer stability for planning and customer relationship purposes and hence, if alternatives are available, will prefer to conduct business with more price stable sectors. For example these buyers are sometimes required to budget up to fifteen months in advance. Deviations from these budgeted estimates have at times to be explained and justified, in particular in the case of publicly listed companies. To avoid this situation buyers in particular favour fixed price contracts or materials which display lower levels of price variability. Finally extreme volatility can also inhibit innovation and R and D.

## 2.2 The role of policy<sup>1</sup>

Prior to the fundamental reform of dairy policy under the Luxembourg agreement in 2003 the policy instruments employed by the EU had very successfully isolated internal EU dairy commodity prices from the greater volatility associated with world prices. Intervention purchasing placed a floor on prices while other measures such as production quotas, export refunds, import tariffs and subsidized consumption measures helped to ensure higher and much less volatile prices than those pertaining in world markets. However the Luxembourg agreement saw the milk sector become fully integrated into the overall “new” CAP. As a result EU dairy product commodity prices became closely aligned with world prices and experienced for the first time in decades the extreme price volatility experienced in world commodities markets generally. In order to mitigate these effects the CAP reform of 2003 saw a switch to decoupled farm payments (Single Payment Scheme), which issues payments based on historic production levels and enables producers to switch to the production of products demanded by the markets. As part of this reform a Dairy Premium was introduced in 2004. This premium is compensation for the reduction in the intervention prices (25% for butter and 15% for skimmed milk powder), it is decoupled from the milk quota and added to the Single Payment from April 2005. These payments are in place to 2020.

A major price collapse in 2009 caused much concern, not least among EU dairy farmers who experienced severe income stress. As a result a High Level group was established under the European Commission which proposed a number of reforms. This led to the milk package 2012 which involved a series of measures aimed at boosting the position of dairy producers in the dairy supply chain and preparing the sector for a more market-oriented and sustainable future<sup>2</sup>. The measures included the promotion of written contracts between farmers and processors, the promotion of producer organisations (PO) which can negotiate contract terms collectively, including the price of raw milk, and the application of rules for inter-branch organisations in the milk sector which allows actors in the dairy supply chain to carry out a number of activities such as for example promotion, research, innovation and quality improvement. Finally this reform led to the establishment of an EU milk market observatory with a view to enhancing transparency in the EU milk market.

The most recent reform (CAP to 2020), which saw the expiration of the milk quota regime, recognises that there is need for a “**safety net**” in case of serious imbalance in the market. The measures adopted include “public intervention” and absorption of private storage costs

<sup>1</sup>A detailed discussion of EU dairy from its inception is presented in Keane and O Connor (2015)

<sup>2</sup>These measures established by the Milk Package will apply until mid-2020.

for butter. This reform also acknowledges that export refunds can be used in cases of market imbalances with specific **ad-hoc measures** also available to be mobilised in case of **emergency** or **significant market disturbances**. **Finally** the European Commission may grant aid for skimmed milk and skimmed-milk powder intended for use as feeding stuffs or to be processed into casein and caseinates.

It should be further noted that Article 36 of Regulation (EU) No 1305/2013 allows for support to cover for:

- (a) financial contributions to premiums for crop, animal and plant insurance against economic losses to farmers caused by adverse climatic events, animal or plant diseases, pest infestation, or an environmental incident;
- (b) financial contributions to mutual funds to pay financial compensation to farmers for economic losses caused by adverse climatic events or by the outbreak of an animal or plant disease or pest infestation or an environmental incident;
- (c) an income stabilisation tool, in the form of financial contributions to mutual funds, providing compensation to farmers for a severe drop in their income. This is dealt with in detail in Article 39

Article 37 provides for the provision of crop, animal, and plant insurance and Article 38 for mutual funds for adverse climatic events, animal and plant diseases, pest infestations and environmental incidents.

### 2.3 Challenges associated with dairy

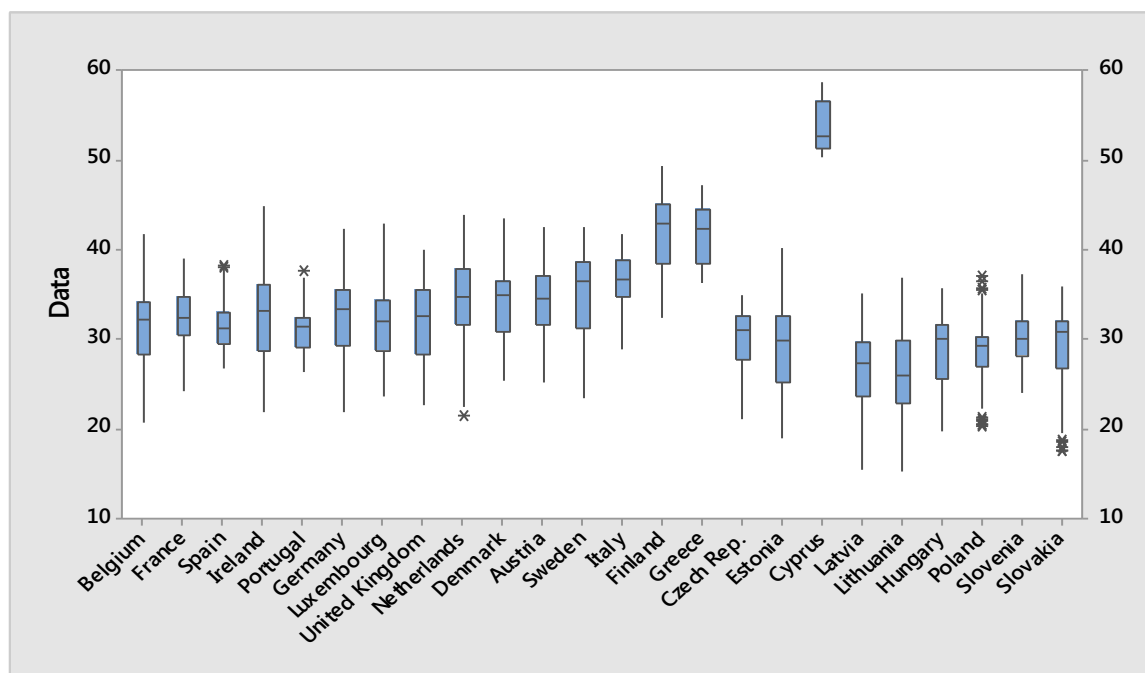
Any appropriate risk management tool for the EU dairy sector must be cognisant of the challenging features associated with milk production and its marketing. By its very nature milk is perishable and in some cases seasonal. In order to deal with this constraint, as well as to meet the demands of its end users, a large proportion of milk is usually processed into a myriad of ever expanding products. A non-exhaustive representation of the breadth of these products is presented in Appendix 1. This schematic fails to capture dairy's growing role as an ingredient in the nutrition and pharmaceutical industries. This diverse product range means that different dairy processors have very diverse product portfolios which in turn provide very different returns to both processor and farmer. The diversity of these returns at farm level is presented in Fig. 4. The data presented show the monthly farm gate prices of selected EU countries over the last six years<sup>3</sup>. Figure 4 clearly demonstrates that not alone are the price levels very different across countries but the level of variability within and across member states is also highly variable from month to month. There is then further variation at local level as these prices represent national averages.

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<sup>3</sup>This data is published by the EU Commission at [http://ec.europa.eu/agriculture/milk-market-observatory/index\\_en.htm](http://ec.europa.eu/agriculture/milk-market-observatory/index_en.htm)



Fig. 4. Boxplot of EU farm gate milk prices Jan-09 to June-15, €/100 Kg



Source: EU Milk Market Observatory

The heterogeneous nature of the EU dairy farm sector is further highlighted in Table 1. From this table we see that any simple homogenous solution to risk management at farm gate is unlikely to be successful with bespoke solutions necessary and desirable.

Table 1: The heterogeneous nature of the EU dairy farm sector, selected countries

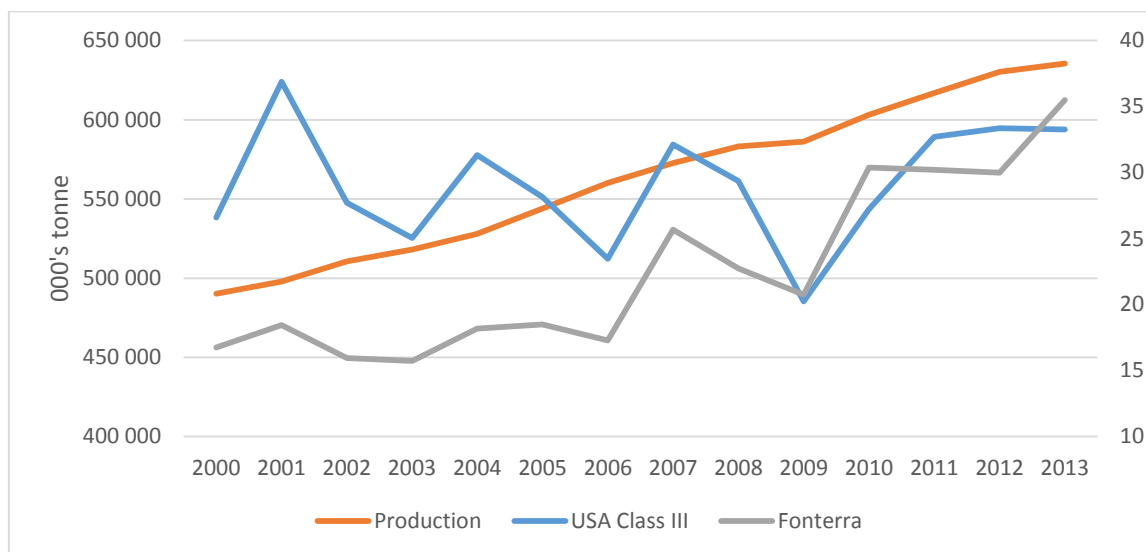
	Fat content	Protein content	Apparent Yield (kg/head) <sup>1</sup>	Apparent milk output per farm (tonnes) <sup>1</sup>
Bulgaria	3.68	3.28	6,924	46.0
Denmark	4.26	3.52	7,592	1292.8
Germany	4.12	3.41	8,963	367.8
Ireland	3.94	3.39	7,882	290.0
Latvia	4.08	3.26	5,438	64.5
Lithuania	4.16	3.25	6,651	32.8
Netherlands	4.4	3.53	7,265	630.1
Poland	3.98	3.21	7,769	64.2
Romania	3.79	3.27	5,532	2.6
Slovenia	4.14	3.37	8,005	65.3
United Kingdom	4.03	3.26	8,254	921.1

Source: Eurostat & <sup>1</sup> Own Calculations

Dairy, unlike many agricultural products, has a production cycle which is measured in years rather than months. It takes almost three years from the time a cow is inseminated to the production of milk from the consequential calf. This means that milk production can be increased modestly in the short run by increasing feed intake but more significant responses require time and substantial investment. The short-term changes in EU milk supply since quota abandonment in April 2015 are discussed in detail in Donnellan and Keane (2015) While the decision to reduce production either by reducing feed input, prematurely terminating

the lactation cycle, or accelerated retirement yields more immediate results, the latter in particular is normally seen as a drastic and unwelcome response. Temporary reduction of the herd size is not desirable as it creates idle capacity, the loss of carefully planned genetic merit and the possibility of introducing disease when the herd is expanded at a later date. This reluctance to cut production capacity is clearly illustrated in Fig. 5 which shows global cow's milk production (on primary axis in red) alongside representative global milk prices (blue and green on secondary axis). Global milk production has increased in an almost linear fashion while prices have risen and dropped considerably. The large dip in prices in 2009 was accompanied by a 0.5% increase in global production.

**Fig. 5.** World cows's milk production (Tonnes) and world milk prices (2000-2013)



Source: FAO

The versatile nature of dairy as a both a commodity and ingredient means that it has become an integral component of a large number of supply chains. In many cases these chains are long as the base commodity is processed into ingredients before in some cases been further processed. As the chains lengthen the number of actors affected by the volatility cited above increase and the desire for suitable risk management tools increases. In particular some of those further along the supply chain often use a large number of ingredients, many of which allow the management of price risk through established futures and derivate markets for example.

### 3 Market based solutions

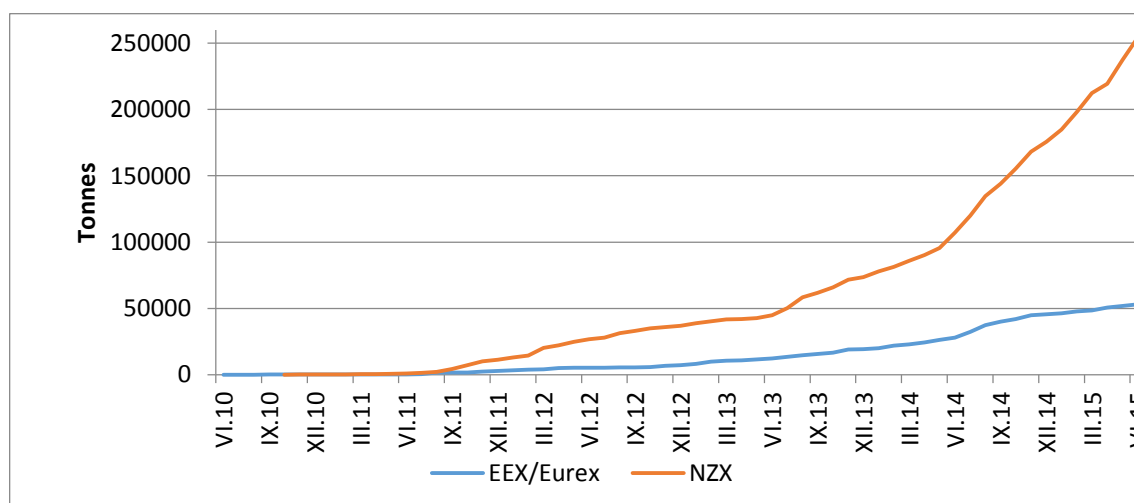
There are a broad range of instruments, both public and private market, which may be utilized to manage price/income volatility. This suite of instruments includes over the counter (OTC) contracts, forward contracting, futures contracts, Options, mutual funds and insurance contracts.<sup>4</sup> The next section will discuss the possible use of insurance and emerging futures markets as possible risk management tools for dairy farmers in the EU.

<sup>4</sup> It should be noted that some instruments can straddle public and private such as subsidised insurance or insurance underwritten by public finances.

### 3.1 Dairy Futures Markets

At present dairy futures contracts are actively traded on four exchanges: CME (USA), Euronext, European Energy Exchange (EEX), and NZX (New Zealand). The CME dairy futures market has been in existence under different guises for decades and is highly developed while the latter two were launched in 2010<sup>5</sup>. Fig. 6 charts the growth in the number of EEX and NZX listed contracts since their 2010 launch. From inception just over 55,000 tonnes of dairy commodities have been traded on the EEX to the end of July 2015 (Fig. 6). By comparison, the volume traded on the NZX surpassed 250,000 tonnes by the same date and is now displaying almost exponential growth. There are a few possible explanations as to why the NZX offering has been more successful than the EEX offering. Firstly, it offers one tonne contracts while the EEX offers five tonne contracts. The smaller contract volumes are more attractive to smaller scale market participants and allow greater flexibility to larger participants albeit at additional cost. The commodities traded on the exchanges also differ. Wholemilk powder is not traded on the EEX but represents the majority of all trades on the NZX. In contrast, butter, which plays a similar leading role on the EEX, was only recently launched on the NZX. There is also an active over the counter (OTC) market in the EU with volumes traded comparable to the EEX exchange volumes and this offers a possible alternative to EEX. There is practically no OTC trade associated with New Zealand dairy. Furthermore, since July 2014 NZX has listed whole milk powder options. Options are somewhat similar to insurance as they offer both a floor (or ceiling) price while also allowing traders the opportunity to benefit from favourable price movements. As options are usually linked to underlying futures contracts, they tend to increase trade in futures markets, as traders rebalance their position as part of their trading activity. In the short period to date since the launch of dairy options, more than 60,000 tonnes of options have traded on NZX. Finally and perhaps most importantly, Fonterra, the giant New Zealand co-op, has been very supportive of the NZX exchange, offering its customers a variety of risk management tools linked to trading on the NZX exchange.

Fig. 6. Cumulative volumes traded (Tonnes) on EEX/EUREX and NZX to end of June 2015



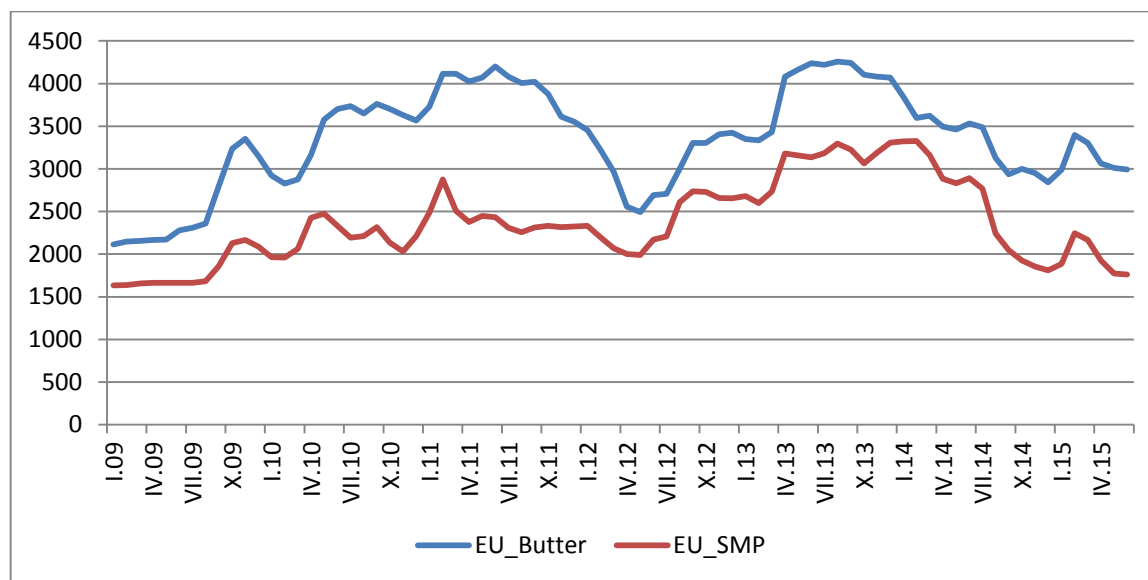
<sup>5</sup>The EEX were initially listed on the EUREX exchange until their transfer in May 2015. Euronext has historically listed dairy contracts and relaunched contracts in early summer 2015 with first trades in August 2015.

Source: EEX and NZX

The growth in these markets since their launch in 2010 suggests that there is a growing demand for futures based risk management solutions in dairying. The growth in Europe has been primarily driven by demand from the buyer or customer side as the larger buyers of dairy commodities have long been very familiar with hedging on futures markets in relation to their non-dairy commodity purchases. Hedging these commodities is considered to be almost a routine activity at this stage. In contrast the seller side (milk processors and dairy farmers) have been reluctant to trade to date, being unfamiliar with futures markets trading. They did not need to consider these tools during the many years of policy led dairy commodity price stability in the EU.

Their reluctance to trade may also reflect the fact that the contracts traded are not the most suitable for their purpose. In particular there are no raw milk contracts listed on the EU exchanges. As a result those wishing to cover their milk position have to cross hedge their exposure using the available butter and SMP contracts. Such a strategy may potentially create basis and basis risk and this may be considerable. The basis reflects the relationship between cash price and futures price and is obtained by subtracting the futures price from the cash price. In this case the cash price may be considered the farm gate price<sup>6</sup>. In order to quantify the possible basis faced by milk hedgers, the monthly farm gate prices of a number of selected EU countries are regressed on the EEX butter and SMP monthly final settlement prices. These are presented in Fig. 7. The farm gate prices are published by the Commission and are available from the milk market observatory<sup>7</sup> (these prices are based on raw cows' milk, actual fat content - prices per 100 kg). All data are modelled from July 2009 to June 2015.

Fig. 7. EEX/EUREX butter and SMP Indices (€ per Tonne)



Source: EEX

<sup>6</sup> Basis risk is the chance that the basis will have unexpectedly strengthened or weakened from the time the hedge is implemented to the time when the hedge is removed.

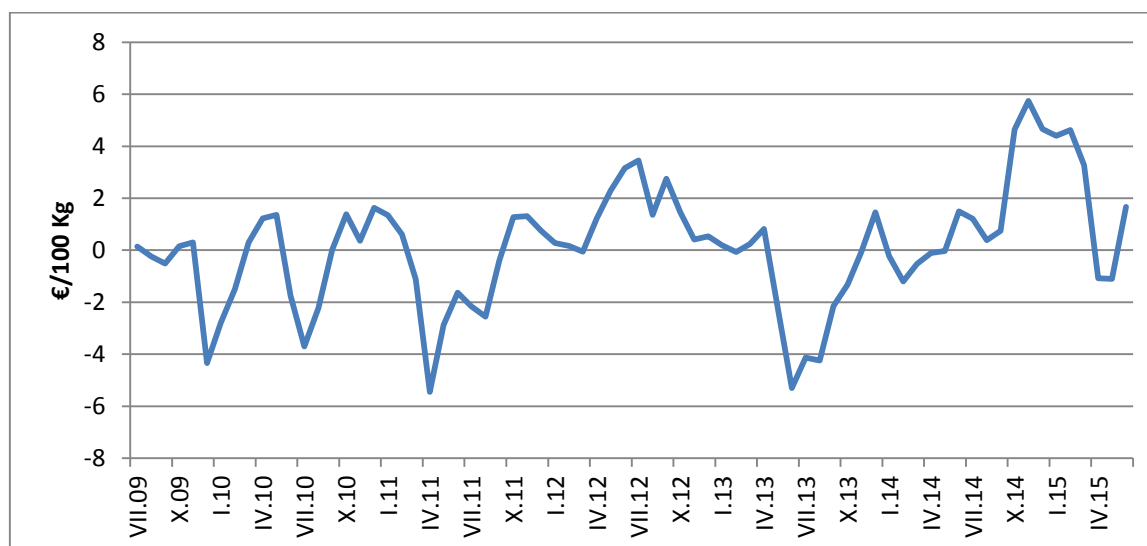
<sup>7</sup>[http://ec.europa.eu/agriculture/milk-market-observatory/index\\_en.htm](http://ec.europa.eu/agriculture/milk-market-observatory/index_en.htm)

Correlation analysis revealed that a lagged relationship exists between the commodity and farm gate prices with a three month lag in most cases showing the strongest relationship. Given that farm gate prices are in most cases determined post-delivery and many commodity sales are contracted months in advance, a lagged relationship is expected. For this reason commodity prices lagged three months are used in all models<sup>8</sup>. In short the relationship modelled can be summarised as follows (Equation 1)

$$\text{Farm gate}_t = \alpha * \text{Butter Index}_{t-3} + \beta * \text{SMP Index}_{t-3} + \varepsilon_t \quad \text{Equation 1}$$

In this model the residuals ( $\varepsilon_t$ ) can be considered the basis associated using the EEX prices to cross hedge the farm gate prices. The residuals based on the German farm gate price are presented in Fig. 8. From this figure it is clear that some basis is present in all months and, while in some months milk processors will benefit from substantial negative basis there are many months when the opposite effect is present. At the extreme this basis is plus or minus in excess of €5.40 per 100 kg which represents a possible basis of in excess of 16% from the long run mean. The associated risk lies in the fact that the basis does not appear to be in any way predictable. The basis risk associated with other selected farm gate series is also presented in Appendix 2.

Fig. 8. Basis for German farm gate milk price model.



Source: Own Calculations

The results of the models considered are summarised in Table 2. Of interest is the fact that in a number of countries (Ireland, Germany, Netherlands Denmark and Poland) SMP ( $\beta$  coefficient) takes a greater weighting than butter while the opposite is true in the remaining cases<sup>9</sup>. This again indicates the heterogeneous nature of EU farm gate prices. This is further emphasised when we consider the means of the series which range from less than €27 per 100 kg in Lithuania to over €35 in the Netherlands. The means of the fitted series are

<sup>8</sup> Other lag lengths were considered however the three month lag was found to be a good fit in all cases hence all models employ this lagged relationship.

<sup>9</sup>The presence of collinearity in some models means that caution should be applied when assessing the relative importance of these weightings. The correlation of 0.766 between the explanatory variables may explain this collinearity.

interestingly very close to the corresponding means of the original series. While these series should be weighted by monthly volumes to provide a direct comparison, it is still reasonable to consider the returns of the actual and fitted series as very similar over the long term. However the range and magnitude of the basis as represented by the minimum and maximum basis suggests that using the indices for cross hedging the farm prices may be unacceptably risky.

**Table 2:** Results of regression model based on equation 1

	Ireland	Germany	Netherlands	Denmark	France	Czech Rep.	Lithuania	Poland
$\alpha$	0.05265	0.05209	0.05136	0.04883	0.06058	0.06283	0.05205	0.04821
$\beta$	0.06293	0.06334	0.07175	0.07396	0.04829	0.03555	0.03747	0.05135
Mean	33.49	33.33	35.27	34.90	32.91	30.42	26.94	29.27
Mean Fitted	33.22	33.23	35.06	34.68	32.5	30.17	26.94	28.99
Min Basis	-7.61	-5.45	-5.83	-6.86	-8.42	-5.16	-5.74	-6.52
Max Basis	7.70	5.74	5.90	6.53	8.98	5.47	3.75	6.10

Source: Own Calculations

The fact that almost more than 39,000 tonnes of butter and only 11,000 tonnes of SMP have traded on the EEX suggest that these markets are primarily used to hedge the commodities rather than milk prices. Milk hedging as suggested by Table 2 would suggest a much closer alignment of volume, while a review of weekly volume also shows that matching weekly trade volumes is unusual suggesting that milk is rarely if at all hedged.

As Burdine et al (2014) point out, while traditional price risk management tools, such as forward contracting and the use of futures and options markets, present opportunities to manage the risks associated with price volatility, they also present challenges. The authors explain that dairy producers generally have struggled to adopt futures and options trading as a means of price protection. For example they claim that the futures contracts available are only a cross-hedge opportunity for the US all-milk price, with a very uncertain basis risk. Furthermore scale issues often prevent smaller dairy operations from using milk futures and options. In the EU the novelty of these tools means that education is required to underpin their adoption and indeed this is crucial at the early stage of futures markets development. In many countries education has not been rolled out to a sufficient degree. In order to attract the necessary speculative interest the rate and quality of data dissemination need to be addressed. While the milk market observatory can be viewed as a welcome development it needs to further improve with regard to timeliness, content and accessibility.

### 3.2 Insurance

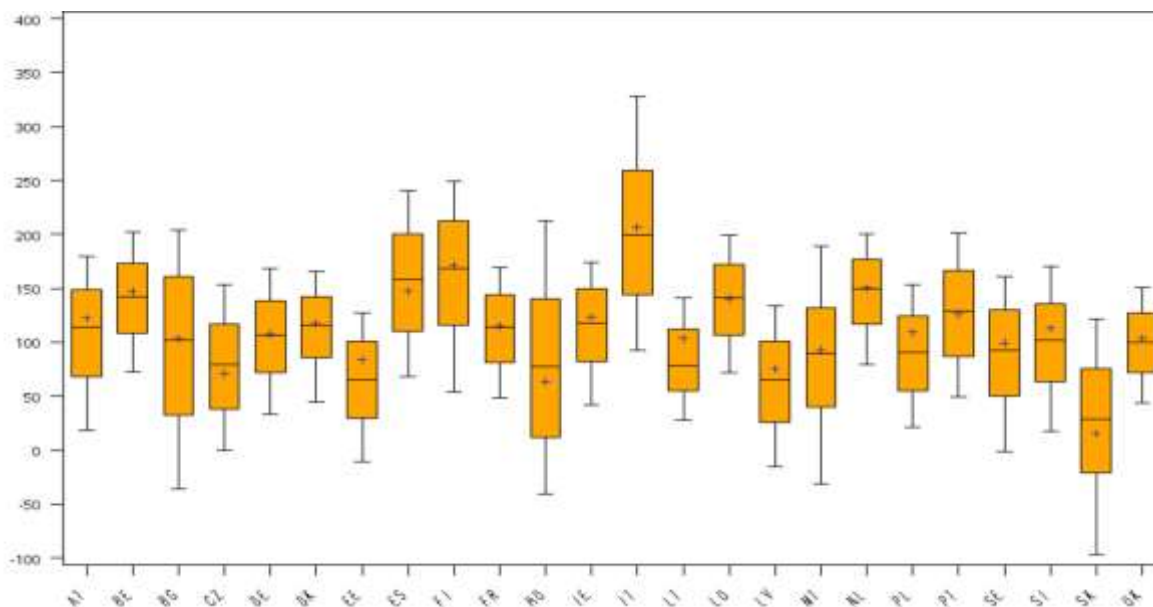
US dairy policy has evolved considerably in recent decades. In many senses it can be seen to lead EU policy but with a similar trajectory. Product price support has yielded to income support which in turn has been replaced by comprehensive insurance tools. The Livestock Gross Margin for Dairy (LGM-Dairy) insurance program was launched in the summer of 2008 and provides protection against the loss of gross margin (market value of milk minus feed costs) on the milk produced from dairy cows. The indemnity at the end of the eleven-month insurance period is the difference, if positive, between the gross margin guarantee and the actual gross margin. The LGM-Dairy uses futures prices and state specific prices

for corn, soybean meal and milk to determine the expected gross margin and the actual gross margin. The price the producer receives at the local market is not used in these calculations.

The Agricultural Act of 2014 (2014 Farm Bill) saw the introduction of the Margin Protection Program for Dairy (MPP-Dairy). This is a voluntary risk management program for dairy producers authorized through Dec. 31, 2018. The MPP-Dairy offers protection to dairy producers when the difference between the all milk price and the average feed cost (the margin) falls below a certain dollar amount selected by the producer. In this program Catastrophic Coverage (CAT) of \$4.00 margin coverage requires no premium payment, but the dairy operation must pay the \$100 administrative fee. Participants can cover at most 90 percent of their established production history under these terms. For increased protection, dairy operations may annually select a percentage of coverage from 25 to 90 percent of the established production history in five percent increments and a coverage level threshold from \$4.50 to \$8.00 in \$.50 increments<sup>10</sup>. This program, along with the Dairy Product Donation Program replaced the Milk Income Loss Contract, Dairy Product Price Support Program and the Dairy Export Incentive Program, so it heralds a new departure in US dairy policy as a price floor is replaced with a more active risk management program<sup>11</sup>.

While the MPP-Dairy would appear to provide an easy to understand and user friendly insurance product for dairy farmers, a number of issues would have to be addressed before consideration could be given to introducing a comparable product in an EU context. As evidenced in the above, dairying in the EU is best described as very heterogeneous. Milk prices vary enormously from country to country (Fig. 4) and so too do margins (Figure 9). While the data presented in this latter figure is dated the general pattern described is still accurate.

**Figure 9:** Weighted boxplot of gross margin with coupled payments per Member State 2011



Source: EU FADN — DG AGRI. Extreme values are not displayed. The whiskers represent the percentiles 10 and 90. The mean is a global ratio.

<sup>10</sup>For more details of this program see [http://www.fsa.usda.gov/Internet/FSA\\_File/mpp\\_dairy.pdf](http://www.fsa.usda.gov/Internet/FSA_File/mpp_dairy.pdf)

<sup>11</sup> For a comprehensive discussion of these policies and US dairy policy the reader is referred to <http://dairymarkets.org/MPP/> or <http://www.ers.usda.gov/topics/animal-products/dairy/policy.aspx>

Indeed the dated nature of this data again points to a fundamental issue in the development of many risk management tools. Likewise the novelty of insurance cover in the dairy sector would require an extensive education program in order to encourage adoption.

#### 4 Conclusions

EU dairy commodity prices have become significantly more volatile in the last 7 years as EU and world prices align. In addition the range with which the prices fall has widened considerably and the dynamics at farm gate has changed with a strong cyclical component now evident in some EU countries farm gate prices. These developments make it more difficult to plan and budget, reduces investment and R&D spend and make less volatile substitutes more attractive. The increased volatility at EU level can in part be attributed to reform of the CAP which has seen a movement from product to producer support with reduced market intervention.

In order to manage the increased risk which has resulted from this policy reform, the EU has extended its risk management toolbox and implemented the milk package of 2012. The latter involved a series of measures aimed at boosting the position of dairy producers in the dairy supply chain. However there is a sense that these measures may not be adequate in times of market stress and are of limited use to others in the supply chain. In such an environment it is understandable that the provision of private risk management tools such as insurance and futures markets should gain prominence. However the provision of these latter tools is not straightforward. The dairy supply chain can be regarded as long, making risk sharing problematic. Dairy farmers and even the raw milk they supply is not homogeneous. Raw milk prices and farm incomes and profitability vary considerably across the EU. This fact, coupled with delayed and in some cases incomplete data, mitigates against the introduction of insurance type products, in particular in the short to medium term. The development of EU dairy futures markets has been steady but slow. There appears to be a demand for these markets on the buy side in particular. The slow adoption may in part be explained by the fact that these tools are new and there is an education gap. However it may also indicate that cross hedging milk with dairy commodities is not ideal at present. The basis is highly variable, not deterministic and substantial at times.

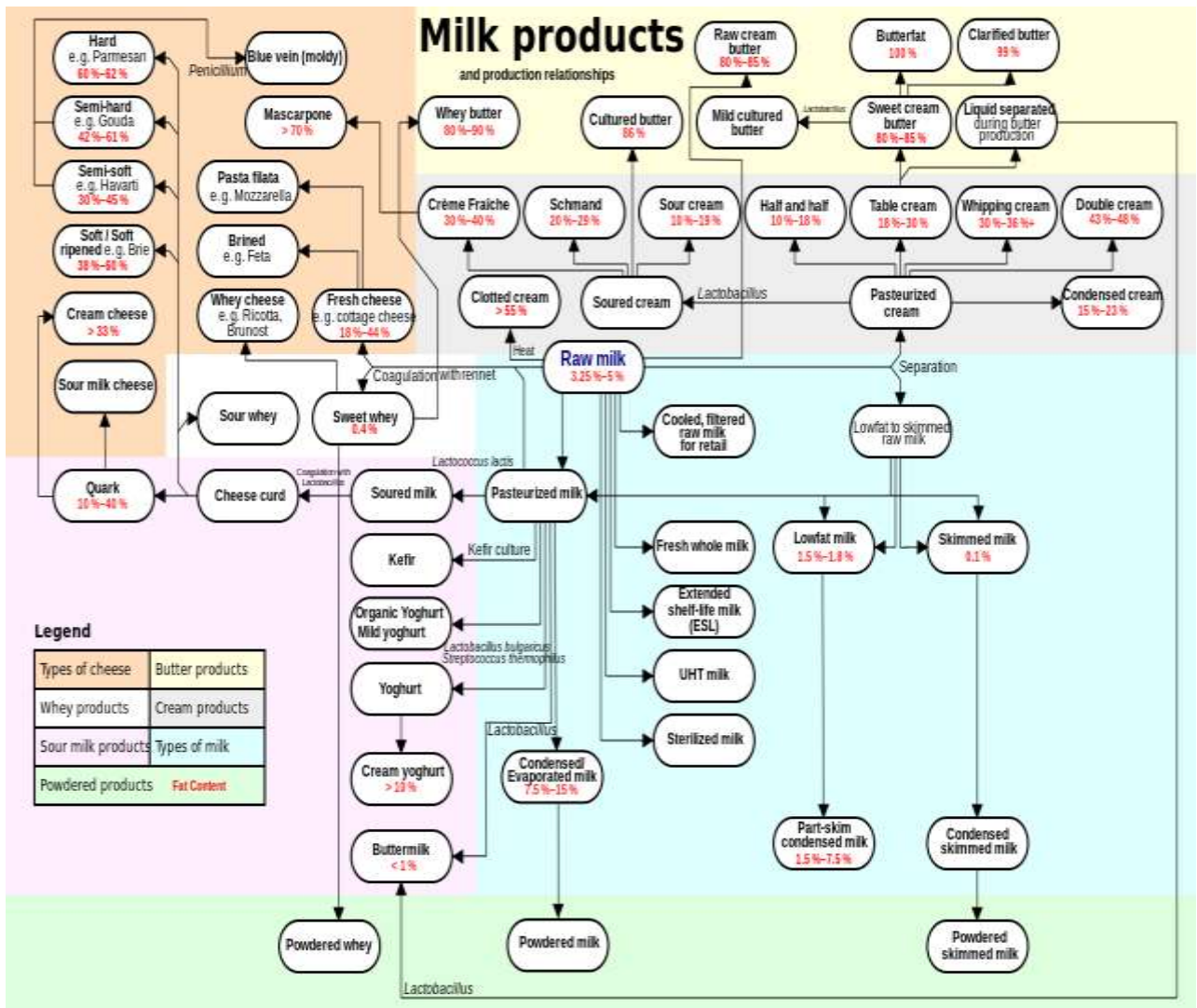
Given that hedging on futures markets can offer the prospect of greater price stability at a time of more extreme volatility, the limited involvement of EU dairies in futures markets trading to date may also point to undue caution on their part. Trading on futures markets requires a vital initial period of learning about a somewhat complex subject which many in EU dairying have yet to undergo. The result of being slow to engage with futures markets is likely however to have the effect of further consolidating Fonterra and southern hemisphere processors, as well as the leading USA dairies, as the long-term leaders in the global dairy industry. Hence, if EU dairying wishes to play a leadership role in the global industry of the future and provide greater market stability for the industry at a time of extreme volatility, it is important that the industry now proceeds to learn about the full details of the processes involved in futures markets trading, including both the potential benefits and the risks, and begins to trade more actively than is apparent to date.



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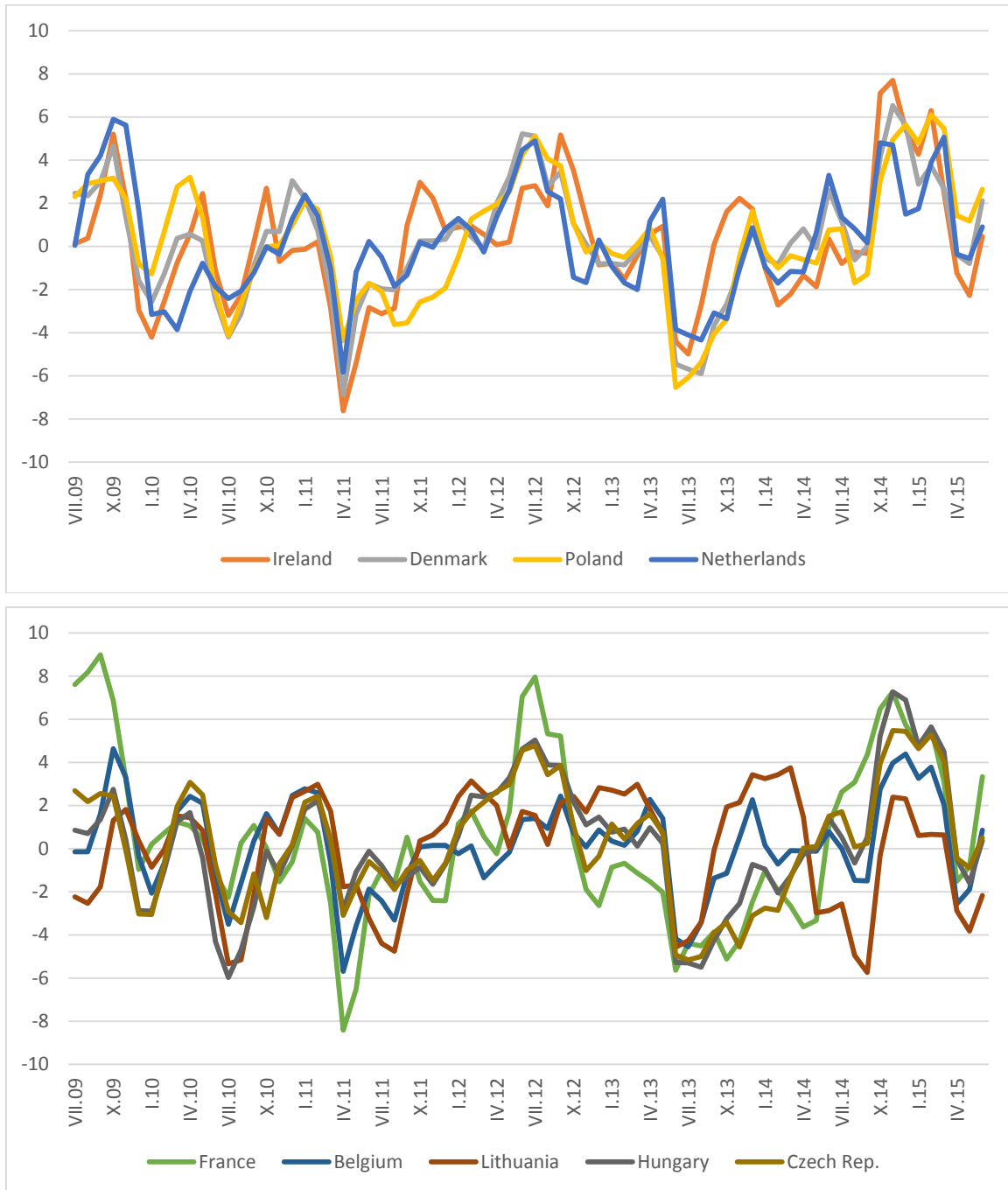
## Appendix 1



Source WikiNight at <https://commons.wikimedia.org/wiki/File%3AMilch.svg>

## Appendix 2

Figure A2.1 Basis associated with selected farm gate prices



Source: Own Calculations



## PARALLEL SESSIONS



## Structural Changes in the Slovak Regional Agriculture

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**Annotation:** Integration into the EU single market provided opportunities to the Slovak Republic (SR) for better exploitation of its comparative advantages. We investigated the Slovak regional economy structural changes, development and factors of regional economic specialisation and concentration with a focus on agriculture. Specialization and concentration of economic activities were quantified by Herfindahl and Entropy indices. Econometric panel models were applied to investigate the impact of selected factors, including the Common Agricultural Policy (CAP) instruments on regional agriculture specialisation. We used yearly data of national and regional (NUTS III and IV) economic activity indicators, selected indicators of agriculture (IL MPRV SR, 2014) and regional indicators of climatic conditions over period 1995-2012. We found that the Slovak economy was relatively specialised already before the accession to the EU. Accession to the EU had statistically significant positive effect on concentration economic activities and diversification of economy. Significant changes in specialisation have occurred in agriculture. The share of crop production has been steadily growing at the expense of animal production. The concentration of both, crop and animal production has increasing trend. Provision of the most CAP instruments in Slovakia, had positive effects on regional crop production diversification and animal production specialization.

**Key words:** agriculture, specialization, concentration, regions, econometric model, panel, Slovakia

**JEL classification:** R12, R15, Q18, C23

### 1 Introduction

Integration into the EU single market provided opportunities to the Slovak Republic for better exploitation of its comparative advantages and led to changes in the economy structure. A general concern of the European integration is associated with growing regional specialization, making regions more vulnerable and prone to adverse shocks (Amiti, 1999; Hallet, 2000). Conclusions on sector concentration development differ by studies. Amiti (1999), Hallet (2000) and Midelfart-Knarvik et al. (2000), Barrios, Strobl (2004) argue that sector concentration is likely to increase as a result of integration. Midelfart-Knarvik et al. (2000), Landesmann (2003) analysed trade pattern of industry in the Central and Eastern Europe in the period 1995-2000. They indicated Slovakia, together with Hungary, the Czech Republic, Estonia and Poland as countries specialized in technology-intensive industries.

Most of existing studies on economy specialisation and sector concentration are focusing on industries (e.g. Aiginger, Rossi-Hansberg, 2006; Ezcurra, Pascual and Rapún, 2006). There is insufficient empirical evidence however, on agricultural sector concentration and specialisation pattern as a result of the EU integration. Studies on agricultural production specialisation and concentration trends in the EU are rare. Daniel (2003) found that the provision of subsidies under the Common Agricultural Policy (CAP) reduces comparative advantage effect, by allowing crop production in less competitive conditions. Arfa et al. (2011) analysed concentration and specialization of agricultural production in France. They found that market signals and environmental regulations were more important in determining dairy farm location. Impact assessment of the SR accession to the EU on the Slovak agriculture

assessed e.g. Blaas (2008); Varošćák (2008); Grznár, Szabo (2012). They do not study however, specialisation and concentration pattern of the regional crop and animal production.

Factors affecting changes in structure of the EU agriculture investigated SASSPO (2006). They found that biophysical and climatic conditions have a major impact on agricultural production, but important factors were also access to markets, logistics and transportation infrastructure. The impact of climate change on agricultural production analysed Barrios, Uttara, and Strobl (2008) in Sub Saharan countries and Mestre-Sanchis, Feijóo-Bello (2009) in marginal areas of the EU. Adaptation of crop production to climate change in 26 countries of Europe addressed Olesen et al. (2011). Their results suggest that farmers across Europe can adapt to climate change, they are altering the timing of cultivation and selection of individual crop varieties.

The goal of our study was to investigate the Slovak regional economy structural changes in the period 1995-2012. What are underlying drivers of regional agricultural specialisation and concentration pattern? The effect of selected factors, including agricultural policy instruments and climate change on regional crop and animal production specialisation we estimate using econometric models and panel data.

## 2 Materials and Methods

We used yearly data of employment and gross value added by sections of economic activities classified according to the high-level aggregation, which aggregates the ISIC Rev. 4/NACE Rev. 2 (European Commission, 2008) at the national, NUTS II (4 regions), NUTS III (8 regions) and NUTS IV (79 regions) from 1995 to 2012 (SO SR, RegDat, 2014). Further we used yearly data on regional agricultural indicators of period 1997-2012 from the Information letters of MPRV SR (2014) and data on regional climatic conditions (SHMU SR, 2015).

Specialization of regional economies and concentration of economic activity in the regions were assessed by the Herfindal index (H) (Eq. 1) and entropy index (an inverse index) (Eq. 2).

$$H_j = \sum_i \left( \frac{E_{ij}}{\sum_i E_{ij}} \right)^2 \quad H_i = \sum_j \left( \frac{E_{ij}}{\sum_j E_{ij}} \right)^2 \quad (1)$$

$$SPEC_j = - \sum_i \left( \frac{E_{ij}}{E_j} \right) \ln \left( \frac{E_{ij}}{E_j} \right) \quad CONC_i = - \sum_j \left( \frac{E_{ij}}{E_i} \right) \ln \left( \frac{E_{ij}}{E_i} \right) \quad (2)$$

Where:  $H_j$  and  $SPEC_j$  index of specialization;  $H_i$  and  $CONC_i$  index of concentration;  $E_{ij}$  employment in economic activity  $i$  in region  $j$ ;  $E_j = \sum_i E_{ij}$  total employment in all economic activities in the region  $j$ ;  $E_i = \sum_j E_{ij}$  total employment in all regions in the economic activity  $i$ ;  $\ln$  natural logarithm.

We investigated effect of selected factors on regional commodity specialization of crop and livestock production (Eq. 3) by estimation of parameters of linear panel models using annual data (IL MPaRV, SHMU) for the period 1997-2012. The dependent variable - regional commodity specialization of crop and livestock production was expressed by Herfindahl index.

$$H = (\text{PRTVO}; \text{PRUZVO}; \text{TRRV}; \text{TRZV}; \text{CRV}; \text{CZV}; \text{POP}; \text{PLP}; \text{LP}; \text{INFR}; \text{EUA}; \text{SUP}; \text{SINV}; \text{SNEINV}; \text{HRV}_1; \text{HZV}_1) \quad (3)$$



Where:

*H* Herfindahl index of regional plant production (livestock production) specialization (Eq. 1)

*PRTV* average regional annual temperature in growing season, °C;

*PRUZVO* average regional annual rainfall in growing season, mm;

*TRRV* plant production receipts per ha of arable land;

*TRZV* animal production receipts per ha of utilized agricultural area (UAA);

*CRV* seeds costs per ha of arable land;

*CZV* livestock feed costs per large animal unit (LU);

*POP* share of arable land;

*PLP* share of meadows and pasture;

*LP* agricultural land price tiers, 1-20;

*INFR* density of the road network in km per km<sup>2</sup>, market access;

*EUA* accession to the EU, dummy variable 0 to 2004, 1 since 2004

*SUP* subsidies per ha of UAA;

*HRV\_1* regional commodity specialization of plant production with one year lag;

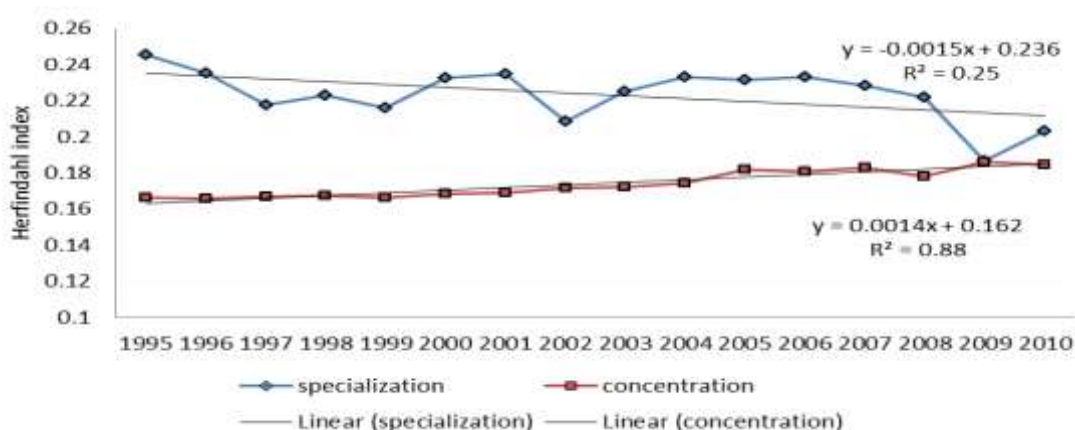
*HZV\_1* regional commodity specialization of livestock production with one year lag.

Model parameters estimation and econometric verification was done in Gretl software. Assumption of homoscedasticity was tested using White's test. Presence of autocorrelation was detected by Durbin-Watson test. Multicollinearity was diagnosed by the variance inflation factor VIF. Greene (2003), Lewis and Linzer (2005) discussed possible estimation methods to resolve the problem of heteroscedasticity. To deal with heteroskedasticity problem in the panel we applied weighted least squares (WLS) method - a special case of Generalised method of least squares (GLS).

### 3 Results and Discussion

The Slovak economy (NUTS I) specialization (Herfindahl index) has been slightly declining, while concentration of economic activities has been increasing over period of 1995-2010 (Fig. 1).

**Fig.1** Development of the Slovak economy specialisation and concentration of economic activities, Herfindahl index, 1995 - 2010



Source: Own calculation based on SO SR data

Diversification of the Slovak economy was growing over observed period 1995-2010. This finding is in line with classical theory of diversification growth along with GDP growth and supports conclusions of De Benedictis, Gallegati, and Tambari (2007). The most developed

in Slovakia - Bratislava region however, had the most diversified regional economy, with growing specialization over time, which supports theories of U-curve specialisation development (Kalemli-Ozcan, Sorensen, and Yosha, 2003; Imbs and Wacziarg, 2003).

There have been significant changes observed in the Slovak agriculture over the period 1997-2012. Gross agricultural output (GAO) of the Slovakia, as well as regional GAO fall down and their structure has changed in favour of crop production. This trend contributes to increasing vulnerability of agricultural production and the Slovak farm performance. Olesen et al. (2011) found clear trends on increasing temperature affecting crop production and crop choice in Europe. According to them increasing frequency of droughts will negatively affect crop yield in southern and central Europe.

The GAO in the Slovakia was relatively evenly spread, with slightly growing concentration. At the regional level, GAO specialization has been increasing especially in Žilina region with prevailing animal production. GAO diversification growth was observed in Nitra and Košice NUTS III regions.

The highest concentration of harvested areas of vegetables (Banská Bystrica region) and sugar beets (Trnava and Nitra regions) were observed in 1997. Animal husbandry production was in the period 1997-2012 evenly distributed in Slovakia. There was significantly growing concentration of poultry and pig production. The most evenly distributed was livestock production.

In the period 1997-2012 regional crop production specialization significantly declined, while specialization of regional animal production increased. Selected factors impact on regional crop and animal production specialization we modelled using linear models and panel data of the 1997-2012 (Tab. 1). We found a significant negative impact of average annual rainfall in the growing season (GS) on regional (NUTS IV) crop production specialization. The effect of average annual temperature (GS) on regional crop production was insignificant, while on diversification of regional animal production was statistically significant.

Increases in input prices of crop production, costs of seeds per ha contributed to regional crop production specialization. Growing input costs of animal production, feed costs led to higher regional animal production diversification. This finding can be explained by low market price of particular animal products and therefore higher risk of specialized livestock production. Market prices and growing receipts of crop production had a positive impact on both regional crop and animal production specialization. Arable land share and higher soil quality had positive effect on regional crop production specialization. Higher density of regional road network contributed to higher diversification of regional crop and animal production in Slovakia. Impact of infrastructure on agriculture could differ by countries. Qin and Zhang (2012) found that better access to roads facilitates agricultural specialization in China.

We investigated also the effects of agricultural policy instruments on agricultural specialization development. Agricultural subsidies had significant effect on growth of regional crop production diversification, and regional animal production specialization (Tab. 1). Lagged regional crop and animal production specialization levels had positive effect on specialisation of agricultural production. This can be explained by advance contracting of both crop and animal production.

We found statistically significant negative impact of average annual temperature in the growing season and average annual rainfall in the growing season on regional crop

and animal production specialization. This finding corresponds with results of Olesen et al. (2011) that farmers across Europe can adapt to climate change and they are altering their production. The effect of agricultural subsidies was significant on crop production diversification and animal production specialisation. Crop production in Slovakia, especially after the accession to the EU gained stronger support than animal production. This finding is in line with conclusions of Arfa et al. (2011) that policy instruments could determine commodity location. Similarly Daniel (2003) found that subsidized products are more sensitive to economic openness and their production is more dispersed throughout the country.

#### 4 Conclusion

Most findings at the Slovak regional level correspond with theoretical expectations and complement findings at the other EU Member States level. We found that the Slovak economy was relatively specialised already in the period before the SR accession to the EU.

**Table 1** Regional crop and animal production specialisation, 1997-2012

Variable	Models			
	Crop production 1	2	Animal production 3	4
const	+***	+***	+***	+*
Year	-.***		+***	
Average regional annual temperature in growing season	+	-	-.***	-.**
Average regional annual rainfall in growing season	-.**	-.***	-	+
Plant production receipts per ha of arable land	+***	+	+**	+
Animal production receipts per ha of UAA	-	-.**	+	-
Seeds costs per ha of arable land	+*	-		
Livestock feed costs per LU			-.***	-
Share of arable land	+*	+	-	+
Share of meadows and pasture	+	-	+	+
Agricultural land price tiers, 1-20	+***	+	+	-
Density of the road network in km per km <sup>2</sup>	-.**	-	-	-.**
Subsidies per ha of UAA	-.***		+***	
Subsidies per ha of UAA (_1)		+*		+*
Regional plant production specialisation (_1)		+***		
Regional livestock production specialisation (_1)				+***

Note: \*, \*\*, and \*\*\* stands for significance at the 10%, 5%, and 1% level, respectively.

Source: Own calculation based on IL MPRV SR, SHMU data

Accession to the EU had positive significant effect on concentration of economic activities and negative effect on economy specialization on national level and in the lagging Eastern Slovakia region.

Significant changes in farm specialisation have occurred in Agriculture over the period 1997-2012. The share of crop production has been steadily growing at the expense of animal production. The concentration of both crop and animal productions has increasing trends.

North Slovakia regions became more specialised on animal production. Regions with medium soil quality on the Eastern and South West Slovakia had the most diversified agricultural production.

We investigated the impact of selected factors, including agricultural subsidies and climatic conditions on the Slovak regional crop and animal production specialization. Support payments per hectare (1997-2012) led in districts to crop production diversification and to animal production specialization. Crop production diversification trends will be further supported by Greening payment under the CAP Reform implementation, while animal production will be in certain extent a subject of national coupled payments.

## Acknowledgements

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## Usability and Accessibility analysis of Czech agrarian portals

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**Annotation:** Nowadays usability and accessibility are one of the key tasks of web portals, especially if these are key information portals of the government. Reasons for increasing the usability and accessibility of web portals are rising especially in the context of the rapid use of alternative devices for browsing the web content. This paper describes the results of a comprehensive usability and accessibility analysis of the two most widely used Czech agrarian portals eAGRI (eagri.cz) and AGRIS (agris.cz). The goal of the testing is to highlight the issues that users may encounter on these portals and to formulate possible remedies. Comprehensive usability testing was performed once for each portal. The results are presented as a Summary Report. The accessibility data-set consists of identified data with 360 observations on both portals measured from October 2014 to March 2015. On the each portal there were randomly selected 30 pages that were tested repeatedly each month. Methodology of the paper is based on applying of common methods of usability and accessibility testing. Usability testing is done based on the methods of the Heuristic analysis of usability as well as by the application and evaluation of the User Scenarios. Accessibility is tested according to the Czech methodological guidelines of Decree no. 64/2008 Coll. (decree on accessibility). Based on the results of the applied methods there are formulated conclusions and recommendations for possible improvements.

**Key words:** usability analysis, accessibility analysis, Scenarios, Heuristic evaluation, Decree no. 64/2008 Coll. eAgri portal, Agris portal.

**JEL classification:** Q1, L86, O32

### 1 Introduction

Nowadays usability and accessibility are one of the key tasks of web portals, especially if these are key information portals of the government. Reasons for increasing the usability and accessibility of web portals are rising especially in the context of the rapid use of alternative devices for browsing the web content (adapted from Benda and Šmejkalová, 2015). The latest research data about the use of this kind of communication technologies by agricultural enterprises in the Czech Republic (carried out by the Department of Information Technologies, on the 1<sup>st</sup> of August, 2014 Faculty of Economics and Management, Czech University of Life Sciences Prague) show that 43 % of respondents use smart mobile devices for various purposes (Stočes et al, 2015).

Development and maintenance of access to ICT must be driven by the needs of people with disabilities. Developments which broaden the scope, applicability and usability of the human technology interface will be driven, at least in part by the needs of people who have disabilities. Besides accessibility issues, web applications have to face more general problems related to usability (adapted from Cook, 2009 and Mesiti, 2011).

Behavior of users on the web changed rapidly during last 20 years. They are focused on their goal and get easily frustrated when they cannot achieve that goal really quickly (Krug, 2009). They take impressions and mental models from previous experiences (Page et al, 2012). Credibility of website is important too (Roghanizad and Neufeld, 2015). Several studies have

documented that a lack of usability of user interface has an impact on actions of the users (Clemmensen, 2009).

This paper describes the results of a comprehensive usability and accessibility analysis of the two most widely used Czech agrarian portals eAgri (eagri.cz) and Agris (agris.cz). The main purpose of the testing is to highlight the issues that users may encounter on these portals and to formulate possible remedies.

## 2 Materials and Methods

### 2.1 Usability analysis

This is the first study undertaking a longitudinal analysis of the level of usability of the Czech agricultural portals - eAgri and Agris. eAgri portal is used as the contact point to obtain information from the Ministry of Agriculture of the Czech Republic and from the subordinated organizations. The main goal of Agris portal is to provide a website with information about the Czech rural area. Typical user scenarios and heuristic evaluation methods were used.

#### Scenarios

Scenarios were created based on the purposes of eAgri and Agris portals and the analysis of commonly visited pages. Three different scenarios were tested in total. Five participants were included in the pilot study with different levels of the knowledge of the rural area and of the examined portals. Study of usability found out that 5 users discover over 75 % of usability problems. The next user usually found the same problems (Tullis and Albert, 2013). Simple and advanced searching, browsing search results for particular information and basic orientation on the layout page were the key parts of the scenarios.

#### Heuristic evaluation

The list of heuristics created by Nielsen (1997) was used for evaluation. The evaluation was performed by one evaluator. Ten rules were considered during the evaluation: The rules are summed up in table no. 1.

**Table 1.** The list of ten heuristic rules

No.	Name	Recommendation
1.	Visibility of system status	provide a feedback of the system in reasonable time
2.	Match between system and the real world	use language familiar to the user, information in a natural and logical order
3.	User control and freedom	help user to deal with mistakes and turns, support undo and redo
4.	Consistency and standards	follow the convention, use consistent styles and actions
5.	Error prevention	eliminate errors and prevent problems, ask for confirmation before complicated tasks
6.	Recognition rather than recall	make options visible, don't force user to remember information about different parts of a dialogue
7.	Flexibility and efficiency of use	system with options for inexperienced and experienced user
8.	Aesthetic and minimalist design	only insert important and relevant information in dialogues
9.	Help users recognize, diagnose, and recover from errors	indicate the problem and suggest a solution
10.	Help and documentation	provide help and documentation with the easy access to information and logical structure

**Source: Nielsen, 1997**



## 2.2 Accessibility analysis

Web accessibility means that people with disabilities can use the Web. Accessibility of both web portals is tested according to the Czech methodological guidelines of Decree no. 64/2008 Coll. on the form of publication of information relating to performance of public administration via web pages for persons with disability (Decree on accessibility).

The accessibility data-set consists of identified data with 360 observations on both portals measured from October 2014 to March 2015. On the each portal there were randomly selected 30 pages that were tested repeatedly each month.

Based on the results of the applied methods there are formulated conclusions and recommendations for possible improvements.

## 3 Results and Discussion

### 3.1 Usability analysis

The heuristic evaluation and the Typical User Scenarios methods had shown different problems and issues in the usability of eAgri and Agris portals. These problems can be sorted by importance. Barnum (2010) divides the problems discovered during usability testing to different categories based on their impact on the user experience (UX):

- catastrophe problem – problem with the highest importance, problem which stops interaction with the application
- major problem – it may have significant impact on the UX
- minor problem – problem with low priority, but may have impact on UX
- cosmetic problem – problem with the lowest priority, should be noted and fixed

#### Scenarios

On the Agris portal users have problems with results of searching. There is no option how to change the number of results on a page and a link to the next page is only on the bottom of the page. On the other hand users find the search results on Agris portal more organized and with relevant information.

The results of eAgri portal are opposite. There is an option to change the number of results on page, but it is limited to 3 variants – 10, 20 and 50. Links to next pages are on the top and on bottom of a page, but search results include Breadcrumbs navigation, title of paper and a short excerpt from the article. That make list of results unclear.

An option for language change is placed on the top of page on the both portals, but on the Agris portal pictures of flags are missing. This is only cosmetic problem, but fixing it would help users find this option easily.

Users with a previous experience with the eAgri portal were able to use “eAgri guidepost”. Inexperienced users have a problem finding the category they were looking for. The eAgri guidepost represents a major problem in usability of this portal. It is catastrophe problem for inexperienced users.

### Heuristic evaluation

It was discovered during the analysis that not all of the heuristics can be evaluated for the eAgri and Agris portals in the pilot study. More detailed study is required in the future for heuristics number 5 and 7.

Feedback of the system and undo and redo functions are supplied by internet browsers. The portals do not provide any information about redo and undo functions. eAgri portal supports feedback by changing the style of the activated links.

Articles on the main page of Agris portal are not sorted by date of adding and there is no explanation what is the criteria for sorting. The main page includes a lot of gadgets on left and right side of the page. They stay in the same places during browsing and the content is static. So there is a little interference during reading. On the right side there are pictures and links to related projects. This part is not separated from the rest of gadgets and the heading of this area is missing.

The main page of the eAgri portal includes specific areas on page - boxes with contact information how to reach the Czech agricultural ministry and how to connect it on the social networks, news and actions, etc. This information are visible only on the main page, but most of the user never visit the main page.

Language used on the portals is easily comprehensible considering the thematic focus. Texts in links, in menus and in the header are short and fitting. eAgri portal provides an error page with information in Czech and English language and with help to user of how to recover from a mistake. There are options – “go back”, “try the search page” or contact administrator. Agris portal doesn't have an error page. The main page is displayed after the inserting an incorrect URL address.

Both portals have a site map to help users in orientation on the portal, but on the eAgri portal, it is placed on the bottom of page, so many users are not able to find it swiftly.

Logo of the eAgri portal becomes smaller after accessing the page of resort organization or section of the portal included in the “eAgri guidepost” and a new link is added in the header. Color and background picture of the header is changing as well. There appear to be two different links, but only one is working.

The Agris portal uses breadcrumb navigation in the middle part of page with the text of articles. It is replaced with option “add article” on the category page. The navigation is placed on the right side of page and it is not used consistently. Some articles are not put in a category and the box “Other from the category” doesn't provide information about name of the category.

Breadcrumb navigation is used on the eAgri portal as well. It is placed between the header of the page and the menu and the main part of a page and it used on each level of navigation, but there are serious problems in the navigation and structure of eAgri portal. Complete database of employees of Czech agricultural ministry and agendas of other resort organizations are included in the portal. This amount of information and pages has impact on the navigation. Constant changes in the layout for different parts of the portal make work with the portal and looking for information very difficult. User must remember the complete way of how to reach the information they are looking for.

### 3.2 Accessibility analysis

Accessibility analysis is provided in terms of the Czech methodological guidelines of Decree no. 64/2008 Coll. (decree on accessibility). During six tested months there were no significant changes found on any portal.

Average results of eAgri portal (eagri.cz):

- Number of key errors – 1,
- Number of contrast errors – 14.

Average results of Agris portal (agris.cz):

- Number of key errors – 4,
- Number of contrast errors – 41.

Average results are calculated from the results of randomly selected 30 pages that were tested repeatedly each month on the both portals. An arithmetic mean is presented and its values are rounded to whole numbers. Indicator “Number of key errors” means that the part of the web is not made in terms of decree on accessibility. Second indicator “Number of contrast errors” means that somewhere on the web there is the very low contrast between foreground and background colors. Web design is similar on the most of the pages and therefore the mistakes are often repeated. The most recurrent errors are:

#### Missing alternative text

Each image must have an alt attribute. Without alternative text, the content of an image will not be available to screen reader users or when the image is unavailable.

This error was found on both portals. At the same time it is the only key error on the eAgri Portal. On the eAgri portal it is made by the security reasons and the number of occurrences is determined by the number of email addresses located within the page content. In every mailing address it is located the image, which replaces the dot. This image is not replaced by alternative text and for example older screen readers or Braille displays, as well as any automatic software of an attacker, are not able to understand the image and do not interpret it well.

On the Agris portal, those errors are more common. Those are presented mainly on image links to other web sites and within the questionnaires and surveys.

Other mentioned errors were found only on Agris portal:

#### Missing form label

A form control does not have a corresponding label. If a form control does not have a properly associated text label, the function or purpose of that form control may not be presented to screen reader users. Form labels also provide visible descriptions and larger clickable targets for form controls.

#### Document language missing

The language of the document is not identified. Identifying the language of the page allows screen readers to read the content in the appropriate language. It also facilitates automatic translation of content.

### Empty heading

A heading contains no content. Some users, especially keyboard and screen reader users, often navigate by heading elements. An empty heading will present no information and may introduce confusion. This error is present within the article parts of the Agris portal.

### Contrast errors

An important indicator is the Number of errors contrast, which is not satisfactory either on any of tested portals. Thus displayable content is hard to read for many users for example for thousands who have only low vision. Adequate contrast is necessary for all users, especially users with low vision. Text and images of text need to have a contrast ratio of at least 4.5:1. This indicator is not sufficiently fulfilled on any portal.

For the access from mobile web browsers the layout of the agrarian WWW portal Agris was redesigned in such a way that it is automatically formatted for the user depending on the display dimension and the differentiation of the final mobile unit (Šimek, Stočes and Vaněk, 2014). Another advantage is that users can switch from "mobile" to "classic" design. This will be appreciated by the users of 10" tablets with high resolution (retina displays). This switch is ergonomically placed into the upper right-hand corner (next to the language and text version options) and has been in this place since the last change of the global design of the portal in 2011 (Šimek, Jarolímek and Masner, 2014). On the contrary the eAgri portal demonstrates considerable deficiencies in this field. Comprehensive comparison of this field could be an appropriate continuation of this paper.

## 4 Conclusion

Matausch et al (2014) states that the implementation of information that is easy-to-read and easy-to-understand and easy-to-navigate on the Web is crucial to enable the broadest user group possible to make use of information that is presented on Web pages. Besides aspects of technical accessibility in terms of being able to reach the information, readability, understandability and memorability is an essential aspect of accessibility for people with disabilities and more user-friendly for all others.

Web Accessibility today provides a profound body of knowledge how to make the web accessible and usable for all, including people with disabilities. In the domain of eInclusion and eParticipation of people with disabilities the focus thereby has primarily been on accessibility in a more technical sense, allowing people to adapt the display and interaction on standard and assistive devices (Miesenberger and Petz, 2014).

The purpose of the usability study was to look on the navigation and structure of the eAgri and Agris portal and find the most visible problems in the usability of these two portals. For the analysis were used typical user scenarios and heuristic evaluation methods.

The analysis showed that there are serious problems in the usability of eAgri portal. Navigation and structure of pages represent the biggest problem. Agris portal has higher level of usability for users, but there are some minor and cosmetic problems, that should be taken care of.

Accessibility analysis demonstrated opposite results. At the portal Agris there were found dozens of accessibility errors. On the other hand portal eAgri is essentially error free except of contrast errors which are presented frequently on both portals. Correcting identified errors can be fast and simple. Application of the rules of accessibility and a slight change in color

design requires no additional investment and can be applied using only partial changes to the source code. For example Document language missing error could be repaired by adding a short HTML code of language definition using the `<html lang>` attribute (e.g., `<html lang="cs">`).

On the basis of the analysis it is not possible to clearly demonstrate which of the portals is more suitable for users. To meet the goals, both portals should apply detailed recommendations and proposed steps which are presented as the results of the applied analyzes such as: application of the Decree no. 64/2008 Coll. or WCAG 2.0 rules with ARIA (Accessible Rich Internet Applications) recommendations, a comprehensive change in navigation, application of responsive design and so on.

A more detailed usability and accessibility study should follow. The goal of the continuous research should be to find problems in the usability and to compare results of new users and advanced ones. Further result of accessibility analysis can be a comprehensive summary of errors with the recommendations and detailed instructions for their correction.

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# Wages in Czech Agricultural, Industrial and Construction Sectors

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**Annotation:** The present paper focuses on the development of wage distribution in the Czech Republic in the period shortly before, during and after the global economic crisis. Special attention is paid to wage development in the agricultural sector and its comparison with the industrial and construction sectors' wage levels. These two sectors were selected for the comparison therefore these three sectors together employ almost 40 percent of the employees of all sectors. The article deals with the development of statistical characteristics of the level, variability and concentration in the given period, mentioning the changes in these characteristics in the course of the economic recession. Data for these calculations come from the official website of the Czech Statistical Office, namely the "Percentages of employees by the band of gross monthly wages by sector" and an information about the survey sample from "Numbers of employees and their average gross monthly wages by sector and education". Data on the number of employees in the individual sectors studied come from the table "Employment and Wages", all for the years 2003–2013. Data from the Czech Statistical Office were completed data from official website of the Eurostat and by individual data from Trexima Company. Descriptive characteristics were computed from data and theoretical probability models were constructed. There are three-parametric lognormal curves with parameters estimated using the method of L-moments. Three-parametric lognormal distribution is the most common used probabilistic distribution in modeling the wage and income distributions. Method of L-moments provides the point parameter estimations sometimes even more accurate than those the maximum likelihood method.

**Key words:** Global economic recession, development of wage distribution, agricultural sector, industrial sector, construction sector, wage levels, wage differentiation.

**JEL classification:** J31, D31, Q14

## 1 Introduction

Many publications and papers in the professional literature concerns with the situation in agriculture, see e.g. Pechrová and Šimpach (2013), Šimpach and Pechrová (2014) or Dömeová and Jindrová (2014). The present paper focuses on the wage development in the Czech agricultural sector in the period prior to, during and after the global economic recession. The wage development in the above sector is compared to that in two other selected economy areas, namely the industrial and construction sectors, all three chosen fields employing almost 40 percent of people in the economy; see Table 1. Moreover, wages in the industrial and construction sectors do not differ markedly from those within other economy areas, even in comparison to the wage levels both in higher- (finance and insurance, IC) and lower-paid (e.g. accommodation, food services) sectors. The research explores wage distributions in the period between 2003 and 2013.

**Table 1.** Ratios of employees (in %) in Czech agricultural, industrial and construction sectors (taken together) to the number of all employees in all sectors of Czech economy

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Ratio	48.78	39.31	39.26	38.25	39.83	38.97	37.69	37.52	37.75	39.89	39.59

Source: Own research

Wage and income development and distribution has become the subject of research by numerous Czech and foreign authors in recent times. As examples, we can mention Bartošová and Bína (2007), which deal with mixture models of household income distribution in the Czech Republic, Behr (2007), who provides a European analysis of changes in gender specific wage inequality using decomposition methods, Dagum (1997), who demonstrates a systemic approach to the generation of income distribution models, Kaasa (2006), who deals with factors of income inequality and their influence mechanisms, Mallick (2008), who shows income distribution and consumption deprivation, Marek (2013), who deals with some aspects of average wage evolution in the Czech Republic, Milanovic (2002), who deals with true world income distribution, 1988 and 1993 and Monti and Santoro (2009), which prepare a note on between-group inequality with an application to households. Vavroušková and Čechura (2012) deal with the issue of agricultural workers.

## 2 Material and Methods

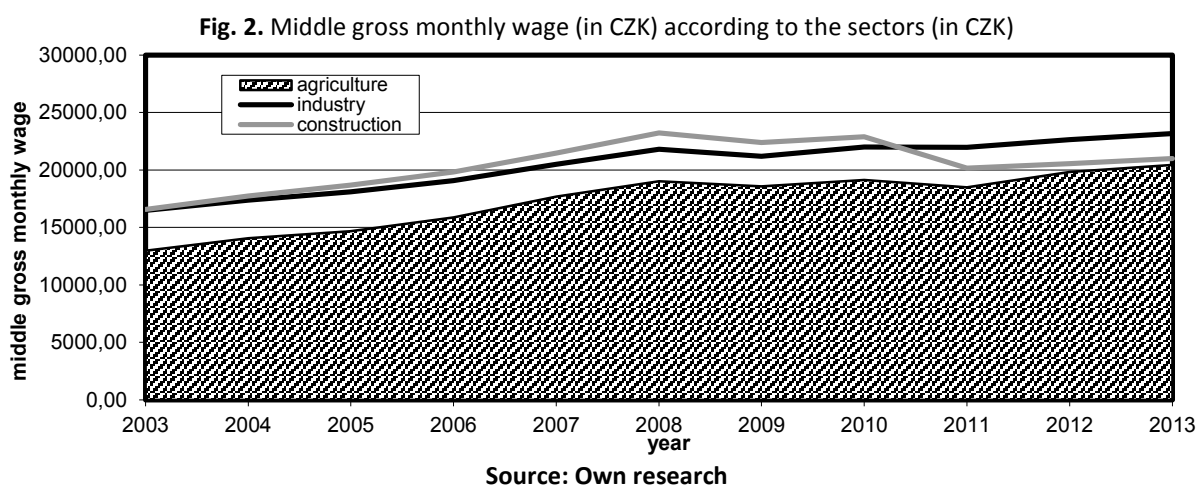
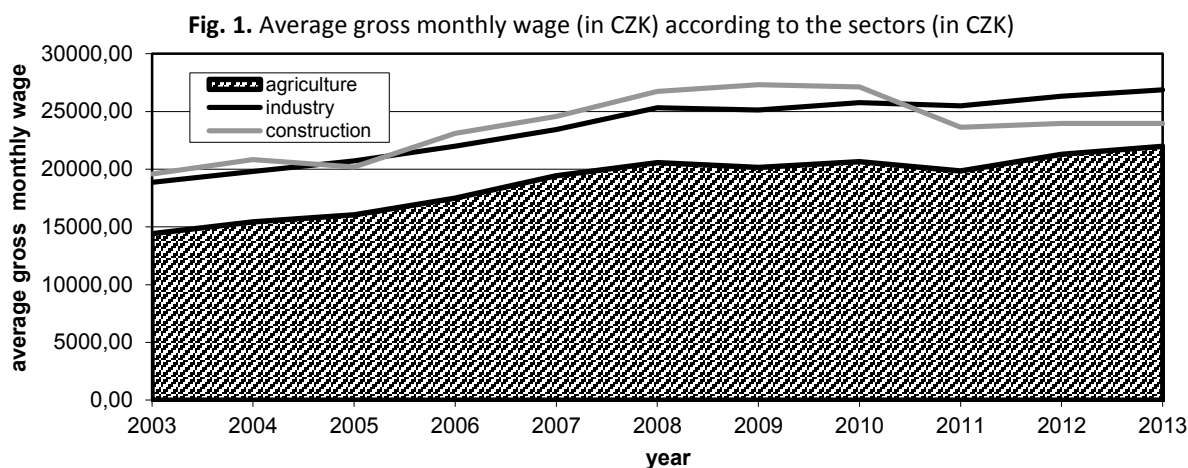
The data for the calculations are taken from the official website of the Czech Statistical Office, namely “Employee ratios according to gross monthly wage bands divided by economy sectors”, the survey sample information being drawn from “Numbers of employees and their average gross monthly wages classified by sectors and educational attainment”. Staff numbers in particular sectors come from the “Employment and wages” table. All the data are for the period 2003–2013. It is to be noted that the results obtained may be, to a certain extent, affected by changes in the methodology. Consistent time series were not available for the whole research period, the Sector Classification of Economic Activities (valid over the years 2003–2008) having been replaced by the Classification of Economic Activities (2009–2013). It is also worth mentioning that CSO data do not distinguish between “wage” in private and “salary” in public sectors, i. e. both are covered by the term “wage”. The figures from the Czech Statistical Office were supplemented by the Eurostat and Trexima company data.

The data were processed using Microsoft Excel spreadsheet and SAS and Statgraphics statistical program packages. In this paper, the method of L-moments of parameter estimation was used; see Hosking (1990) or Kyselý and Pícek (2007). Three-parameter lognormal curves represent the basic probability theoretical distribution; see Johnson, Kotz and Balakrishnan (1994), simple descriptive characteristics used in the calculations being explained in Triola (2003). The key variable in this study is the gross monthly (nominal) wage (in CZK).

## 3 Results and Discussion

Figure 1 allows us to compare the average gross monthly wage in the industrial and construction sectors with that in the agricultural sector. Similarly, Figure 2 enables a comparison of middle gross monthly wages in the above sectors.





It is clear from these figures that the wage levels in the industrial and construction sectors are close to each other, while the level of wages in the agricultural sector is considerably lower in comparison to the former sectors. It is also obvious that in the period of global economic crisis, the growth of wage levels in all the three sectors virtually stopped, the earnings having fallen sharply in 2011, particularly in the construction sector. An upward trend in the wage development over the following years is much slower than before the recession, which is shown in Table 2. It follows from this table that in the pre-crisis years the average gross monthly wage in the agricultural, industrial and building sectors increased by averages of 7.36, 6.06 and 6.44 percent per annum, the middle gross monthly wage in the respective sectors rising by 7.98, 5.76 and 6.98 percent on average. In the period 2011–2013, on the other hand, the average gross monthly wage increased on average only by 2.10 and 1.42 percent a year in the agricultural and industrial sectors, respectively, in the construction sector even decreasing by average of 4.07 percent.

**Table 2.** Annual increase (+) or decrease (-) in the level of gross monthly wage (in %)

Year	Agriculture		Industry		Construction	
	Mean	Median	Mean	Median	Mean	Median
2003	-	-	-	-	-	-
2004	7.05	8.53	5.03	5.38	6.43	7.11
2005	3.92	4.31	4.65	4.30	-3.09	5.28
2006	9.06	8.05	6.08	5.25	14.39	6.14
2007	11.10	11.45	6.55	7.58	6.38	8.26
2008	5.82	7.66	8.02	6.35	8.87	8.16
2009	-2.00	-2.36	-0.69	-2.83	2.10	-3.49
2010	2.39	3.01	2.45	3.87	-0.66	2.19
2011	-3.86	-3.36	-1.05	-0.18	-12.87	-11.92
2012	7.26	7.11	3.33	3.10	1.43	1.99
2013	3.21	3.19	2.04	2.27	-0.10	2.04
∅ 2003-08	7.36	7.98	6.06	5.76	6.44	6.98
∅ 2008-11	0.52	1.14	2.12	1.74	-0.96	-1.55
∅ 2011-13	2.10	2.22	1.42	1.72	-4.07	-2.86
∅ 2005-13	4.30	4.66	3.60	3.46	2.04	2.40

Source: Own research

As already mentioned above, the wage level in the agricultural sector is significantly lower than in the sectors of industry and construction. In Tables 3 and 4,  $\mu_A$ ,  $\mu_I$  and  $\mu_C$  denote the expected values in the respective sectors. The null hypothesis of an equality of the expected values in the two corresponding sectors has been tested against an alternative hypothesis that the expected value in one sector is below that in another sector. The average gross monthly wage in the agricultural sector is lower than that in the industrial and construction sectors (left-sided alternative figures in Table 3) and the average gross monthly wage in the industrial sector is lower than that in the construction sector in 2003, 2004, 2006, 2007, 2008, 2009 and 2010 (left-sided alternative in Table 4), contrary to the years 2005, 2011, 2012 and 2013 (right-sided alternative in Table 4).

In Table 3, all alternative hypotheses are left-sided, thus the critical range at a 5% significance level is  $W_{0.05} = \{u: u \leq -1.645\}$  and at a 1% significance level  $W_{0.01} = \{u: u \leq -2.326\}$ . Critical ranges for hypothesis tests are included in Table 4. There are always two independent samples. Because of the large sample sizes, the test criterion

$$U = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (1)$$

has an asymptotically standardized normal distribution assuming the null hypothesis is true. In this formula,  $\bar{x}_1$  and  $\bar{x}_2$  denote the averages and  $s_1^2$  and  $s_2^2$  the variances in the first and second sample, respectively,  $n_1$  and  $n_2$  indicating the sample sizes.

**Table 3.** Hypothesis testing of the equality of expected values  $\mu_A = \mu_I$  and  $\mu_A = \mu_C$ 

Agriculture – Industry			Agriculture - Construction		
Year	Alternative hypothesis	Test criterion	Year	Alternative hypothesis	Test criterion
2003	$\mu_A < \mu_I$	-93.694	2003	$\mu_A < \mu_C$	-58,878
2004	$\mu_A < \mu_I$	-96.308	2004	$\mu_A < \mu_C$	-60.559
2005	$\mu_A < \mu_I$	-105.493	2005	$\mu_A < \mu_C$	-47.422
2006	$\mu_A < \mu_I$	-83.180	2006	$\mu_A < \mu_C$	-51.851
2007	$\mu_A < \mu_I$	-64.951	2007	$\mu_A < \mu_C$	-50.856
2008	$\mu_A < \mu_I$	-66.671	2008	$\mu_A < \mu_C$	-52.955
2009	$\mu_A < \mu_I$	-69.214	2009	$\mu_A < \mu_C$	-44.361
2010	$\mu_A < \mu_I$	-67.926	2010	$\mu_A < \mu_C$	-45.876
2011	$\mu_A < \mu_I$	-75.214	2011	$\mu_A < \mu_C$	-32.923
2012	$\mu_A < \mu_I$	-134.962	2012	$\mu_A < \mu_C$	-48.509
2013	$\mu_A < \mu_I$	-136.676	2013	$\mu_A < \mu_C$	-41.616

Source: Own research

**Table 4.** Hypothesis testing of the equality of expected values  $\mu_I = \mu_C$ 

Industry – Construction				
Year	Alternative hypothesis	Test criterion	Critical range at 5% significance level	Critical range at 1% significance level
2003	$\mu_I < \mu_C$	-9.054	$W_{0.05} = \{u: u \leq -1.645\}$	$W_{0.01} = \{u: u \leq -2.326\}$
2004	$\mu_I < \mu_C$	-12.555	$W_{0.05} = \{u: u \leq -1.645\}$	$W_{0.01} = \{u: u \leq -2.326\}$
2005	$\mu_I > \mu_C$	6.702	$W_{0.05} = \{u: u \geq 1.645\}$	$W_{0.01} = \{u: u \geq 2.326\}$
2006	$\mu_I < \mu_C$	-11.147	$W_{0.05} = \{u: u \leq -1.645\}$	$W_{0.01} = \{u: u \leq -2.326\}$
2007	$\mu_I < \mu_C$	-13.083	$W_{0.05} = \{u: u \leq -1.645\}$	$W_{0.01} = \{u: u \leq -2.326\}$
2008	$\mu_I < \mu_C$	-14.423	$W_{0.05} = \{u: u \leq -1.645\}$	$W_{0.01} = \{u: u \leq -2.326\}$
2009	$\mu_I < \mu_C$	-14.413	$W_{0.05} = \{u: u \leq -1.645\}$	$W_{0.01} = \{u: u \leq -2.326\}$
2010	$\mu_I < \mu_C$	-10.899	$W_{0.05} = \{u: u \leq -1.645\}$	$W_{0.01} = \{u: u \leq -2.326\}$
2011	$\mu_I > \mu_C$	19.490	$W_{0.05} = \{u: u \geq 1.645\}$	$W_{0.01} = \{u: u \geq 2.326\}$
2012	$\mu_I > \mu_C$	47.615	$W_{0.05} = \{u: u \geq 1.645\}$	$W_{0.01} = \{u: u \geq 2.326\}$
2013	$\mu_I > \mu_C$	70.593	$W_{0.05} = \{u: u \geq 1.645\}$	$W_{0.01} = \{u: u \geq 2.326\}$

Source: Own research

**Table 5.** Average gross monthly wage (in CZK) for the selected professions/jobs in agricultural sector in 2013

Profession/job	Milkmaid	Breeder, nurse of animals	Tractor driver, combine driver	Agricultural engineer, agronomist	Agricultural technician	Agricultural technologist	Zoo technician
Wage	15,997	14,766	21,839	25,320	20,864	28,833	22,575

Source: own research

Fig. 3. Development of the probability density function in agricultural sector

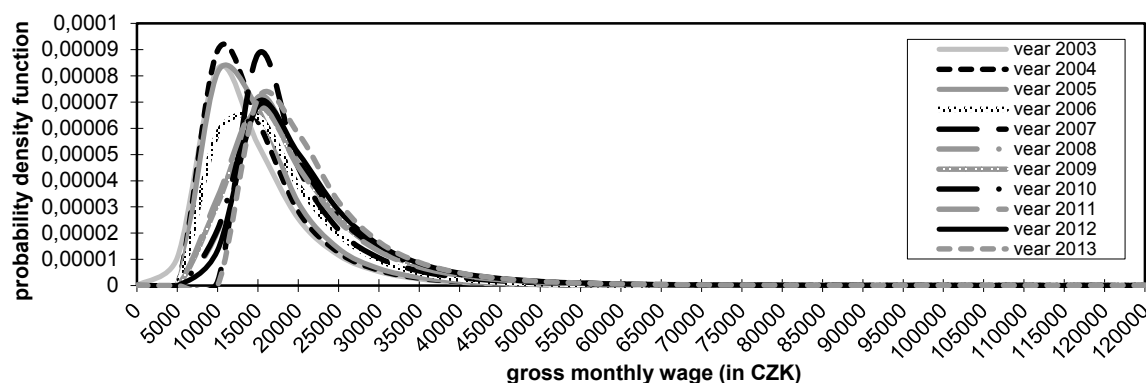


Fig. 4. Development of the probability density function in industrial sector

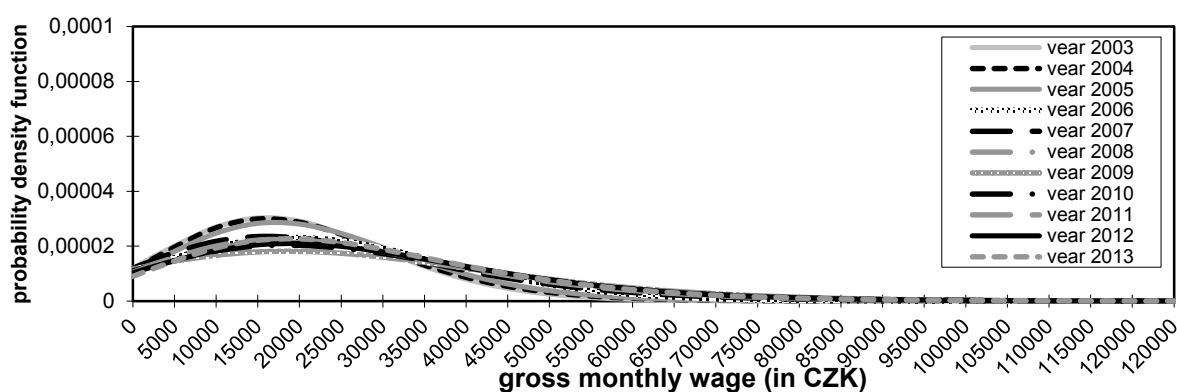
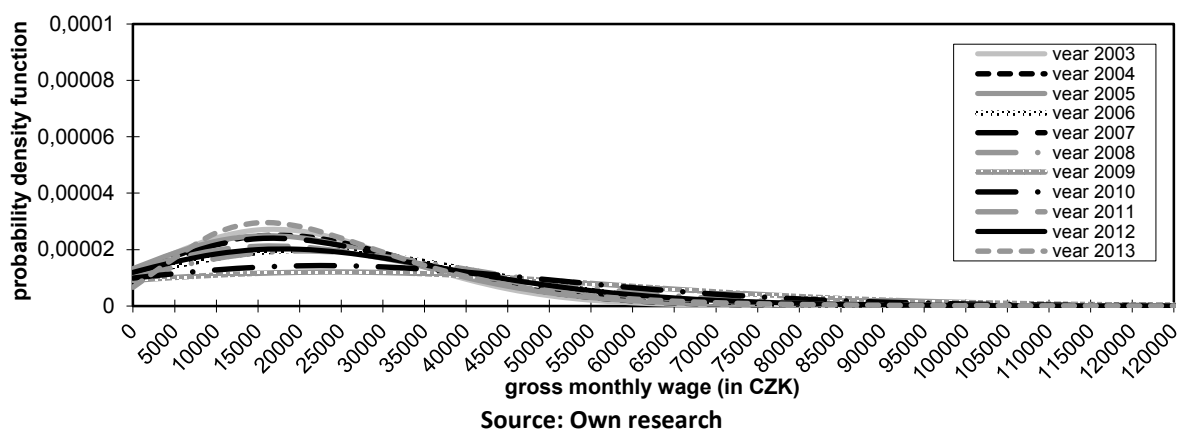


Fig. 5. Development of the probability density function in construction sector



With respect to the results shown in Table 3, it is clear that all the tests are significant, which is mainly due to large sizes of both random samples. The test of such a high power almost always leads to the rejection of the null hypothesis of equality of the expected values in both the sectors, even at a 1% significance level. We can, therefore, conclude that the level of wages in the agricultural sector is significantly lower than that in the industrial and construction sectors in the period 2003–2013. Likewise, all the tests in Table 4 came out significant as well, even at a 1% significance level, although the differences between sample wage averages in the industrial and construction sectors are not as striking as those of these two sectors compared with sample average wages in the competing agricultural sector; see Figure 1. Thus we can draw the conclusion that the level of wages in the industrial sector

is significantly lower than that in the construction sector in the years 2003, 2004 and 2006–2010. In 2005, 2011–2013, on the other hand, the level of wages in the industrial sector is significantly higher than that in the construction sector.

Interestingly, Table 5 provides an overview of the average gross monthly wage in the selected professions in the agricultural sector. As expected, agricultural technologists, engineers and agronomists achieve the highest, while breeders, nurses of animals and milkmaids earn the lowest average gross monthly wages.

Figures 3–5 indicate the development of a theoretical (model) wage distribution in time. There are three-parameter lognormal curves with parameters estimated employing the method of L-moments. The three-parameter lognormal distribution is the most common probabilistic approach used in modeling wage and income distributions. The advantages of the method of L-moments are known from the statistical literature; see, e.g. Hosking (1990). This method provides point parameter estimations that are sometimes even more accurate than those made by the maximum likelihood method. It is to be noted that there is the same scale on the vertical axis for all the three Figures 3–5. A very similar development of wage distribution in the industrial and construction sectors can be observed from Figures 4–5. If we, however, compare the wage development in these two sectors with that in the agricultural sector, we can report completely different findings in the latter. Since the wage distributions in the agricultural sector are characterized by large skewness and kurtosis, more workers earn much lower wages than in the industrial and construction sectors. Wage distributions in the industrial and construction sectors, on the other hand, are much less skewed with very small kurtosis.

#### 4 Conclusion

Statistically, the level of gross monthly wage in the Czech agricultural sector is significantly lower than in the other two sectors of economy. The differences in the level of gross monthly wage between industrial and construction sectors are also statistically significant. However, this is probably due to the large sample sizes, which result in a high power of the test, thus leading to the rejection of the tested hypothesis. Furthermore, the relationship between the above sectors in terms of the level of gross monthly wage is changeable over time, both sectors reaching higher wage levels at certain times throughout the research period.

The global economic downturn brought about profound changes in the behavior of wage distribution, the growth of earnings having virtually stopped – a decline in both average and middle gross monthly wages in all three sectors analyzed having been reported even in 2011. With the recession subsiding, wages began to grow again, but in a much slower pace than in the before-crisis period. The economic downturn meant an increase in the concentration and variability, particularly in the construction sector. It can be concluded that the behavior of the wage distribution in the agricultural sector is noticeably different from that in the other two sectors.

It follows from the above that there is a significant disproportion between the levels of wages in the Czech agricultural sector on the one hand and the level of wages in the Czech industrial and construction sectors on the other. The solution of this situation may be to increase subsidies for the agricultural sector and the binding of these subsidies with labor power. Another solution may lie in the forgiveness of employer payments for health insurance and social security for farmers following the example of Poland.

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## Labour productivity in agriculture – value known or unknown?

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**Annotation:** The authors devote this contribution to selected questions of labour productivity in agriculture. They result from the indisputable role of this economic indicator (and its monitoring) on both the microeconomic and macroeconomic level, and also in relation to its impact on performance, competitiveness, etc. Labour is defined in classical theory as one of the primary factors of production, together with land and capital. The increasing importance of secondary factors has been highlighted by some authors, including information, technology, and the results of science and research. However, it is only labour which can be considered as the factor which connects all the other factors and exploits them - it would not be functional without it. Labour productivity (LP) is indeed one of the partial indicators of overall productivity, but it still stands at the forefront in both theory and practice. Regarding Czech agriculture, from the analysis (using the current method of LP monitoring) it was clearly shown that productivity of Czech agriculture has considerable reserves. It is alarming to see the low value of the Gross Value Added (GVA), suggesting considerably higher cost inputs. Furthermore, according to Eurostat data, over the period of nine years, GVA has increased in the prices of agricultural producers by only 5% (2012/2004), and the GVA in current prices even decreased by 15% (2012/2004). The result is the low level of labour productivity in comparison with economically developed EU countries (45.2% of labour productivity achieved in Austria - 2012).

**Key words:** Labour productivity, indicators, labour costs, GVA, AWU.

**JEL classification:** Q12, J30

### 1 Introduction

Productivity is one of the decisive factors, which affects performance, efficiency and competitiveness in a significant way, both at the microeconomic and macroeconomic level. This role is not questioned in either theory or practice. Theoretical approaches distinguish between several types of productivity, depending on what respect is accessed to productivity. According to the degree of involvement of production factors there are, essentially, two basic ways to monitor labour productivity: "total productivity" (factor productivity), and "partial productivity" (productivity linked to just one factor of production). Depending on the level at which productivity is monitored, we can define this as "microeconomic" (productivity in some type of fabrication, in company unit or in company as a whole) and "macroeconomic" (sector of the national economy, national economy as a whole etc.). Additionally, some authors (Synek, 2002) recommend to watch it as "technical" (measured in physical units) and "techno-economic" (measured in monetary units).

It is generally preferred in practice to express the productivity by participation of production factors. Priority is given to monitoring of the partial productivity against total productivity; the preferred type of partial productivity is labour productivity, i.e. productivity resulting from labour. However, theoretical approaches in this area do not coincide completely. Some authors question the uniqueness of labour productivity (Veber, 2000; Kislingerova, 2008; Klecka, 2007), while pointing out that the partial productivity indicators may distort reality, because the result is formed by the simultaneous action of all factors, not just one, and it is



therefore necessary to prioritize the monitoring of total factor productivity before partial productivity. Total output cannot be understood to be a consequence of the primary performance of the labour factor alone, but it is also subject to technical advances (technology), and other internal and external factors. Labour productivity (LP) therefore has a secondary influence. This view appears both in older publications (Solow, 1957) and newer (Van Praag and Versloot, 2008), where the fundamental factor behind the growth of performance is not considered as labour, but technological progress. Other approaches, moreover, were not considered to be long-term primary factors of production (land, labour, capital) as single basic economic resources, but warn of the irreplaceable role of knowledge and information (Drucker, 1994). It is obvious that labour is not the only factor necessary to achieve a certain result. However, without the involvement of the labour force, all other factors of production would remain “dead”. Labour force (i.e. human labour) is the only factor able to combine and use all these other factors of production, and we can even say “gain” from them. The authors of this paper are therefore primarily engaged in the productivity of human labour, in order to determine whether the method of its monitoring is relevant, transparent and meaningful.

One of the main issues that are associated with labour productivity is the way in which it can, and should be measured. Generally, productivity can be understood as the relative relationship between the size of the benefit (output) and the resources employed to achieve it (inputs). This was simplified by Coelli (2005) as the ratio of outputs and inputs. It then depends on which category is used as the numerator and which is the denominator of this mutual relationship. Variability in labour productivity indicators exists depending on which category is selected in the calculation of productivity. The measurement of labour productivity was originally applied to manual labour. In that case it was a simple procedure, where in the numerator of the relationship was production (usually in terms of volume), and in the denominator was the number of the labour force, or the number of hours worked. Labour productivity then expressed how much of production was made by one person or per time unit. The indicator was clear and transparent. As the labour productivity started to be monitored at higher levels (company unit, enterprise, sector, national economy), it was clear that they must seek other inputs and outputs to reflect the involvement of all workers (labour forces), not only the manual workers. Additionally, in the numerator, the result expressed in terms of volume could not be used, but rather, its’ value<sup>12</sup>. It is obvious that to determine the actual productivity on the sectorial level or in the national economy is not realistically possible. If we consider as the labour input the number of the labour force, there arises the problem of differences in its professions, its quality, skills, status participation in the formation of value, and its influence on it. When using the time, it is not entirely conclusive that recorded work time is the actual time of work. If we wanted pure “yield” of human labour, there should

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<sup>12</sup> Note: In this context it may be noted that in the former centrally planned economies after their transition to market relations, the amount of production in monetary terms has long been used (in determining the productivity), rather than created or added value. A typical example was, e.g. monitoring of labour productivity just in agriculture in the Czech Republic.<sup>13</sup> Components explained 45.89%, 10.75% and 9.62% of the variance respectively of the total variance (66.26%). In addition, by using a Barlett’s test of sphericity (Chi-square: 179 032, df: 66; p<0.01), an overall measure of intercorrelations among variables in the analysis was obtained. The degrees of correlation among variables and the suitability of factor analysis also were calculated using a Kaiser-Meyer-Olkin (KMO) test (0.771), which measures the sampling adequacy for both the overall test and each individual variable (Field, 2012).

be the worth of work, which was only the result of the labour force. However, as stated above, it is not possible to completely separate factors in the process of “value creation” to assess their own contribution to this process.

Labour productivity has an important role in agriculture, especially in connection with the requirement to increase its competitiveness. If the productivity of agriculture is increasing, its’ competitiveness is also increasing (Bašek and Kraus, 2011). This does not mean that productivity is the only factor that affects competitiveness. An important factor is the price development, the cost development, science, research, engineering and technology and others. Some authors suggest that labour productivity in agriculture is largely in line with labour productivity in non-agricultural sectors, and with the level of the overall economic development of the country (Schmitt, 1988). They recommend to monitor the share (in %) of added value generated by one farmer, to the added value created by one labour force in the national economy.

## 2 Objectives and methods

The authors of this paper, in view of the above problem with the productivity measurement, pose the following two research questions, which are also the objectives of the contribution:

- Whether the current methods of quantification of labour productivity in agriculture are appropriate, or whether it is possible to monitor LP in other ways than by the usual indicators.
- Whether, after 11 years of using the CAP, Czech agriculture shows similar labour productivity as in the more economically-developed countries of the EU.

These objectives correspond to the chosen methodology. The following indicators were selected to monitor and analyse labour productivity in agriculture:  
 - Traditional indicator (1), used for the measurement of labour productivity in agriculture, uses the contribution of this sector to the gross domestic product on the output side, expressed as “gross value added” (GVA), and on the input side “annual work unit” (AWU). The AWU corresponds to the work performed by one person who is occupied on an agricultural holding on a full-time basis. Full-time means the minimum hours required by the relevant national provisions governing contracts of employment. If the national provisions do not indicate the number of hours, then 1,800 hours are taken to be the minimum annual working hours: equivalent to 225 working days of eight hours each.

Gross value added is considered to be the output of labour force activities, defined as the difference between total agricultural production, including the balance of operating taxes and subsidies, and production consumption (Farm Accountancy Data Network - FADN), or as the value of all newly generated goods and services, less the value of all goods and services consumed as intermediate consumption of the agricultural industry (Economic Accounts for Agriculture - EAA). Certain shortcomings of this option are that the GVA is affected by all factors of production, not only by labour force. The indicator can be used for comparison, but it does not reflect the actual efficiency of the separate production factor “labour”.

$$\text{Labour productivity} = \text{GVA}/\text{AWU} \quad (1)$$

One option that would eliminate the above mentioned lack is to express output as “net value added” (NVA), i.e. the GVA, less any fixed capital costs, which are expressed through depreciations. The influence of other production factors is not, however, eliminated by this indicator.

$$\text{Labour productivity} = \text{NVA}/\text{AWU} \quad (2)$$

Relationship (2) has eliminated the fixed capital costs. Other production factor costs avoidance is possible by eliminating the costs of wages paid, costs of rent and costs of financial capital (interests paid). The final category is that of entrepreneurial income (EAA), or income from agricultural activities (FADN), but items such as received rent and interest income must be excluded as the income from these are unrelated to the production factors used.

$$\text{Labour productivity} = \text{entrepreneurial income (income from agricultural activities)} / \text{AWU} \quad (3)$$

Another way to monitor LP is to track the relationship between GVA and labour costs. The advantage of this approach is that it takes into account the cost, i.e. the economic side of output creation. All other indicators of labour productivity use more or less physical inputs (time, people). On the other hand, it can be considered as a shortcoming that the current database only provides data on staff costs; the costs of the entrepreneur (entrepreneur’s reward) are not given in the databases currently available.

$$\text{Labour productivity} = \text{GVA} / \text{labour costs} \quad (4)$$

The indicator of labour productivity is a significant indicator itself, however, it is necessary to compare it with other indicators. This comparison makes it possible to assess the productivity in a complex way, interrelated. The authors of this paper used the following indicators in the context of comparison:

$$\text{Average labour productivity in agriculture} / \text{average wage in agriculture} \quad (5)$$

Generally, it is on behalf of prospective economic growth that labour productivity would grow faster than average wages. This rule can be also apply to agriculture.

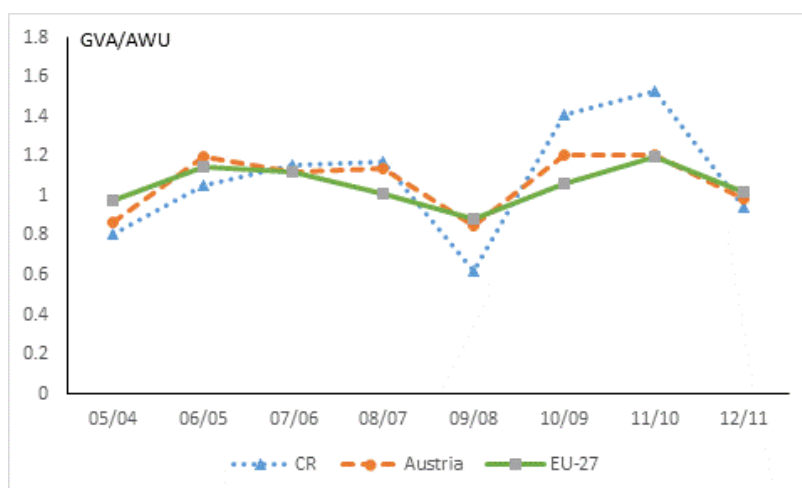
$$\text{Average labour productivity in agriculture} / \text{average wage in national economy} \quad (6)$$

The authors, when choosing this indicator, reflect some creative approaches emphasizing the relevance of the position of sectors in the national economy. To quantify the time series of indicators, data provided by Eurostat, the Czech Statistical Office, Ministry of Agriculture and the Austrian “Ministerium für ein Lebenswertes Österreich” were used.

### 3 Results and Discussion

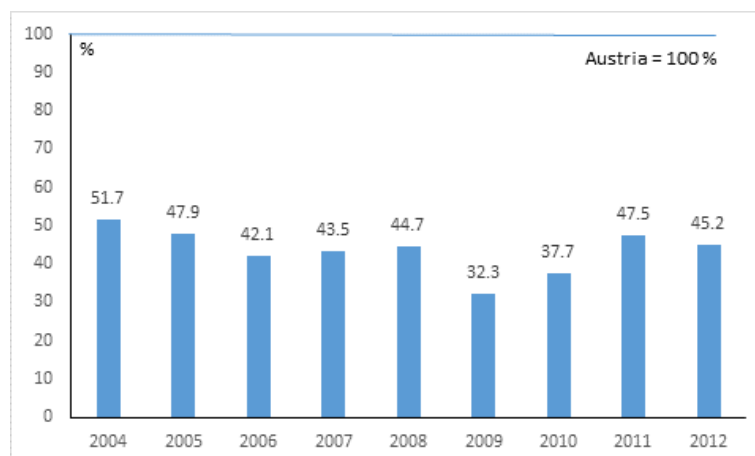
If we follow the development of labour productivity using index analysis in agriculture of the CR (*figure 1*), we can conclude that it shows a significant positive trend. The periods of moderate growth alternate with declines (2009/2008 - impact of the crisis; 2012/2011), followed by a significant rise. These "jumps" were not caused by actual labour productivity growth, but by the choice of methods for setting the trend (index analysis), because the level of the indicator of labour productivity would, after falling, go back to its original level. The growth of this indicator is also affected by the development of GVA and AWU, when the AWU decreased faster than increased gross value added. In contrast, labour productivity in Austrian agriculture, for example, is stable, and has similar annual increases, as does the average for the EU-27. Even if the more stable and balanced growth would be eligible for the Czech agriculture productivity, the current situation is not quite a negative development at all.

**Fig. 1.** Growth of labour productivity in agriculture - comparison the CR, Austria, the EU-27 (index)



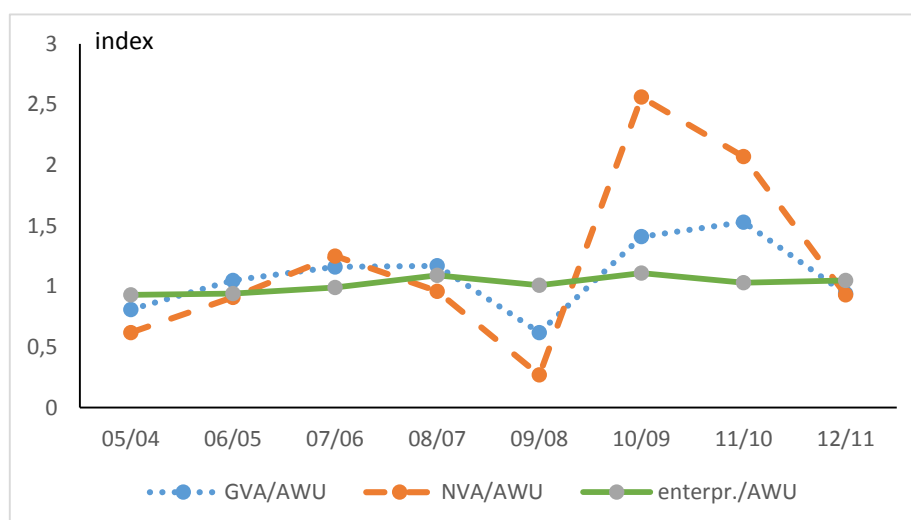
Source: authors, using Eurostat data

If we evaluate the absolute level of labour productivity measured by GVA/AWU, however, the situation is different. Labour productivity showed no significant increases in the monitored nine years (2004-2012) following the Czech accession into the EU, the annual values are on average around €9.35 million, while for example, in Austria, it is €21.45 million for the same period. The comparison of the annual value of labour productivity in Austrian and in Czech agriculture is shown in *figure 2*. It clearly shows that LP in Czech agriculture is on average of 44% of the labour productivity of Austrian agriculture. It correspond also with findings of Rungsuriyawiboon and Hockmann (2012), who analysed Polish farms and stated that it may take capital and labour approximately 27 and 30 years resp., to adjust fully to their optimal level. Their findings imply, that the Polish farms in that study, on average, could have been reduced the dynamic and variable factors by 46% and 42%, resp., and still produce the same level of output. An approximate vertical analysis shows that in case of Czech agriculture the cause of this is high cost input (intermediate consumption). Why this is so, it is a subject for further research.

**Fig. 2.** Comparison of levels of labour productivity in agriculture of the CR and Austria (%)

Source: authors, using Eurostat data

Using the above methodology, the traditional indicator of labour productivity of Czech agriculture (GVA / AWU) was compared with other possible indicators of labour productivity - NVA / AWU - and with the income from agricultural activity per AWU (*figure 3*). The net value added created by one AWU has substantially the same tendency with the development of GVA / AWU, albeit with significant inter-annual differences. In contrast, the income generated by one work unit is basically still the same. The fact that the entrepreneurial income/AWU did not fall as significantly as in the case of GVA/AWU and NVA/AWU in 2008/2007 and 2009/2008 was a consequence of endowment policy, an aim of which is always to keep incomes of agricultural producers (for social and political reason) at an appropriate level. The data in graph 3 are introduced in the form of indices, meaning that they illustrate a trend, rather than a level, of the given indicator. Therefore NVA/AWU is above the value of the index GVA/AWU in 2007/2006.

**Fig. 3.** Comparison of labour productivity development in agriculture of the CR (comparison of indicators, index)

Source: authors, using "Green Reports" of the CR 2004 - 2013

The comparison of the development of LP with wage developments (or with labour costs) is significant. The data in *table 1* indicate that labour productivity development in agriculture in the reporting period did not always fulfil the basic principle of faster productivity growth

before wages or labour costs. It is obvious that in conditions where the decisive majority of the labour force in agriculture is hired (71.5% in 2012), wages cannot be changed every year depending on the results of agricultural enterprises. In contrast, the situation of individual farmers, whose incomes are directly dependent on what kind of results they will reach every year, is quite different. Data given in that table relate only to workers, because there are no records of business rewards of individual farms in the Czech Republic.

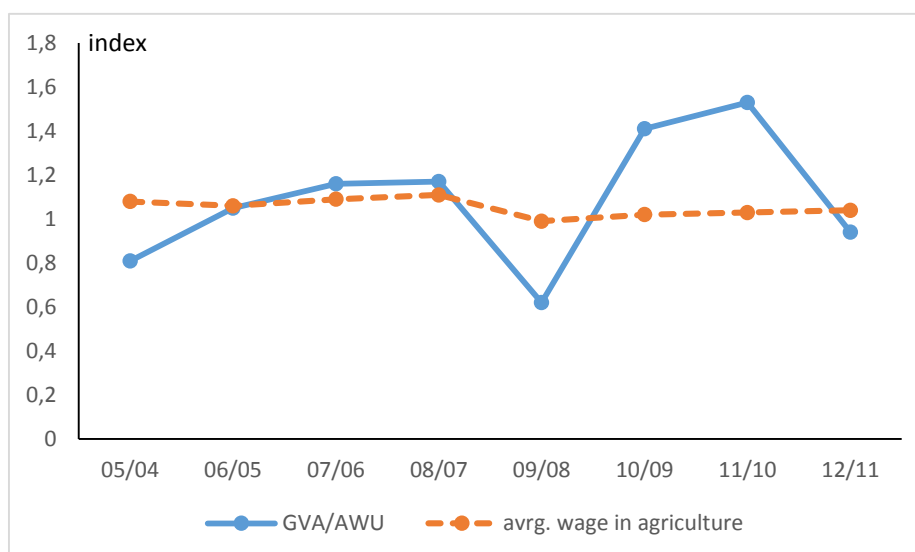
**Table 1.** Comparison of labour productivity development and labour costs

	05/04	06/05	07/06	08/07	09/08	10/09	11/10	12/11
GVA/labour costs	1.05	1.04	1.06	1.07	0.95	0.97	0.99	1.00
GVA/AWU	0.81	1.05	1.16	1.17	0.62	1.41	1.53	0.94
Average wage	1.08	1.06	1.09	1.44	0.99	1.02	1.03	1.04

Source: Czech Statistical Office, Green Reports 2004-2013

As mentioned above, an additional characteristic, which is recommended by some authors and can be used, is the relationship of labour productivity achieved in agriculture compared to labour productivity in the national economy as a whole. This comparison is shown in figure 4. The comparison shows the disparity in trends. While in agriculture labour productivity is not fully balanced, in the national economy growth in LP was not seen during the reporting period (a mean chain index was 1.00). We do not believe that this indicator is relevant to the agricultural sector (Bohackova, 2013). This view stems from the fact that agriculture has its own specifics, which significantly differ from other sectors of the national economy. In making this statement we mean the specific conditions for business (natural conditions) for the way of production (biological nature), as well as the very nature of the product, its processing, and its' specific market. Although macroeconomic conditions are substantially identical for all sectors of the national economy (the same methodology is used for monitoring and quantifying resulting indicators in the national accounts), it is not possible to ignore the specifics of the agricultural sector. If it were not taken into account, the comparison would not be transparent. Graph 4 gives only information; a deeper analysis (at the level of national economy) would exceed the aims of the paper.

**Fig. 4.** Comparison of labour productivity development and wages development in agriculture (index)



Source: Czech Statistical Office, Green Reports 2004-2013

## 4 Conclusion

Within the article it is not possible to include all the substantive areas related to productivity in detail. Yet, even with this analysis, it is possible to approximate the findings and deduce certain conclusions. These conclusions may be given both in the general, theoretical context, and also in the practical context of agriculture in the CR.

In general, it is particularly important to clarify whether it makes sense to monitor labour productivity (i.e. a partial productivity) in the agricultural sector. Would it not be more useful to monitor the overall productivity, i.e. the productivity of all factors of production as a whole? Arguments can be “for” or “against”. To monitor the productivity of the labour factor, it can be argued that human labour connects all the other factors of production. Without this factor the others would basically not be used. So the output is basically the result of the labour factor. On the other hand, it is very difficult, almost impossible, to determine how efficiently the labour factor is used, since all categories characterizing outputs/results cannot accurately be divided into those that are caused by only the capital, by just labour or land, or by information etc.

If we accept the fact that the monitoring of labour productivity makes sense, then we must decide how we are going to express it. It is easier for manual labour, where we can usually find a relationship between labour and result. It is more difficult both at the corporate level and sectorial level. The nature (essence) of “work” in agriculture has changed substantially, to watch outputs in kind (natural output; output at fixed prices) misses the point. Logically, natural outputs in a market economy are replaced by output value (revenues).

Since it is impossible to determine the direct output bound only with the production factor of labour, the authors recommend to monitor overall productivity (i.e. the productivity of all factors of production). An indicator of overall agricultural productivity could then have the form of a ratio indicator, where the numerator could be GVA (it represents a value that exceeds the input), the denominator should then be the value of all contributing factors of production (e.g. their costs).

Regarding Czech agriculture, from the analysis (using the current method of LP monitoring) it was clearly shown that productivity of Czech agriculture has considerable reserves. It is alarming to see the low value of the Gross value added, suggesting considerably higher cost inputs. Furthermore, according to Eurostat data, over the period of nine years following Czech accession to the EU, GVA has increased in the prices of agricultural producers by only 5% (2012/2004), and the GVA in current prices even decreased by 15% (2012/2004). The result is the low level of labour productivity in comparison to economically developed EU countries (such as 45.2% of labour productivity achieved in Austria - 2012).

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## Legal Aspects of Agricultural Land in the Czech Republic

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**Annotation:** The protection of land is an essential part of EU agricultural policy. Currently is underway in the most EU Member States the soil degradation that threatens their sustainable use. The General Assembly of the United Nations declared the year 2015 the International Year of soil and the December 5, 2015 the International Day of the soil. The aim of this event is to increase public awareness and the responsible national authorities about the importance of soil conservation, its sustainable management as the basis of the food system, its importance for the production of fuels and protect of essential ecosystem services upon which the biodiversity depends. The aim of this article, based on an analysis of the loss of agricultural land during the reporting period, is to determine the causes of the reduction of agricultural land and to determine whether the main cause of the seizure of agriculture is insufficient legal regulation. A partial objective will be to seek a balance between social interests of municipalities and regions in order to ensure the development of entrepreneurial activities and the ever increasing use of agricultural land for non-agricultural purposes. This issue will be investigated in relation to the legislation in the Czech Republic and the Slovak Republic in terms of agricultural land protection in these countries. International Year of the land gives space to think about how the state has continued to pursue a policy of land protection in the Czech Republic and change long-term building of materialistic relationship to the land, as a means to making a profit. Land is a final and non-renewable natural resource. Its protection primarily is in the interests of each country and its citizens.

**Key words:** Agricultural land, soil, degradation, building, law

**JEL classification:** K11, Q18, Q24

### 1 Introduction

The UN General Assembly declared 2015 the Year of Soils 2015, and 05.12.2015 the World Soil Day. The event aims to draw attention to the fact that in most EU countries, occupation and degradation of land designated originally for agricultural production are currently underway in a manner that borders on its sustainable use for its primary mission: the production of food and feed sources. The aim of the paper is to raise awareness of the public and responsible national authorities about the importance of agriculture, in particular of arable land, the sustainability of its scale and farming skills as the basis of the food system. Land is also a base for the production of biofuels and feed for farm animals. Finally, we also protect it as a landscaping element and a base for a dependent biologically diverse ecosystem. (Pražan and Dumbrovský 2011) Land protection is a necessary part of the agricultural policy of the EU. Interest in Agricultural Land Fund protection is a part of the environmental protection policy within the EU. However, protection of land as such remains fully within the competence of individual states.

Currently, the protection of the Agricultural Land Fund is resolved by Act No. 334/1992 Coll., on Agricultural Land Fund Protection, in amended wording, and it is implemented by two decrees, i.e. Decree No. 13/1994 Coll., by which are regulated some of the details of the protection of the Agricultural Land Fund, and Decree No. 48/2011 Coll., on Determining Classes of Protection. The content of the Act is the definition of the Agricultural Land Fund, its

qualitative and quantitative protection, the regime of the removal of agricultural land from the Agricultural Land Fund, payments for removal of agricultural land, the powers of state administration in the Agricultural Land Fund protection section and sanction provisions. An analysis of the historical development of the legal regulations of the relevant issue illustrates the political situation of the relevant period and reflects changes in society. Outlining the loss of the Agricultural Land Fund for the monitored period in relation to legislation only refers to the overall situation in society.

## 2 Materials and Methods

The aim of this paper is to analyse the legal regulation of the protection of ALR, and to find out, through the evaluation of the current legal regulation, whether it is appropriately efficient, or whether it should be changed, in particular, by making it stricter due to the dramatic loss of agricultural land. Such loss is mainly caused by the acquisition of agricultural land for the purposes of the construction of support areas for (large) cities, the so-called business and industrial zones. The authors of this article are enquiring the following hypothetical questions: is the present legal regulation of the protection of the ALR sufficient, timely, and efficient, and whether it is desirable to make the protection of ALR stricter (both qualitatively and regarding its size), whether it is desirable to make the obligations of the proprietors and tenants stricter, and, in particular, to make the acquisition of land by new tenants more difficult.

Methods: analysis of legal documents, descriptive and compilation synthesis, and a short structured interview. The quantitative data are withdrawn from public sources, from the sources of the Czech statistical office, and from the sources published on the internet pages of the Ministry of Agriculture of the Czech Republic (for example, the Situation prospective report on land...). The paper incorporates an interview with the chair of the Association of private farmers and thus the inclusion of the viewpoint of a significant number of agriculturally active persons on the endangerment of ALR by losses and on the nature of the current legislation. The citations and references have been chosen mainly with the use of the databases Scopus and Web of Science.

Object of inquiry: historical and current legislation regarding the protection of agricultural lands and its functioning in the society.

## 3 Results and Discussion

### 3.1 Agricultural Land

Land is the greatest wealth of every country. "Soil is the uppermost part of the earth's crust made up of a mixture of mineral components, dead organic matter and living organisms. It is vertically structured, connected with its subsoil and is created from weathered matter or unbound mineral and organic sediments." (Hauptman et al., 2009, p. 9). Land is both property and goods, and an archive of natural and civilizational development. According to Act No. 17/1992 Coll., on the Environment (Section 2), land is specified as a component of the environment that may not be damaged above the level set out by special regulations (Section 8, Section 12).

### 3.2 Agricultural Land Fund

The basic legal regulation that regulates requirements on the protection of agricultural land is Decree No. 334/1992 Coll., on Agricultural Land Fund Protection, as amended, and its implementing decree. These regulations regulate obligations during economic activities on the Agricultural Land Fund (ALF), during spatial planning activities, during construction, mining and industrial activities and geological and hydrogeological surveys. These are activities that present, if operated improperly, a risk of long-term or permanent loss of important production and ecological functions of land. The Act also regulates the process of decision making on removal of land from ALF (decisions on changing the agricultural use of land for non-agricultural use). Annexations are focused mainly on flat land plots with fertile soil, along roads and in the suburbs of towns, although there are hundreds of hectares of premises that have lost their mission (so-called brownfields) in each region. Construction would have been more costly herein, but the problem of “what to do with them” would be resolved.

### 3.3 Reductions in arable land – current state

According to press reports and statements from the professional and political public, in recent years there has been a dramatic decline in arable land (generally ALF), according to the following statistical findings:

At present, along with erosion, soil sealing combined with uncontrolled expansion of settlements is the biggest problem that agricultural land faces. According to a situational outlook report from December 2012, from 2001 to 2006, 20 thousand hectares of agricultural land were lost in the Czech Republic, i.e. 11.2 ha/day. In 2006, the loss of land for settlement and transport infrastructure is estimated at 16 hectares/day. In 2007 it decreased by 5,226 hectares and in 2008 by 5,096 hectares, i.e. 14 ha/day. In the Czech Republic, the amount of covered surface in 2006 was 243 m<sup>2</sup>/1 inhabitant, which is above the average of European Union values. In recent years, reductions in agricultural land ranged from 12 to 15 ha per day. From 2000 to 2013 in the Czech Republic, approximately 4,743 hectares from the ALF and 461 ha of forest land were seized for the construction of road infrastructure. The most significant decline in the ALF occurred in the South and Central Bohemian Region in connection with the construction of the Prague ring road and the D1 and D5 highways. This information may sound alarming. However, in a historical context the greatest reduction in cultivable arable land in our country occurred from 1966 to 1986. A transport infrastructure was being created during this period, and in particular the construction of the D1 highway was begun, including all the feeder roads from villages leading to it, and there was also massive construction of prefabricated housing mostly at the edges of cities.

“With regard to Agricultural Land Fund (ALF) protection, we do not know whether it is once again five minutes to midnight (...). In terms of the ALF reduction development, all we have available is summary data from the Real Estate Cadastre. All that we can ascertain from this data are the year-on-year differences in the scope of registered types of land plots in regions or throughout the Czech Republic, and from this data it is not possible to assess the real trends in the ALF reduction. The year-on-year loss of registered agricultural land cannot be equated only with its annexation. (...) The actual trends in the loss of agricultural land and the quality structure of removed agricultural land are not currently available from public sources”. (Mackovič 2010). We can only identify with this opinion. In the article titled *Nekoordinovaný nový vývoj maloobchodní činnosti a jeho vliv na využití území a půdy* (uncoordinated development of new retail activity and its impact on use of territories and land)..., authors

Spilková and Šefr (2010) inform about the “conflicting use of land that manifests as an annexation of agricultural land and quality land on the edges of cities due to shopping centres and similar development in retail chains. (...) in outlying Prague districts, where for the past 10 years there has been a significant change in the use of land as a result of the commercial increase in urbanization process (...); the text of the article discusses (...) some of the problematic issues of this dynamic development, particularly its consequences for the environment in relation to virtually non-existent planning and regulation of the vast expansion of trade in all post-communist countries, especially in the Czech Republic.” In the Czech Republic, all land is currently registered in a public list, i.e. the Real Estate Cadastre, on the basis of Act No. 256/2013 Coll., on the Real Estate Cadastre. The basic territorial unit of the list is a cadastral territory, wherein another unit is a land plot which is then classified according to the type and method of use. In addition to the Real Estate Cadastre, on the basis of Act No. 252/1997 Coll., on Agriculture, another public list, the Land Parcel Identification System was established in 2004 for the purpose of registering land and its use. The Land Parcel Identification System (LPIS) is a geographic system for registering use of agricultural land according to user relationships serving for the administration of grants. The LPIS is managed by the Ministry of Agriculture of the Czech Republic, and the basic unit of the list is a land block with a minimum area of 0.1 ha. There is about a 15% difference in the records of the agricultural land in the Real Estate Cadastre and LPIS, due to the fact that all land is registered in the Real Estate Cadastre, and in the LPIS only the land that has been registered by its users. Additionally, the LPIS usually does not capture agricultural land in built-up areas, small crofts, gardens and abandoned land. For example, according to the Real Estate Cadastre, at the end of 2002 agricultural land occupied an area of 4,272,801 hectares, according to LPIS it was 3,709,427 hectares (Trojáček, 2004, p. 36).

If we look into the past even further, we will find that since 1936, when the area of agricultural land was 5,137,279 ha, almost one fifth of this rare component of the environment has disappeared. There were several reasons for this in the past: the expulsion of Germans and subsequent lack of settlement in border regions after the Second World War, the installation of the “Iron Curtain” and the socialization of agriculture after 1948, the actions of the troops (among other things the creation of military districts), extensive industrialization, development of urbanization. If we, for example look at the decline in the size of arable land as set out by the Czech Environmental Information Agency, between 2000 and 2013 the size of arable land decreased by 116,500 ha. In 2011, building used up approx. 2,700 ha of arable land, which is about the size of the district of Prague 5. From 2005 to 2007, road infrastructure used up approx. 800 ha annually.

**Table 1.** The management of agricultural land in international comparison

	Land area in thousands of hectares			The loss of land in %	
	2003	2008	2013	2003-2008	2008-2013
CR	3668	3572	3521	-2,63	-1,43
Germany	17008	16926	16700	-0,48	-1,34
Poland	16136	15608	14410	-3,28	-7,67
Austria	3375	3171	2862	-6,03	-9,73
Slovakia	2236	1936	1929	-13,42	-0,39

Source: CENIA

The given table shows that the greatest loss of ALR happened in the period between 2003 and 2008 in Slovakia. The new legal arrangement is established by the Act No. 140/2014, Coll. (Act on acquisition of property of agricultural lands and about the amendments of certain acts). The Slovak legislators view this as a preventive tool of protection of agricultural lands, where one of the greatest limits in the acquisition of land property is the fact that active farmers are prioritized and the land will be protected already by its sole proper agro-technical and agro-environmental management. At present, this provision is contested by a constitutional complaint and is being dealt with by the Constitutional court of the Slovak Republic.

Primarily, the disposal of arable land is characteristic. These disposals essentially do not relate to forest land plots, as to preferably remove arable land is also tempting because it is easier and can be used for development without added costs. Forest land needs to be modified, and this increases the initial costs by harvesting timber and removing roots. Likewise, land plots with old disused buildings (in particular in the suburbs) are not attractive, as the cost of removing unnecessary structures, liquidation or landfilling are also economic brakes.

### **3.4 Land protection legislation from a historical perspective**

One of the first prerequisites of protection of the land fund – both quantitative and qualitative, are mainly land use plans for the development of regions and legislation for protecting the Agricultural Land Fund. From 1948 to the present, land protection legislation has undergone extensive changes accenting the relationship to the land in terms of state establishment. Decree No. 241/1948 Coll., on the First Five-year Plan was not focused primarily on agricultural land in terms of its conservation and use. It only determined the growth of agricultural production until 1953, but it did not include the surface use of land. Construction – which necessarily relates to the seizure of land – should have increased by 21% by 1953 compared to 1948 within the scope of investment projects. Nevertheless, in view of government decrees, this Act can be considered as a forerunner of legislation on land as the implementing regulation to Act No. 55/1951 Coll., on expansion of arable land and securing of land for agricultural production; this Decree thus already “forbids” the conversion of arable land to non-agricultural land. Agricultural land should be preserved for its purpose and preferably be expanded. District national committees should have immediately taken measures to ensure that uncultivated arable land was cultivated as arable. The authors of this article are of the opinion that there had not yet been a dramatic annexation of agricultural land at that time, as state power was focused primarily on the restoration of the post-war economy and was renewing the war-battered industrial and general manufacturing complexes; at that time construction was rather intensively-regenerative than expansive; in addition, the well-known desire of state power for almost absolute food self-sufficiency was, in its own way, a curious type of protection of arable land at that time.

This was followed by Decree No. 48/1959 Coll., on the Protection of the ALF, as well as implementing Decree No. 7/1960 Coll., which already established the concept of the agricultural land fund in the post-war period. The legislation is interesting in particular due to its cogent provision, according to which national committees were obliged “within unified land registration, to have an overview of the agricultural land fund in municipalities according to individual sectors, owners (users), areas and cultivations, and to designate in it all of the changes and maintain it in accordance with the actual state.” (Section 6, Act 48/1959 Coll.). This regulation is essentially a substitute of the Real Estate Cadastre, which did not exist at that time. The legislation included protection of the ALF during its management and during

activities other than those that were agricultural; in particular industrial, construction and mining. Exclusion from ALF was possible (Section 12, Act. 48/1959 Coll.) and was fully within the competence of the executive bodies of national committees (at that time the NV Council); the exclusion had to be justified both economically and politically. Here it also considered possible degradation of land by ash, smoke and other emissions from industrial operations.

Decree 7/1960 Coll., came into effect on 25 January 1960 as an implementing decree to the relevant Act, and it was a reaction to the massive, and in many ways unscrupulous industry development and construction activities, including the building of large dams (at that time, for example, the Orlik Dam), i.e. activities that necessarily and evidently led to the annexation of the ALF. This was legislation that protected the ALF which included all of the mechanisms of affecting in its functions (including protection from industrial air pollution), taking into account in particular politically motivated development of the centralized economy of that time. The authors of this article consider the regulation as deliberate and modern for that period in time. Even then it included the regime of irreversibly removed land from agricultural purposes (transportation routes, large bodies of water) and required fertile topsoil stripping used for restoration of land that had been agriculturally-unused up to that time, so it could be revalued. And other measures to mitigate the effects of industrial development on farmland. On the other hand, it is necessary to state that the regulation only corresponded to the possibilities and conditions of a centralized and planned economy and the preferred "society-wide" ownership of land; despite its sophistication, it cannot be used as a good example nowadays, as it ignores the mechanisms of pluralistic ownership and market economy needs.

Both of the previous regulations were cancelled by Act No. 53/1966 Coll. This Act did not require and implementing regulation and mechanisms of exclusion of land from the ALF; it regulated protection, etc., as legal and not subordinate. This legislation apparently reacted to the planned and already-initiated massive building activity, in particular in the vicinity of large and medium-sized towns and cities. This consisted of dealing with the society-wide interest in improving housing, especially for young people, thereby stressing the pro-family policy and acquisition workforce to ever-strengthened industrial production, which was also concentrated in cities. The growth of so-called "satellite" suburban housing estates (which later became part of the towns or even created independent municipalities, i.e. the new City of Most) necessarily occupied farmland, especially fertile and arable land, as even historically-established towns were originally primarily agricultural - people settled where they could enjoy quality primary agricultural production. The land around the historic centres was fertile, and it was this land that was occupied in the turbulent urban development at the time of the Industrial Revolution - and of course the expansion of socialist construction.

This Act replaced Act No. 53/1966 Coll. on the Protection of the ALF, which is analysed below, and it was the first to implement payments for removal of agricultural land taken from agricultural production (with exceptions) and introduced an institute of penalties for failure to use the ALF. It was obvious that the development of residential areas in cities would result in considerable land disposals, and it aims to prevent spontaneity and land waste whilst adhering to societal demand for apartments, and in fact, for a different lifestyle (which was in a sense imposed upon people). The Act was amended and thus "modernized" via Amendment No. 75/1976 Coll. The Act was able to distinguish removal of land from agricultural purposes as permanent or temporary. Contributions were paid in both cases and

belonged to the State Fund for the Reclamation of Land. They were recoverable in cases wherein the user later returned the land to its original agricultural purpose and re-cultivated it for just such a purpose (Section 21, Act 75/1976 Coll.); contributions did not have to be paid in the event of removal that did not disrupt the integrity and quality of the ALF (Section 22, Act No. 75/1976 Coll.), e.g. during the removal of land in an urban municipality, during the removal of land for the construction of transport structures (!) and airports, e.g. for the establishment of first degree protection zones for drinking water sources ... etc., mainly for the purposes that were a necessity for the whole of society. There was also no precedence given to expanding the area of arable agricultural land. This is the first time we see the appearance of the term economic damage, such as damage to a socialist agricultural organization that arose from the annexation of agricultural land; the damage could be eliminated via measure serving to intensify agricultural production: this measure was carried out either by the perpetrator of the damage, or the perpetrator provided funds for it.

The originator was the person in whose interest the land was taken away (examples include the building investor). The Act reflected the turbulent construction of the sixties and quite responsibly prevented the chaos and certain unscrupulousness which such a mass "event" usually entails. But the realization that losses of often good agricultural land must necessarily occur is apparent. In its time this legislation was the maximum possible that could be done in order to protect the size of agricultural land at the time.

Decree No. 334/1992 Coll. on the Protection of the ALF, uses some similar principles and starting points such as previous legislation, but the change to the political-economic conditions after 1989 necessitated changes. However, the principles of protecting the ALF changed, such as banning land pollution via hazardous substances and hazardous elements, including registration of such pollution and remedial measures, and the possibility to penalize breaches of this legislation, which can be perceived as a response to a wild landfills and nearly contemptuous attitudes toward the land and environment by today's land owners. However, land protection is particularly aimed at development, and hence the increasing use of agricultural land for non-agricultural purposes, i.e. how to prevent speculative land management by its owners, to whom the land was returned in restitutions. The new legislation increased the responsibility of owners and tenants of land regarding its management. They do not work with it as the source of their livelihood and blithely get rid of it without examining its subsequent fate. Land is thus often falls victim to developer plans (Šefr, Spilková 2010). Even the amendment effective from 2015, which releases land for low payments only for use, which, despite being non-agricultural, still serves societal interests (construction of line structures) primarily of the state, will evidently not prevent spontaneous disposals by non-state (private) activities, although it does create stricter obligations for owners or tenants of agricultural land in withdrawing land from the ALF (Section 9, Act No. 334/1992 Coll.).

The interview with Jan Stehlík, the chair of the Association of private farmers has revealed that he perceives the present trend of the loss of land after 1990 as caused by the industrialization of the society and the main ratio of acquisition is composed by logistic centres. The present legal arrangement of the Act on Land aims at softening the conditions of removal of land from ALR, but he views the legal arrangements as sufficient. From the viewpoint of state influence in this field, he is worried about possible misuse of removal from the ALR in public interest, in order for the private influences not to override the real interests of the state. The example of Slovakia, and the limitation of the sales of agricultural lands to the cultivating persons only, is seen by Mr. Stehlík as inappropriate, and he is in particular worried

about the risks caused by the possible lowering of the costs of agricultural lands. He views such regulation as redundant. The preservation of ALR should by his opinion be balanced and the emphasis should be put on the protection of land during cultivation, mainly in the area of preventing erosion and drying of the land.

#### 4 Conclusion

The authors are of the opinion that the current protection regulation is sufficient and modern. The given table shows that the greatest loss of ALR happened in the period between 2003 and 2008 in Slovakia. The new legal arrangement is established by the Act No. 140/2014, Coll. (Act on acquisition of property of agricultural lands and about the amendments of certain acts). The Slovak legislators view this as a preventive tool of protection of agricultural lands, where one of the greatest limits in the acquisition of land property is the fact that active farmers are prioritized and the land will be protected already by its sole proper agro-technical and agro-environmental management. At present, this provision is contested by a constitutional complaint and is being dealt with by the Constitutional court of the Slovak Republic.

The market itself is able to appreciate instant, not lasting values. Effective protection of land can only be ensured by state regulation. Increasing payments for exclusion of land from the Agricultural Land Fund, which has been approved, is a step in the right direction, but it is insufficient. The value of removed and permanently-destroyed land should be comparable to its yield over thousands of years, and its water management, climatic and aesthetic functions must be taken into consideration. During the last decade, Europe is experiencing intense land degradation that is caused or worsened by human activities. Enough fertile land is a prerequisite for the survival of future generations. The point is for the losses to become smaller, or even for there to be no losses at all. What this requires is quality and thoughtful legislation. The current Act on the Protection of the ALF meets modern regulations typical for at least present-day Europe.

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## Agricultural policy and law as reflected by Websites of Czech organic farmers

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**Annotation:** European integration is inseparably linked to the Common Agricultural Policy (“CAP”) and information technologies (“IS/IT”). The growth strategy Europe 2020 encourages the EU to become a smart, sustainable and inclusive place where innovation supports inclusion, even within the sphere of agriculture and CAP addresses, farmers. Czech organic farmers and their Websites were tested in 2014 and in 2015 to assess their commitment to the Agricultural policy and law in the light of the recent scientific literature. The assessment of data was done while focusing on the attitude of Czech organic farmers and their Websites and how they reflect the agricultural policy and law. A battery of qualitative as well quantitative strategies was employed, along with Meta-Analysis processing. The evaluation was performed from various angles, relying on quantitative, rather than qualitative, methods, more on induction than deduction attempting to move to scientific objectification. The selected criteria targeted the domain names and Websites’ content and interconnectivity, friendliness and the capacity to carry out various policies and tasks. Hypotheses were tested and casuistic observations were added. The result offers new insights in the unjustly underplayed arena, with a strong potential to contribute to a flourishing agribusiness. Although the semi-conclusions are yielded from a micro-sample, their homogeneity, direct feedback and back-up by published data suggest that Czech organic farmers understand the CAP and IS/IT, but they remain non-committal. Their Websites suggest their awareness about Agricultural policy and law and IS/IT and their low interest to get actively engaged. Due to the restricted sample, a further search and studies need to be done to analyze this asymmetry and to correct it to enhance the efficiency of the partnership between the EU and its farmers.

**Key words:** Common Agricultural Policy (“CAP”), Organic farmers, Websites.

**JEL classification:** M15, Q13, Q16, R11

### 1 Introduction

Post-Lisbon Europe has despite, or maybe even because of, the ‘overcome’ crises, many strong-points which need to be further effectively and efficiently developed. According to the new strategy launched in the EU in 2010 for the new decade (“Europe 2020”), these strengths include, among others, the talent and creativity of Europeans leading to innovations and a high quality agricultural sector (EC, 2010). Indeed, the success of modern European integration strongly depends upon the employment of innovations and an optimal advancement of the agriculture sphere, while the simultaneous combination of both is highly desirable. The hallmark of this trend is the Internet with its www composed by Websites, which are sets of related and connected Webpages located and served by domains around computers with an appropriate storage capacity, or similar Internet devices (Köhler and Arntd, 2011). According to the EU policy and law, especially each business from the EU should have or rent such a server, register a domain and attach Websites with Webpages carrying information and so enhance it’s competitiveness in the cyber-world (Cvik and MacGregor, 2014). Czech organic farmers have the choice to take full advantage of modern IS/IT, especially Websites, to boost their activities and thus further advance the agricultural policy of the EU, as set by EU law, or to pass on it. Since not each and every farmer is computer

literate, they might not know that a host web server is a storage for a Website attached to a domain, while a domain name is mainly a word indicator of an IP resource (MacGregor, 2012), that the server space can be rented and the domain name registered for a few EUR annually, and that a Website can be created easily. There is a potential for an asymmetry of expectation and information emerges (MacGregor, 2014). The EU underlines the importance of IS/IT and of the sustainable development and pays attention to both pillars of the famous Common Agricultural Policy (“CAP”), production support and rural development, while farmers may be overwhelmed or at least reluctant (Cvik and MacGregor, 2014). Modern EU agricultural policies and law need the active engagement of all stakeholders in a manner going even beyond the principle of shared management (Peters, 2014) and the Internet is a great vehicle for it, especially if Websites are used (MacGregor, 2013). Innovations significantly impact the professional, social and private life in the EU (MacGregor, 2012) and are important factors for regional economic development and growth, but they are unequally distributed across different parts of the EU (Copus et al, 2008). The Council Regulation (EC) No. 1698/2005 with its principles of assistance (Art.5) and partnership (Art.6) is an example of the bottom-up approach in the context of CAP and IS/IT, namely motivating all stakeholders to use appropriate Websites. In addition, Website presentations increase the competitiveness of farms and farmers (Šmejkalová, 2013). The static objective of the paper is to test the knowledge of Czech organic farmers about IS/IT and EU policy and law, and their interest in an active involvement in relation to domain names as titles (Huber and Hitzelberg, 2010) and the content of their Websites. The dynamic objective is to identify the evolution from 2014 to 2015 and possible new trends.

## 2 Materials and Methods

This paper represents a continuation of primary research, of which the first stage was completed and published in 2014 (Cvik and MacGregor, 2014). This second stage pursues the selection of material and methods for an investigation of Websites of a pre-selected homogenous group of Czech organic farmers as a representative micro-sample. A triad of sources, approaches and methods was selected of a primary as well as secondary nature – research, identification and reviews of published data (i), retrieving and assessing selected Websites (ii) and distributing, collecting and processing questionnaire replies (iii). Collected data and information are evaluated, based on quantitative analysis with an ad hoc qualitative complementing, and re-assessed in a comparative manner with respect to results and conclusions earned in 2014. A complex set of data is re-addressed by Meta-Analysis (Schmidt and Hunter, 2014). The 1<sup>st</sup> hypothesis assumes that Websites of pre-selected Czech organic farmers demonstrate their active endorsement of the CAP and its application (H1). The 2<sup>nd</sup> hypothesis assumes that deficiencies detected in 2014 were corrected in 2015 (H2).

## 3 Results and Discussion

EU agriculture needs to attain higher levels of production of safe, quality food, while preserving natural resources. This can be done exclusively in a competitive and viable agricultural sector operating within a properly functioning supply chain and which contributes to a thriving rural economy (EC, 2013). Since 70% of EU farms are less than 5 hectares in size, the cooperation (EC, 2014a) and use of IS/IT are vital. The famous pro-integration EU tandem, shaping EU law and policies, the Commission and the Court of Justice (Burley and Mattli, 1993) as well as other stakeholders know that this can hardly be achieved without effective

and efficient employment of IS/IT instruments by farmers in their business per se, as well in their cooperation. This is previewed by CAP, but is it previewed and materialized by farmers? The EU does not order Czech farmers to register domains under certain domain names, and to attach Websites with a particular content to become eager warriors for modern CAP and the post-Lisbon EU as such. Instead, the EU has spent a significant effort to prepare and offer a battery of methods and soft-instruments suggesting that such Websites should be win-win, i.e. beneficial for both the EU and Czech organic farmer. Is this true or a myth, is this reality or just an exercise in rhetoric? Has the situation changed from 2014 to 2015?

In 2014, 80% of Czech SMEs had Websites, but only 60% of Czech agrarian SMEs (ČSÚ, 2014), while considering that 62% Czech agrarian enterprises are small, 31% medium sized and 7% large, which generate 65-80 % of production (ČSÚ, 2014). Ultimately, the Czech agrarian SMEs must e-cooperate in order to growth in a smart and sustainable manner. A test of their perception and readiness in this respect can be qualitatively done, based on a homogenous sample. Thus, the same five Czech organic farmers as in 2014 were contacted with extended questionnaires and their replies, along with the current and past appearance of their Websites, were assessed. The original quintet included Miroslav Horut with [www.biofarmaroznov.cz](http://www.biofarmaroznov.cz), Biofarm XXX, Biofarm Zeleny dvur with [www.zelenydvur.cz](http://www.zelenydvur.cz), Yes Fresh s.r.o. with [www.freshbedynky.cz](http://www.freshbedynky.cz) and Biofarm YYY. In 2015, the first 4 provided feedback, i.e. the last Biofarm YYY failed to. Hence the data about a quartet of farms from 2014 and 2015 will be explored and projected to H1 and H2. The organic farm, Křížové pole – Doležalovi with <http://www.farmadolezal.cz/> is added. Due to inherent similarities in the size, operation and strategies of these five subjects, their Websites can constitute a micro-sample for an introductory case study. These five Websites are platforms oriented towards self-presentation and e-business, but not community and rural development. The first three Websites have not been changed at all while the fourth and fifth Websites have been sophisticatedly updated. This suggests that only Yes Fresh s.r.o. and Doležalovi are proactively employing IS/IT and it needs to be assessed based on data provided by the subjects via questionnaires in the light of the published literature.

The 1<sup>st</sup> examined farmer, Miroslav Horut, has one full time employee, focuses on quality dairy products and the dignity of their animal life. The 2<sup>nd</sup> examined farmer completed the questionnaires in 2014 and 2015 with a desire to stay anonymous. His family farm functions since 2011, does not have any employees and focuses on pork and beef breeding and honey production. Their Website is rather simple and provides merely basic data (Cvik and MacGregor, 2014). The questionnaire search about the 1<sup>st</sup> examined farm of M.Horut and the 2<sup>nd</sup> examined subject, XXX, generated the data indicated in Table 1.

Mr. Horout demonstrates an above average awareness about CAP and IS/IT as well as a readiness to work on his Website to help his agribusiness. He perceives CAP realistically and has not made any dramatic changes in his attitude, business and Website in the last year, with one important exception. He started to more intensively cooperate with other farmers. His can-do-attitude, eagerness to cooperate and clarity of his propositions regarding CAP make him an ideal candidate to be enrolled in pilot projects combining CAP and IS/IT. The anonymous XXX demonstrates an average awareness about CAP and IS/IT and a readiness to work hard on his Website to help his agribusiness. He perceives CAP realistically and has not made any dramatic changes in his attitude, business and Website in the last year with one important exception. He started to manage his Website by himself, but he reduced his cooperation with other farmers. He aims for diversification and appears to be inclined to give

up on common actions and rather wants to be completely independent and on his own. He has been losing faith in agricultural policy and its connection with IS/IT. This individualistic trend is pretty common for the Czech Republic where the traditional setting was discontinued due to the communistic regime and many Czech farmers struggle with the idea of a community led-rural development. This is a contribution to the myriad of “policy tails and analytical dogs” issues regarding rural development (Copus, 2014) and CAP in general.

**Table 1.** Questionnaire (combined 2014, 2015) –Biofarm Miroslav Horut and XXX

Question	Answer Horut	Answer XXX
Website since	2011 (Biofarm since 2001)	2014
Who selected the domain name	Website designer	Biofarmer
Who manages the Website	3 <sup>rd</sup> party	3 <sup>rd</sup> party in 2014, Biofarmer in 2015
Did you receive any public help with your www	No (disappointment re CAP application)	No (disappointment re CAP application)
Would you like to receive it	Yes	Yes
Cooperation with other farms	No in 2014, Yes in 2015	Yes in 2014, No in 2015
Links to other farms Websites	No	No
How do you perceive CAP and its importance	Positive and negative, advantages for big (!!)	More positives than negatives (still critical re CAP application)
What would you like to change	100 ha limit, amount of bureaucracy	Certain rules
Receiving funding support from the EU, reg.	EU and CZ support for employment	Only from EU (reluctance re CAP application)
Any strategic decision about www in 2014-15	No	No
General plans for future	More efficiency and speed for our work	More efficiency and diversity
Plans regarding www	No changes expected	No changes expected

Source: Own processing

The 3<sup>rd</sup> examined is the organic farm Zelený Dvůr located in Prague, which functions since 2006 and focuses on bio vegetables and animal breeding. Interestingly, the Website includes references to legislatively set bio certificates such as *Bio Produkt ekologického zemědělství*. The 4<sup>th</sup> examined is YesFresh, s.r.o. which sells boxes with Bioproducts named Fresh bedýnky. (Cvik and MacGregor, 2014). The questionnaire search about the 3<sup>rd</sup> examined and the 4<sup>th</sup> examined subjects generated the data indicated in Table 2.

The organic farmer from Zelený Dvůr demonstrates an awareness about IP law, CAP and IS/IT, and will to work hard on his Website to help his agribusiness. He perceives CAP positively and hasn't made any big changes in his attitude, business and Website. He gladly cooperates with other farmers and wants to deepen his specialization and to improve quality. He is grateful for CAP support and his can-do-attitude, eagerness to cooperate and the clarity of his propositions regarding CAP make him an ideal candidate for pilot projects combining CAP and IS/IT. No dramatic changes happened for the subject with the most developed Website,

Yes Fresh. Although e-presentation suggests professionalism, the champions - Yes Fresh and Biofarm Zelený dvůr do not use e-platforms for communication with the public administration and thus decline to use IS/IT to support public law goals. The added new subject, Doležalovi - beneficiary of the post-communistic land restitution and “emerging Davids” (Hockerts and Wüstenhagen, 2010) - manages to receive EU as well as state/region funding support, stated that their “Website is indispensable” for their Agribusiness and that e. g. they rely on Agri-tourism for which they get almost all clients via Website. This insight matches with published data about the importance of IS/IT (Di Domenico and Miller, 2012) for sustainable transformation (Hockerts and Wüstenhagen, 2010), and sustainable growth.

**Table 2.** Questionnaire (combined 2014, 2015) – Biofarm Zelený Dvůr and Fr. Bed.

Question	Answer Zelený Dvůr	Answer Fresh bedynky
Website since	2008	2009
Who selected the domain name	Biofarmer	Biofarmer
Who manages the Website	Biofarmer	Biofarmer
Did you receive any public help with your www	No (disappointment re CAP application)	No (disappointment re CAP application)
Would you like to receive it	Yes	Yes
Cooperation with other farms	Yes	Yes
Links to other farms Websites	No in 2014, Yes in 2015	Yes
How do you perceive CAP and its importance	Positive, especially because of dotation	Not key, we are no primary producers
What would you like to change...	Clearer and more just rules	No comments
Receiving funding support from the EU, reg.	Only from EU	No public support!!! (disappointment re CAP)
Any strategic decision about www in 2014-15	No	Yes, we completely changed www design
General plans for future	Focusing only on one animal type	No dramatic changes, keep working
Plans regarding www	Quality improvement, More detailed data	Keep working, our www is for us critical

**Source: Own processing**

All the answering farmers admit the semi-professional nature of their Websites and occasional improvisations as well as their wish to improve their employment of IS/IT in order to boost their agribusiness, and they vainly wait for more guidance and assistance within the appropriate policy and legal framework. They all basically agree upon CAP, but they are disappointed regarding its application and informally glossed their reluctance (see comments in parentheses). They want a simplification of CAP rules and more attractive and interactive

Website to get more clients and to learn more about them. These conclusions match with the Overview of CAP Reform 2014-2020 presented by the European Commission in 2013 (EC, 2013) and points already published regarding EU agrarian case studies, such as Spanish virgin oil <http://www.orolivesur.com/> (Carmona et al, 2012). The challenge to strike the right balance between effectiveness and efficiency is recognized by all stakeholders.

#### 4 Conclusion

The agriculture sector has been at the center of modern European integration, and the desired growth strategy of the post-Lisbon EU relies on smart, sustainable and inclusive agribusiness supported by innovations in tangible and intangible forms. According to the perspective from above, natural synergy between the agribusiness and IS/IT should contribute towards the competitiveness and stability of the EU. These expectations can be successfully implemented and materialized only if an educated and active support of all stakeholders is obtained. Since an average European farmer has only 12 hectares of land (EC, 2014a) and an organic farmer even less, their e-cooperation is critical. The tested micro-sample of Websites and answers of Czech organic farmers suggests that there is a conceptual agreement and materialization discrepancy, i.e. farmers agree with goals but keep feeling not publicly supported. Both H1 and H2, i.e. the 1<sup>st</sup> hypothesis that Websites of pre-selected Czech organic farmers demonstrate their active support of the CAP and its application and the 2<sup>nd</sup> hypothesis that deficiencies diagnosed in 2014 were corrected in 2015, were based on the homogenous tested micro-sample rejected. There seems to be aborted opportunities in the setting of high as well low economic disparity (Rýsová, 2009), which are not in compliance with CAP and Europe 2020 objectives. Czech farmers agree upon both pillars of CAP and the EU focus on IS/IT, and understand them, but they are disappointed about how this is materialized. They want more transparency and simplification regarding CAP and IS/IT and a true partnership between EU and its farmers, not mere proclamations (EC, 2014b) and empty “fair deals” (EC, 2014a).

The detected semi-professionals and improvisations of Websites and complaints of farmers show that there is not such a bottom-up support of the EU agricultural policy and law as expected by the new EU programs, in individual as well as EU rural networking contexts (Peters and Gregory, 2014). Although testing 5 subjects is not conventionally accepted for statistical purposes, these Websites and comments match similar published data and show the level of disparity and the innovative engagement gap, which are definitely less significant than in other studies (Copus, 2008). Czech farmers belong to the large majority of the Czech SMEs having Websites (Asociace, 2013), but in a less intense manner (ČSÚ, 2014). Their good understanding of IS/IT, their endorsement of EU policy and law goals, their readiness to work on their Websites, their community reluctance and their calling for public assistance deserve to be further researched and studied. Future studies should analyze why, then, and how their endorsement and support of EU agricultural policy can be boosted by transparency steps and public support projects, e.g. Website coaching. If this is proven, then this constitutes a call to be answered for the sake of the mentioned partnership and the CAP in general.

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## Technological Progress in European Pork Production

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**Annotation:** The paper deals with the analysis of technological progress in European pork production. The analysis is based on the estimation of multiple output distance function for 24 EU countries using the FADN data covering the period 2004 – 2011. The results show that technological change had a positive contribution to the production possibilities in almost all countries. Moreover, the biased rather than Hicks neutral technological change was estimated. The direction of biased technological change is country specific. Efficiency differences were found to be important reasons for variation in the production in 12 countries. The top 10 % farmers highly exploit their production possibilities. This also holds for average farm. On the other hand, 10 % of the worst farmers waste their resources and may have problems to compete on the market. Moreover, we can observe significant differences in TFP levels among EU member countries. In particular, the old member states have on average higher TFP level as compared to new member states. Technical change was identified as the important factor of TFP development.

**Key words:** Pork production, SFA, multiple output distance function, technological change, TFP.

**JEL classification:** D 24, O 12, P 27

### 1 Introduction

Pork production is an important agricultural sector for many EU countries. As compared to other agricultural sectors the pork production has very industrial character. That is, the efficiency and productivity levels are very important factors determining the overall competitiveness of pork producers. The aim of this paper is to provide a coherent comparison of technical efficiency and total factor productivity levels among the EU member states and to assess the role of technological change in efficiency and productivity development. In particular, the paper addresses the following research questions. The first relates to the impacts of technological change and technical efficiency. The aim is to assess whether there is indication that the countries follow a sustainable development path characterized by the development and adoption of innovation and reduced waste of resources due to inefficient input use. The second question concerns total factor productivity, especially we will assess the impact of technological change on TFP.

Productivity and efficiency as important factors determining the overall competitiveness of agricultural producers have received special attention in the European agricultural research in the last two decades (e.g. Bureau and Butault (1992), Ball et al. (2001), Brümmer et al. (2002), Davidova et al. (2003), Mulder et al. (2004), Thorne (2005), Kleinhans et al. (2007), Wijnands et al. (2008), Fogarasi and Latruffe (2009), Latruffe et al. (2012), Špička (2013)). The authors addressed research questions on adjustment processes connected with competitiveness, CAP changes and EU enlargement in old as well as new member countries. However, the majority of these studies are country specific. The comparison among the EU member countries can be found only in few studies (Čechura et al. (2014b), 2015)). In this paper, we try to fill the gap in the research by conducting a metafrontier analysis

of the comparative assessment of technical efficiency and productivity differences among EU member countries and of the role of technological change.

## 2 Materials and Methods

### 2.1 Theoretical framework and estimation strategy

The research questions will be addressed by the estimation of the multiple output distance function model for 24 EU countries. Moreover, to produce coherent comparison of TFP levels and their components we use the efficient outputs from the multiple output distance function country estimates in the estimation of metafrontier multiple output distance function. Both country as well as metafrontier models are formulated as translog multiple output distance functions with three outputs and five inputs:

$$D_{Oit} = \alpha_0 + \sum_{m=1}^3 \alpha_m \ln y_{mit} + \frac{1}{2} \sum_{m=1}^3 \sum_{n=1}^3 \alpha_{mn} \ln y_{mit} \ln y_{nit} + \sum_{k=1}^5 \beta_k \ln x_{kit} + \frac{1}{2} \sum_{k=1}^5 \sum_{l=1}^5 \beta_{kl} \ln x_{kit} \ln x_{lit} + \frac{1}{2} \sum_{k=1}^5 \sum_{n=1}^3 \gamma_{kn} \ln x_{kit} \ln y_{nit} \quad (1)$$

where subscripts  $i$ , with  $i=1,2,\dots,N$ , and  $t$ , with  $t=1,\dots,T$ , refer to a certain producer and time (year), respectively.  $\alpha$ ,  $\beta$  and  $\gamma$  are vectors of parameters to be estimated.

After the imposition of homogeneity and symmetry restrictions (Coelli and Perelman, 1996) we get:

$$-\ln y_{1it} = \alpha_0 + \sum_{m=2}^3 \alpha_m \ln y_{mit}^* + \frac{1}{2} \sum_{m=2}^3 \sum_{n=2}^3 \alpha_{mn} \ln y_{mit}^* \ln y_{nit}^* + \sum_{k=1}^5 \beta_k \ln x_{kit} + \frac{1}{2} \sum_{k=1}^5 \sum_{l=1}^5 \beta_{kl} \ln x_{kit} \ln x_{lit} + \frac{1}{2} \sum_{k=1}^5 \sum_{m=2}^3 \gamma_{km} \ln x_{kit} \ln y_{mit}^* + u_{it} + v_{it} \quad (2)$$

where  $y_{mit}^* = \frac{y_{mit}}{y_{1it}}$ ,  $v_{it}$ , is statistical noise and  $u_{it} = -\ln D_{Oit}$  states for inefficiency term. Moreover, we standardly assume that  $v_{it} \sim N(0, \sigma_v^2)$ ,  $u_{it} \sim N^+(0, \sigma_s^2)$ , and they are distributed independently of each other, and of the regressors (Kumbhakar and Lovell, 2000).

The technological change is captured by the time variable ( $t$ ):

$$-\ln y_{1it} = \alpha_0 + \sum_{m=2}^3 \alpha_m \ln y_{mit}^* + \frac{1}{2} \sum_{m=2}^3 \sum_{n=2}^3 \alpha_{mn} \ln y_{mit}^* \ln y_{nit}^* + \sum_{k=1}^5 \beta_k \ln x_{kit} + \frac{1}{2} \sum_{k=1}^5 \sum_{l=1}^5 \beta_{kl} \ln x_{kit} \ln x_{lit} + \frac{1}{2} \sum_{k=1}^5 \sum_{m=2}^3 \gamma_{km} \ln x_{kit} \ln y_{mit}^* + \delta_t t + \frac{1}{2} \delta_{tt} t^2 + \sum_{m=2}^3 \alpha_{mt} t \ln y_{mit}^* + \sum_k^5 \beta_{kt} t \ln x_{kit} + u_{it} + v_{it} \quad (3)$$

In all models it is considered explicitly that agricultural production possibilities are affected by firm heterogeneity which impacts on the level as well as on the shape of the production possibilities. The heterogeneity is captured by the extended version of the RPM model introduced by Alvarez et al. (2004). Alvarez et al. introduce the heterogeneity component  $m_i^*$  in the model specification.  $m_i^* \sim \bullet(0,1)$  might possess any distribution with zero mean and unit variance and determines the level of fitted parameters as well as the level of technical efficiency. Moreover, it is assumed that the distribution is the same for all random parameters. That is, the model specification, which is estimated in the empirical part (country specific models as well as the metafrontier model), has a form:

$$\begin{aligned}
-\ln y_{1it} = & \alpha_0 + \sum_{m=2}^3 \alpha_m \ln y_{mit}^* + \frac{1}{2} \sum_{m=2}^3 \sum_{n=2}^3 \alpha_{mn} \ln y_{mit}^* \ln y_{nit}^* + \sum_{k=1}^5 \beta_k \ln x_{kit} \\
& + \frac{1}{2} \sum_{k=1}^5 \sum_{l=1}^5 \beta_{kl} \ln x_{kit} \ln x_{lit} + \frac{1}{2} \sum_{k=1}^5 \sum_{m=2}^3 \gamma_{km} \ln x_{kit} \ln y_{mit}^* \\
& + \delta_t t + \frac{1}{2} \delta_{tt} t^2 + \sum_{m=2}^3 \alpha_{mt} t \ln y_{mit}^* + \sum_k^5 \beta_{kt} t \ln x_{kit} \\
& + \alpha_{m^*} m_i^* + \frac{1}{2} \alpha_{m^* m^*} m_i^{*2} + \delta_{tm^*} m_i^* t + \sum_{k=1}^5 \beta_{km^*} m_i^* \ln x_{kit} + u_{it} + v_{it} \quad (4)
\end{aligned}$$

Furthermore, Alvarez et al. (2004) showed that  $u_{it}$  can be estimated according to Jondrow et al. (1982).

Total factor productivity is calculated in the form of the Törnqvist-Theil index (TTI) (see Diewert, 1976) and Caves et al. (1982).

## 2.2 Data

We use the FADN dataset provided by the European Commission. The dataset consists of 24 EU member states (only Croatia, Cyprus, Luxemburg and Malta are missing) and covers the period from 2004 to 2011 (except for Austria (2005 – 2011), Bulgaria and Rumania (2008 – 2011)).

The variable we use in the analysis are as follows:  $y_1$  pork production,  $y_2$  other animal production,  $y_3$  plant production,  $x_1$  labour,  $x_2$  land,  $x_3$  capital,  $x_4$  specific material and  $x_5$  other material.

Labour is represented by the total labour measured in AWU. Land is the total utilised land. Capital is a sum of contract work and depreciation. Specific material in pork production represents cost on feed for pigs and poultry. Outputs as well as inputs (except for labour and land) are deflated by country price indexes on each individual output and input (2005 = 100). The country price indexes are taken from the EUROSTAT database.

The multiple output distance functions are estimated only for specialized producers. The specialization is defined as at least 50 % share of pork production on total animal production respectively.

## 3 Results and Discussion

First, we start with the discussion of the fitted parameters. Instead of the presentation of all parameters standardly discussed in the stochastic frontier estimates we concentrate only on the parameters related to the technological change. The complete results together with the discussion are provided in Cechura et al. (2014a).

Table 1 provides the parameter estimates on technological change and biased technological change. Technological change has a significant positive contribution to the production possibilities in the majority of the countries. A significant negative contribution can be observed only in Belgium, Poland and Sweden. The positive impact of technological change accelerates over time in Bulgaria, the Czech Republic, Lithuania, the Netherlands and Slovenia. On the other hand, the positive impact of technological change decelerates over time in Denmark, the United Kingdom and Portugal.

Table 1. Technological change and biased technological change

EU member country		t	tt	x1*t	x2*t	x3*t	x4*t	x5*t	m*t
Austria	Coeff.	0.0078	-0.0095	0.0262	-0.0293	-0.0129	0.0058	0.0135	0.0112
			**	***	***				***
Belgium	Coeff.	0.0068	0.0053	0.0034	0.0033	0.0226	-0.0105	-0.0263	-0.0016
		***	**			***	**	***	
Bulgaria	Coeff.	-0.0385	-0.0454	-0.022	0.0291	0.1625	-0.1273	-0.0334	-0.324
		***	***		**	***	***	*	***
Czech Republic	Coeff.	-0.0056	-0.012	0.0034	-0.015	-0.0068	-0.0109	0.0317	-0.0275
		***	***		***	***	***	***	***
Germany	Coeff.	-0.0432	-0.0001	0.004	-0.0054	-0.006	0.0004	0.0128	-0.0029
		***			**	***		***	***
Denmark	Coeff.	-0.0544	0.0052	-0.0002	0.0298	0.0064	-0.0294	-0.0069	-0.0094
		***	**		***		***		***
Estonia	Coeff.	-0.0363	0.03	-0.085	-0.0484	-0.0215	0.0342	0.0663	0.0087
			**	***					
Spain	Coeff.	0.0064	0.0137	0.0183	0.0001	0.0008	-0.0086	-0.01	0.0373
			**	*			**		***
Finland	Coeff.	-0.1555	-0.0315	-0.0681	-0.2027	-0.0313	0.1645	0.0804	0.0124
		***			***		**		*
France	Coeff.	-0.0071	0.0023	-0.0104	0.0024	0.0159	0.0218	-0.0242	0.0014
		***		**		**	***	***	
United Kingdom	Coeff.	-0.0134	0.0116	0.0223	0.0027	0.0211	0.0197	-0.063	-0.0251
		***	***	***		***	***	***	***
Greece	Coeff.	-0.0259	0.0757	0.433	-0.1107	-0.0438	0.0611	0.0708	0
Hungary	Coeff.	-0.0105	-0.0004	-0.0066	-0.0058	0.003	-0.0094	0.0175	0.0026
		*							
Ireland	Coeff.	LNO	LNO	LNO	LNO	LNO	LNO	LNO	LNO
Italy	Coeff.	-0.0035	-0.0019	-0.0172	0.0033	-0.0221	0.0056	0.0156	-0.011
						***		**	**
Lithuania	Coeff.	-0.0297	-0.0295	0.0367	0.0367	0.061	-0.0002	-0.0738	-0.0679
		***	***		**	***		***	***
Latvia	Coeff.	-0.0161	0.005	-0.0058	0.0236	-0.0078	0.0019	0.0003	-0.018
		**			*				***
Netherlands	Coeff.	-0.0137	-0.0073	-0.0046	0.0003	-0.0247	0.0268	-0.0122	0.0035
		***	**			***	***		
Poland	Coeff.	0.0218	-0.0163	0.004	0.0081	0.0026	-0.0116	0.0008	-0.0014
		***	***	**	***	*	***		**
Portugal	Coeff.	-0.0507	0.0455	0.0669	-0.0203	-0.032	-0.0104	0.0511	0.0562
		**	***	*	***			***	***
Romania	Coeff.	-10.3885	-0.0165	-0.0272	0.0127	0.0283	0.0247	-0.0311	-0.0063
						*			
Sweden	Coeff.	0.0072	0.005	0.0053	0	-0.0061	0.0037	-0.0072	0.0005
		***	**						
Slovenia	Coeff.	-0.0257	-0.0267	-0.0268	0.004	-0.0284	0.0347	-0.0083	-0.0824
		***	***			**	***		***
Slovakia	Coeff.	-0.0135	0.0048	0.0021	0.105	-0.0045	0.0293	-0.1411	0.0554
					***		**	***	***

Note: \*\*\*, \*\*, \* denotes significance at the 1%, 5%, and 10% levels respectively; LNO – Low Number of Observations; The parameter estimate for Romania was negatively influenced by low Number of observations.

Source: own calculation

Parameter  $\beta_{TT}$  is not significant in Germany, Finland, France, Hungary and Latvia. In Poland, the negative impact of technological change decelerates over time. In Belgium and Sweden, on the other hand, the negative contribution of technological change accelerates over time.

The biased technological change is pronounced in almost all analysed countries. However, the direction of biased technological change differs among countries and there are no common patterns. In most of cases, biased technological change can be observed for land and capital. However, the frequencies of these inputs using or saving technological change are more or less balanced. The capital-using biased technological change can be found in the Czech Republic, Germany, Italy, the Netherlands and Slovenia. On the other hand, the capital-saving technological change is typical for France, the United Kingdom, Lithuania and Poland. Austria, the United Kingdom, Poland and Portugal can be characterized by labour-saving technological change. Estonia and France experienced labour-using biased technological change. The biased technological change is material-saving in the majority of cases. There can also be found substitution between specific and other materials. It is the case of the Czech Republic, France and the United Kingdom.

The presumption of labour saving and capital using biased technological change cannot be confirmed.

As far as the technical efficiency estimates are concerned the parameter  $\sigma^2$  is significant only in 12 member states, namely in Belgium, the Czech Republic, Germany, Denmark, Spain, France, Hungary, Italy, the Netherlands, Poland, Sweden and Slovakia. However, in the Czech Republic, Germany and Poland the differences in the efficiency of inputs use are rather small among pork specialized companies ( $\sigma^2$  is smaller than one). The variability of residuals is caused by random components. That is, the technical efficiency differences among pork producers do not contribute so much to the variation in production in these countries. However, this is not the case of Belgium, Denmark, Spain, France, Hungary, Italy, Netherlands, Sweden and Slovakia. In these countries the efficiency differences among producers are pronounced.

The average value of technical efficiency of pork specialized farms is in the interval between 0.80 and 0.93. Spain is the country with the lowest average value of technical efficiency. The highest average value was estimated for the Czech Republic.

Whereas the minimum values differ significantly among the countries (interval 0.29 to 0.74), the interval of maximum values is considerably close (0.95-0.99). This means that highly efficient producers operate close to the frontier in all EU member states. On the other hand, the large differences among the best and worst producers can be identified. These differences are in the interval from 0.24 (Poland) to 0.66 (Sweden).

The differences in technical efficiency can be also found in the top 10 % producers. These top producers have a technical efficiency higher than 0.88. On the other hand, the first decile (the worst 10 % producers) has a higher variation among the countries from 0.69 in Hungary to 0.90 in Poland.

The spread between 1st and 10th decile is on average 14.0 %. However, this interval is significantly smaller for Poland (4.2 %), Germany (5.7 %), the Czech Republic (6.3 %), and significantly higher in Hungary (23.0 %), Sweden (21.5 %), and Spain (20.9 %). This means that 80 % of Hungarian farms operate with a technical efficiency between 0.70 and 0.93. On the other hand, 80 % of Polish farms have a technical efficiency between 0.90 and 0.95.

This demonstrates the significant variability among countries as well as low technical efficiency differences in Poland, Germany and the Czech Republic.

**Table 2. Share of technological change on TFP**

Country	TTI - Total Factor Productivity (TFP)	Share of technological change on TFP (%)
Austria	0.9058	24.04
Belgium	1.1145	2.04
Bulgaria	0.9773	15.30
Czech Republic	0.9334	2.34
Denmark	1.1548	8.99
Germany	1.1012	5.30
Greece	1.0050	10.91
Spain	1.3786	1.88
Estonia	0.8621	1.92
Finland	0.7610	3.44
France	1.0680	4.71
Hungary	0.9680	8.13
Ireland	NA	NA
Italy	1.3555	2.54
Lithuania	0.9141	11.65
Latvia	0.8821	2.99
Netherlands	1.1084	2.27
Poland	0.9628	4.42
Portugal	1.1757	5.29
Romania	0.8809	26.17
Slovakia	1.0421	2.09
Sweden	1.0108	5.56
Slovenia	0.9230	13.80
United Kingdom	1.0522	10.66

Source: own calculation and depiction

The impact of unobservable management (heterogeneity component) on production elasticities or technical efficiency, as the case may be, differs among analysed countries. Technological change has a significantly positive impact on technical efficiency in five countries, namely in Spain, the United Kingdom, Italy, Latvia and Slovenia. On the other hand, the contribution of technological change to technical efficiency development is significantly negative in eight countries: Austria, the Czech Republic, Germany, Denmark, Finland, Lithuania, Poland and Portugal.

Moreover, the estimates show that the differences among the EU regions are pronounced. We can find regions with significant positive contribution of technological change on production. On the other hand, there are also regions with significant technological regress. However, these regions are not so numerous and the results can be influenced by low number of observations in these cases. It holds in majority of cases that the index is in the interval between 0.9 and 1.1.

Finally, table 2 provides the estimates of total factor productivity (TFP) indexes and the share of technological change component on TFP. As far as the level of total factor productivity is concerned we can find significant differences among the countries. In particular, the old member states have on average higher productivity level as compared to the new member states. The share of technological change component on TFP differs among the countries as well. The share of technological change is in some countries substantial, however, in majority of cases is less than 10 %. Higher importance of technological change can be observed from a dynamic perspective, i.e. as a contribution to the TFP development.

#### 4 Conclusion

In the conclusion we focus on the research questions raised in the introduction. The results show that technological change has a significant positive contribution to the production possibilities in the majority of the countries. Belgium, Poland and Sweden are exceptions. Moreover, the biased technological change is pronounced in almost all analysed countries. However, the presumption of labour saving and capital using biased technological change cannot be confirmed.

The differences in technical efficiency were estimated only for 12 member states, namely for Belgium, the Czech Republic, Germany, Denmark, Spain, France, Hungary, Italy, the Netherlands, Poland, Sweden and Slovakia. However, in the Czech Republic, Germany and Poland the differences in the efficiency of inputs use are rather small among pork specialized companies. That is, the technical efficiency differences among pork producers do not contribute so much to the variation in production in these countries. However, this is not the case of Belgium, Denmark, Spain, France, Hungary, Italy, Netherlands, Sweden and Slovakia. In these countries the efficiency differences among producers are pronounced.

Technological change has a significantly positive impact on technical efficiency in five countries, namely in Spain, the United Kingdom, Italy, Latvia and Slovenia. On the other hand, the contribution of technological change to technical efficiency development is significantly negative in eight countries: Austria, the Czech Republic, Germany, Denmark, Finland, Lithuania, Poland and Portugal. Moreover, the estimates show that the differences among the EU regions are pronounced.

As far as the level of total factor productivity is concerned technological progress is an important determinant of TFP development. TFP differs significantly between the old and new member states and the technological change shall be an important determinant of the regional convergence of TFP. However, we cannot observe significant regional convergence in the analyzed period despite the fact that some exceptions can be find.

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## Risk management of rural municipalities as a limit of their basic self-governing functions

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**Annotation:** The paper deals with municipalities which are characterized by relatively high debt and risk management, and also by problems in the functioning of the local democratic process. A conclusion is offered that economic problems and high debts particularly threaten smaller rural municipalities characterized by low administrative capacity. Small rural municipalities can improve the appearance of villages and the level of social services, but the basic issues of economic development of the locality are beyond its real horizon.

**Key words:** Municipality, local government, development of municipalities, municipal budget, indebted municipality.

**JEL classification:** H72, H74, H61, G18

### 1 Introduction

The development of local governments is a serious issue. Its significance is reinforced by changes in the nature of governance and the functioning of modern states. Some authors point out the consequences of the on-going fragmentation of society. Traditional governance is failing, and society can no longer be managed or governed from a single superior area. Instead, the self-regulating and self-governing ability of social players and society in the broad sense of the word is exercised (Fenger and Bekkers, 2007). Collective decision making is moving to areas outside the direct influence of parliamentary level politics. This raises the issue of legitimacy which is the result of the on-going decentralization and changes in vertical separation of powers (Fenger and Bekkers, 2007). In terms of Czech society, all of this is reinforced by political changes and transformative transition after 1989. The authors who analyse transformation processes in post-communist countries point out that although in the 1990s municipal elections and democratic procedures were quickly embraced, local governments long remained only in embryonic form and still showed a certain lack of real political and economic decision-making mechanism at the local level (Reid, 2003; Baldersheim et al., 1996).

The literature provides opinions that representative democracy works best at the local level (Sisk et al., 2001). For citizens, an autonomous municipality represents a natural political space which they are directly a part of. Therefore, from the perspective of a citizen, the significance of the local community is just behind the nation-state, with whom the citizen identifies as a member of a nation. The civic experience gained in the municipal environment is of a fundamentally different nature than experience acquired in relation to politics at the national level. Belonging to the local community is obviously something other than civic identification with the nation and the nation-state. From this arises the individuality and specificity of democracy in the local political space (for the issue of local identity and local democracy, see Pratchett, 2004; and Čmejrek 2008).

Nevertheless, the democratic character of a local democracy should probably not be idealized. Analyses of the functioning of rural municipalities reveal important specifics of the democratic process at the local level. What most clearly comes to the fore is a certain asymmetry in the decision making process. Usually the mayor has a major influence on decision-making in rural communities, while the council plays a minor role and in many cases changes to a sort of advisory board for the mayor. The mayor has the primary say in determining development priorities and the collective goals of the municipality. Council meetings tend to be rife with the absence of criticism of the mayor and the suggestions and requests of councillors do not seek to control the activities of the executive. Decision-making is not transparent and is influenced by hidden vested interests and important decisions sometimes take place outside official meetings (see, in particular Bernard et al., 2011; and Čmejrek, Bubeníček and Čopík, 2010).

An inseparable part of the political process at all levels of the citizens' trust in institutions. Opinion polls on the issue show how significantly local-level politics and public administration differ compared to the national level. *“Local governments are largely evaluated positively by their voters, both in terms of operational capacity and in terms of transparency and respect for democratic rules. There is no alienation of the political sphere from the people, which is known from national level politics”* (Bernard et al., 2011, pp. 203). On the other hand, statistical analyses *“offer an interpretation according to which local governments rather do not have enough power and capacity to truly affect something in the municipality. Municipalities that develop and provide plenty of tempting opportunities for their residents have local governments with fairly similar characteristics to municipalities that do not offer attractive conditions and struggle to keep their local populations”* (Bernard et al., 2011, pp. 204).

Local development can be defined as *“a social change leading to improved quality of life for a significant portion of the local population”* (Bernard et al., 2011, pp. 21). In relation to the development of local communities, there are also efforts to characterize successful rural municipalities (Perlín and Šimčíková, 2008) or successful rural areas (Czapiewski, 2006). The focus of this paper is in opposite direction – municipalities that can be described as unsuccessful. These are municipalities which are characterized by relatively high debt and risk management, and to this are usually related local problems in the functioning of the local democratic process, the collapse of local government authorities, problematic municipal elections and even the unwillingness of citizens to run for office.

## 2 Materials and Methods

This paper is methodologically conceived as a comparative case study of three municipalities. The starting point was to select municipalities suitable for research. The primary sources of information used were accessible electronic databases and other public sources. This means information from Ministry of Finance CR: MONITOR, which contains budgetary and accounting information of all municipalities in the Czech Republic (Czech Ministry of Finance, 2015a). Another basis was information processed by the Ministry of Finance on the development of debts of regional budgets and monitoring of the economic activities of municipalities (Czech Ministry of Finance, 2015b).

From the municipalities in which a high risk of insolvency was identified according to monitoring of economic activities for 2011, 2012 and 2013, we selected the municipalities

of Bublava, Prameny and Turovice for the comparative study. The data and information on individually-selected municipalities was acquired via a study of documents and polling. The studied documents included the budgets of the municipalities, minutes from council meetings, articles from regional newspapers, etc. Additional information was acquired from interviews with representatives of the local governments.

### 3 Results and Discussion

Utilization of loans or liabilities in general is not something that is extraordinary and unhealthy in the private or public sector, and autonomous municipalities are not an exception. Moreover, most of the borrowed funds focused and continue to focus on long-term investments – reconstruction and construction of technical infrastructure, regeneration and construction of the housing fund, building of additional public facilities, etc. According to data of the Ministry of Finance, 1994 reported indebtedness of 1,969 municipalities out of a total of 6,221 municipalities (31.7%). In 2014 there were 6,248 municipalities in the Czech Republic. Of these, 3,235 were in debt (51.8%). In 1994 the sum of loans, municipal bonds and received financial assistance provided to municipalities amounted to a total of 14.3 billion CZK. In 2014 the debt of municipalities in the Czech Republic amounted to 88.9 billion CZK. When looking at the total amount we find that since 2005, after an initial increase, the total value of the debts of municipalities is roughly between 80 and 90 billion CZK. Around 50% of the total amount pertains to the four largest cities in the Czech Republic - Prague, Brno, Ostrava and Plzeň (Czech Ministry of Finance, 2015b).

Although debt amount is not a problem for many of the municipalities, some of the municipalities are virtually paralyzed by the amounts of their debts. Excessive indebtedness and consequent insolvency represent the greatest risk for municipalities that have made wrong investment decisions, or they were tasked with levies for a breach of budgetary discipline (or both). The risks for the economic situations of municipalities often relate to their failure to comply with the conditions of grant projects supported by EU funds, or from national subsidy programmes. The leaders of municipalities may make mistakes in the preparation and implementation phase of projects. For projects supported by the EU, the sustainability of the project for a set period can also be costly, as it requires an annual expenditure of operating funds of the respective municipalities.

On the basis of a Resolution of the Government of the Czech Republic (1395/2008), the Ministry of Finance monitors and evaluates the economic activities of municipalities. Risky municipalities are considered those with a share of current assets for short term liabilities in the interval between 0 and 1, and the proportion of liabilities to total assets of the municipality exceeding 25%. In 2012, economic situations of 68 municipalities were assessed as potentially risky. A year later there were 52 municipalities. The majority (15) of them were from the Central Bohemian Region. In proportion to the total number of municipalities, the Karlovy Vary Region recorded the highest number of risky municipalities in its territory (1.5% of the total number of municipalities). More than two-fifths of the total number of economically-risky municipalities had 200 to 499 residents. A quarter of them had populations of 199 people or less. Smaller municipalities are generally more vulnerable to encountering potential issues with grants, and their volume often equals a substantial portion of their total income. If a municipality needs to return a grant due to breach of terms (does not receive it, pays a penalty), it will often find itself in an impossible situation (Ministry of Finance, 2015b; Kameníčková, 2015).

Based on the monitoring of economic activities of municipalities for 2011, 2012 and 2013, we focused on the municipalities of Bublava, Prameny and Turovice, for which high risks of insolvency were identified. What are the causes of the significant indebtedness of these municipalities? What impacts do the critical financial situations have on the local public and political life? Does high indebtedness of municipalities lead to a decline in civic activity or in active or passive political participation?

#### Bublava

Bublava is situated in the district of Sokolov and falls under the Kraslice municipality with extended powers. As of 1 January 2014 its population was 374 residents. There is a post office in Bublava. Since 1999, twenty new apartments have been completed here, 15 of them from 2009 to 2013 (Czech Statistical Office, 2014). Bublava is located in the tourist area of Krušné hory on the border with Germany. Services offered in the town are a hotel, several guesthouses, restaurants and a store (Bublava website, 2015).

Bublava's indebtedness relates to the intent to build an aqua park in the town. Construction began in 1999 and Bublava acquired money for it from the state budget. However, the aqua park was not completed because the town was unable to get another grant that it requested for the completion of the aqua park in 2002 (this was the fourth request for a grant, as the three previous ones had been successful). The result is an unfinished aqua park and a liability toward the state for failing to adhere to the purpose of the grant and mistakes in the drawing thereof. After remission of part of the assessed fines, the liability of the town toward the state was 30.6 million CZK. The budget of the construction was around 95 million CZK and the Bublava has an annual income between 4 and 5 million CZK (without accepted transfers – grants). Bublava also has an on-going court dispute in the matter of the construction of the aqua park with construction company Skanska. If Bublava is not successful in the dispute, the town may have to pay more than 19 million CZK (without attributions). A curious aspect is the fact that according to the municipal documents, the Bublava town council did not approve the construction and only acknowledged it, and thereby the Act on Municipalities was breached. Bublava may in fact win the court dispute with the construction company and actually receive money (the unfinished aqua park would become the property of Skanska). Bublava is able to provide public services – lighting, waste removal, etc. (compare Hornek, 2014; Nejvyšší kontrolní úřad - Supreme Audit Office, 2005). Bublava has been able to pay some of the money back, and by the end of 2014 it reported liabilities in the total amount of 37,866,000 CZK with total assets of nearly 110 million CZK (Czech Ministry of Finance, 2015a).

Interest in local public events resulting from the unfinished aqua park and the indebtedness of the town grew. This is also manifested in the utilization of active and passive voting right (Tab. 1).

**Table 1.** Overview of basic data on utilization of active and passive voting right by the residents of Bublava (municipal elections)

	1994	1998	2002	2006	2010	2014
candidate lists	4	3	6	5	6	3
number of elected representatives	5	5	7	7	7	7
number of candidates	16	15	44	29	43	21
candidates / eligible voters	6.8 %	5.5 %	15.5 %	11 %	13.1 %	5.9 %
candidates / representatives	3.2	3	6.3	4.1	6.1	3
eligible voters	234	272	289	264	327	357
voter participation in Bublava	82.48 %	65.44 %	78.89	75 %	88.69	80.95

Source: own processing according to the CSO election server.

### Prameny

Prameny is situated in the district of Cheb and falls under the Mariánské Lázně municipality with extended powers. As of 1 January 2014 its population was 118 residents. Since 1999, two new apartments have been completed here, both from 2009 to 2013 (Czech Statistical Office, 2014). The only service offered in the town is one guesthouse.

The critical financial situation and the related indebtedness are mainly related to the intention of using the mineral springs in the town (Prameny was spa town until the end of World War II). Prameny invested millions of CZK in the project. The investors, however, eventually withdrew from the project. This was due, among other things, to a lack of approval from CHKO (Landscape Protected Area) Slavkovský les. This resulted in a poor financial situation for the municipality. With an income of less than two million CZK, Prameny reports liabilities totalling 90,393,000 CZK at the end of 2014. Prameny has total assets of nearly 20 million CZK (Czech Ministry of Finance, 2015a). Prameny has blocked accounts and basic services (e.g. lighting) are paid by the Czech Ministry of Finance. A significant portion of the assets of Prameny (including the town hall) were sold at auctions (Interview with Prameny mayor, 2014; compare Hornek 2014; Michalíková 2015).

Until the first extraordinary elections in the municipality in 2009, the local political scene was characterized by minimal competition. Most of the councillors and residents had trusted the mayor and his vision of building a mineral water bottling plant. During the extraordinary elections in 2009 (preceded by a disintegration of local government in 2008) two candidate lists with different development concepts for Prameny (yes or no to bottling plant) competed with each other. That same year the council once again fell apart. This was followed by a successive announcement of the six elections in which none of the local citizens (candidates) registered. Prameny was governed by administrators appointed by the Czech Ministry of Interior. The locals only provided a candidate list for the 2012 elections. There were two candidate lists in the general election in the autumn of 2014. Before the election, criticism against the mayor elected in 2012 was heard. Information appears in the press about a bonus paid out to the mayor by the Karlovy Vary Regional Authority (Michalíková, 2015). Following the withdrawal of the opposition councillor, including alternate members of his election party,

council again fell apart in May 2015 (Dolanská, 2015). In 2012 the Obnova obce Prameny (Renewal of the municipality of Prameny) civic association was formed.

**Table 2.** Overview of basic data on utilization of active and passive voting right by the residents of Prameny (municipal elections)

	1994	1998	2002	2006	2009 extraord inary	2012 extraord inary	2014
candidate lists	4	6	5	5	2	1	2
number of elected representatives	6	6	5	5	5	5	5
number of candidates	7	6	5	6	12	5	10
candidates / eligible voters	8.6 %	7.4 %	5.2 %	5.3 %	10.4 %	4.5 %	9.5 %
candidates / representatives	1.2	1	1	1.2	2.4	1	2
eligible voters	81	89	96	114	115	112	105
voter participation in Prameny	79.01 %	40.45 %	50 %	60.53 %	82.61 %	33.04 %	75.24

Note: from 2009 to 2011 the elections did not take place six times – no interest of locals in running for office.

Source: own processing according to the CSO election server.

### Turovice

Turovice is situated in the district of Přerov and falls under the Přerov municipality with extended powers. As of 1 January 2014 its population was 222 residents. Since 1999, 7 new apartments have been completed here, four of them from 1999 to 2003 (Czech Statistical Office, 2014). There are no civic amenities in the Turovice (Turovice Zoning Plan, 2015).

Turovice is indebted due to the construction of a senior citizens home. In 2006 Turovice acquired a grant of 42 million CZK. The construction was to have been completed in 2008, but the construction company requested an increased price of the construction. The subsequent dispute between the town and construction company led to the withdrawal of the construction company (it is being resolved in court). Turovice was unable to complete the building by the deadline. The town is to return the grant and a penalty in almost the same amount to the state. Turovice is only able to provide the most essential public services – some public lighting, etc. (compare Česká televize, 2015b; Hornek 2014). Turovice has an annual budget of slightly over two million CZK. By the end of 2014 the town reported liabilities in the total amount of 84,461,000 CZK. The total assets of Turovice only slightly exceeded 60 million CZK (Czech Ministry of Finance, 2015a).

There is not much interest in participation in the local government. Table 3 captures the utilization of active and passive voting right. Associations also work in the town – Czech Breeders Association, fire fighters and a football club (Turovice website, 2015).



**Table 3.** Overview of basic data on utilization of active and passive voting right by the residents of Turovice (municipal elections)

	1994	1998	2002	2006	2010	2014
candidate lists	4	2	2	2	2	1
number of elected representatives	9	9	9	9	7	7
number of candidates	15	13	18	18	15	9
candidates / eligible voters	9.5 %	8 %	11.3 %	10.5 %	7.7 %	4.6 %
candidates / representatives	1.7	1.4	2	2	2.1	1.29
eligible voters	168	162	160	171	194	196
voter participation in Turovice	79.76 %	75.93 %	71.88 %	77.19 %	61.86	46.94

Source: own processing according to the CSO election server.

## 4 Conclusion

All three municipalities (Bublava, Prameny, and Turovice) became highly indebted and must deal with the related critical financial situation due their failure to handle the investment projects. The case of the construction of the aqua park in Bublava is interesting in that according to available sources, it was not approved by the municipal council (it only acknowledged it). The issue of the approval, or lack thereof, of the basic self-governing body of the municipality is assessed in the context of court dispute of Bublava versus construction company Skanska. Prameny is an example of a visionary at the head of the town. However, the intention to use mineral water, which has long been supported the majority of councillors, ultimately failed. Only then did political competition appear in the municipality. Turovice found itself in a practically insurmountable financial situation as a result of a dispute with a construction company. The case of Bublava is also interesting in that the critical financial situation was virtually simultaneously accompanied by increased public participation on the part of residents; it was rather the opposite in Prameny and Turovice, although in 2009 and 2014 elections were held in Prameny with competing candidate lists.

Problems with investment projects also occur in other municipalities. For instance, for several years the local government in Úholičky, a town with about 700 inhabitants in the Prague - West District has dealt with the construction of building small-scale apartments. However, due to a lack of contracts on the exchange of land under the construction site, Úholičky also had to repay a grant and pay penalties. Úholičky was saved from its economic problems by its particularly extraordinary income for depositing waste in the landfill in Úholičky's cadastral area (Čopík and Kment, 2011).

A conclusion is offered that economic problems and high debts particularly threaten smaller municipalities characterized by low administrative capacity. Yet higher indebtedness can also affect larger municipalities. For instance, the city of Kolín (Kolín District) with more than 30,000 residents "acquired" a relatively high debt in connection with the construction of the TPCA car factory. The local government committed itself to the construction of apartments and other investments. Compared to the local government, the automaker negotiated comparatively very favourable conditions (Česká televize, 2015a).

Municipalities utilize liabilities in particular to build long term investments. Overall, the indebtedness of local governments in Czech Republic is not critical. In 2014 about half

of all municipalities had loans or other financial aid, and only a small number of them face critical economic situations and the related high indebtedness. In most cases these are small rural municipalities with small administrative capacity. These municipalities have no chance of venturing into the major economic projects. As confirmed by other studies (Bernard et al. 2011) the local governments of small rural municipalities are usually well aware of this fact and do not give much hope for the success of efforts to implement local economic development projects. This also represents a significant limit to community-driven local development (CLLD), which can influence the spatial definition of its activities (Čmejrek and Čopík, 2014) and improve the appearance of municipalities and the level of social services, but the basic issues of economic development of the locality are beyond its real horizon.

The stories of municipalities Bublava, Prameny and Turovice indicate that in the Czech Republic there is no mechanism for dealing with insolvent municipalities. The current bankruptcy law does not apply to local governments. It is hard to imagine that an insolvent municipality would not provide long-term public services, or would completely disappear. Some municipalities operate only through extraordinary measures. Prameny's accounts have been frozen and the municipality only has several tens of thousands of crowns annually (revenues collected in cash). Basic services are covered by the Ministry of the Interior of the Czech Republic, the Karlovy Vary Region and the citizens themselves. With liabilities around ninety million CZK and revenues of less than two million CZK, it would take the municipality many decades to pay off its debts (assuming no there is no interest). Discussions on resolving the situation of heavily-indebted municipalities in the Czech Republic have been taking place for several years, and foreign experiences are often mentioned. Municipal indebtedness is regulated in many European countries. In some countries (Denmark), loans to municipalities are very limited. Elsewhere (Germany, Austria, Ireland), loans to municipalities are subject to approval by higher levels of government (Kameníčková, 2015; Šefčík, 2014). During the municipal order valid in the Czech Republic from 1850 to 1945, certain economic operations of municipalities and districts required approval (Čopík, 2014). However, approvals of the economic operations of municipalities are also criticized and are considered a restriction of autonomy, and thus they are not always able prevent economic problems. The most plausible alternative appears to be the adoption of legislative changes for insolvency of municipalities (municipalities, regions). The cases of the municipalities that we have analysed also point to this fact. Funds in the blocked accounts of Prameny are slowly increasing, and during insolvency proceedings its liabilities could be paid at least in part. In the next few years, creditors may be able to acquire a part of their receivables and the local governments could subsequently begin to functioning normally again. In all of analysed municipalities, citizens and their elected governments are interested in dealing with the unfavourable economic situation of their municipalities. In Bublava the economic problems have prompted citizens to greater participation in public affairs. Enactment of insolvency proceedings would expand the possibilities for local governments to resolve their own potential adverse economic situations.

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## Positive Disparities in Micro Regions

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**Annotation:** The most important subjects in the local development strategies are the Local Action Groups (LAG) on the territories of micro regions. In the Czech Republic, there are 179 MAS (in 2014) with more than 4000 member communities. According to the decision of the Ministry of Local Development the LAG should now formulate real and reasonable development strategies as a basis for development projects in the period 2014 -2020. Discovering the inner disparities can be incorporated into the development strategies. The LAGs with prevailing either economic or environmental qualities should develop their weaker features. The study compares all communities inside the LAG Vyhličky in Central Bohemia and divides them into three groups. The contribution proposes evaluation of the quality of life and comparison between regional subjects based on direct processing of official statistical data. The disparities were qualified using two aggregated indexes: economic activity index and environmental quality index. The mutual evaluation of chosen communities is quite complicated due to a high number of independent territorial units. Specialized maps were created for visualization to improve the transparency of the results. The result of the study is a methodological proposal of finding inner disparities in micro regions. The aggregated indexes and their ratios can serve for the decision support in the community-led development.

**Key words:** Micro region, local action group, quality of life, disparities, community-led development.

**JEL classification:** O18

### 1 Introduction

The community led development in the Czech Republic (CR) is focused on the Local Action Groups (LAG) who are the representatives of local public and private interests on the territories of micro regions. In the CR, there are 179 LAG (in 2014) with more than 4000 member communities. The LAG is responsible identifying and implementing a local development strategy, making decisions about the allocation of its financial resources and managing them (Sršeň and Dubský, 2014). The allocation of local financial sources means also allocation of state and European sources via various foundations. LAG in the Czech Republic should now formulate real and reasonable development strategies as a basis for development projects in the period 2014-2020. In 5 EU member states (Denmark, Hungary, Cyprus, Lithuania and Slovakia) the LAGs can already apply for multiple funds, in the case of the Czech Republic the local Strategies prepared by LAGs will be reviewed and assessed by the Ministry of Local Development (Kolářová et al., 2014).

The development of rural areas can be measured by the marketable surplus of farms and improvements in productivity (Hubbard and Gorton, 2009). Over more the agriculture produces a wide range of non-commodity goods and services, shapes the environment and affects social and cultural systems (Van Huylenbroeck et al., 2007). Now, the European agriculture and rural areas are facing multiple socio-economic changes, including a transition from an agriculture-based to a service-based economy (Dessein, Bock and Krom, 2013).

The quality of life is influenced by a higher number of factors. The criteria of the quality of life in the rural areas are in a continuous process and the evaluation is to a huge extent influenced by subjective factors (Dömeová and Jindrová, 2014). Most people want to live close to good public and private service, such as high quality schools, medical services, libraries, high speed internet access, and transportation (Sirgy et al., 2000). Cultural, recreational, and entertainment opportunities are important (Silver et al., 2010 and Silver, 2012), as well as scenic landscapes and good climate (Deller et al., 1997). No doubts, some of these demands are in contradiction.

The main idea of the article is that the disparities inside small regions could be positive. The LAGs with prevailing either economic or environmental qualities should develop their weaker features, and support the inner disparities between the member communities. The LAG with intensive economic activity should develop recreation and residential areas not in a close neighbourhood to industrial capacities, possibly in a different community, but not in a big distance – in the same LAG. The territories with high quality nature environment usually need to bring in some working opportunities and financial income. The goal of the local strategies there should establish appropriate businesses which will not interfere with the natural locations but provide working places for local inhabitants. The ideal balanced LAG has places with intensive economic activity and other places with convenient environment for living and relaxation.

The study compares all communities inside one LAG from the point of view of their economical activity and environmental values. The result of the study is a methodological proposal of finding inner disparities in the LAG showed on a real example.

## 2 Materials and Methods

The source of data was the official statistic of the Czech Statistical Office which was released for free in 2014 and published on the web pages of the office (ČSÚ, 2015). The evaluation of disparities was based on the analysis of chosen indicators for 2013. The basic territories for discovering the regional disparities were communities associated in the LAGs.

The choice of the indicators was based on the descriptors used in the Strategy of the National Development of the Czech Republic (MMR ČR, 2008) and on the strategic documents of the regions. The indicators were divided into three groups: Environmental, Social, and Economic.

The goal of the article is to analyze inner disparities between the communities with intensive economic activity, and the others with quality environment for living and recreation. Therefore only the groups of economic and environmental indicators were applied.

The calculation of the aggregated indexes (AI) is based on a aggregation method (Dufek and Minařík, 2010). The method first finds the community inside the LAG where the analysed indicator reaches the maximal value (if the rising value of the indicator is positive) or minimal value (if the indicator performs negative influence and its value should decrease). The scores

for all indicators are calculated and their sum is the score of the community  $\sum_{i=1}^n b_{ij}$ . The AI

of the community (formula (1)) is given by the share of the score of the community and the average score of all communities in the LAG. No weights for indicators were applied in this study.

The value equal or around one means average evaluation of the community.

$$AI = \frac{\sum_{i=1}^n b_{ij} v_i}{\sum_{i=1}^n \sum_{j=1}^m b_{ij} v_i} \quad (1)$$

$m$

where:

$b_{ij}$  ..... Score of  $i$ -th indicator;  $i = 1, \dots, n$ , a  $j$ -th community;  $j = 1, \dots, m$ ,

$n$  ..... Number of indicators,

$m$  .... Number of communities

$x_{ij}$  .... Original value of  $i$ -th indicator for  $j$ -th community,

$x_{max}$  .. Maximal value of  $i$ -th indicator,

$x_{min}$  .. Minimal value of  $i$ -th indicator,

$v$  ..... Weight of  $i$ -th indicator.

The score value  $b_{ij}$  is equal to:

$$b_{ij} = \frac{x_{ij} - x_{min}}{x_{max} - x_{min}} \text{ for positive force} \quad (2)$$

$$b_{ij} = \frac{x_{max} - x_{ij}}{x_{max} - x_{min}} \text{ for negative force} \quad (3)$$

The disparities inside LAGs were qualified using two AI ( $AI_{\text{economy}}$  and  $AI_{\text{environment}}$ ) for each community. The  $AI_{\text{economy}}$  was based on 31 indicators. There were all indicators for economical subjects on given territory classified according to their economic activity (CZ-NASA) and legal form.

The  $AI_{\text{environment}}$  used following indicators (area ratios): Arable land, gardens and orchards, permanent grasslands, forest lands, water body areas, built up area, other areas.

The ratio  $R_{e/e}$  between the economic and environmental indexes was calculated as:

$$R_{e/e} = \frac{AI_{\text{economy}}}{AI_{\text{environment}}} \quad (4)$$

The mutual evaluation of chosen communities is quite complicated and the results are not easy to read due to a high number of independent territorial units. Specialized maps were created for visualization of the inner disparities to improve the transparency of the results. The maps enable complex and illustrative depiction of differences in observed phenomenon and lead to identification of the disparities. The maps were created as a web application based on Google maps.

The maps contain visualization of two aggregate indexes: economic and environmental. The values of indexes were divided into seven groups. The number seven was assigned according to the rules used for calculation of the number of intervals (Kába and Svatošová, 2012). The width of the intervals were derived from the variation  $R$ . Each interval has different color in the map.

$$R = SI_{\text{Score max}} - SI_{\text{Score min}} \quad (5)$$

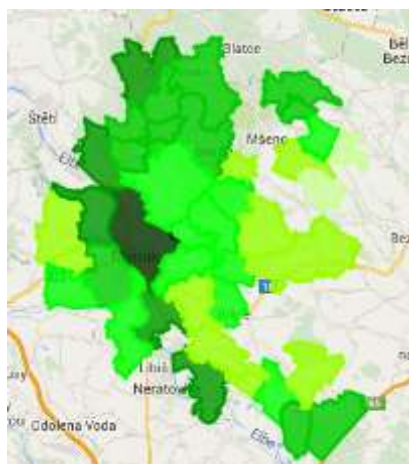
For proceeding the data and application of multiple dimensional statistical analyses the software IBM SPSS version 22 was used.

### 3 Results and Discussion

The sample territory was the LAG Vyhličky from central Bohemia which contains 40 communities. The aggregated indexes were calculated for all communities and depicted in the maps (see Fig. 1 and 2).

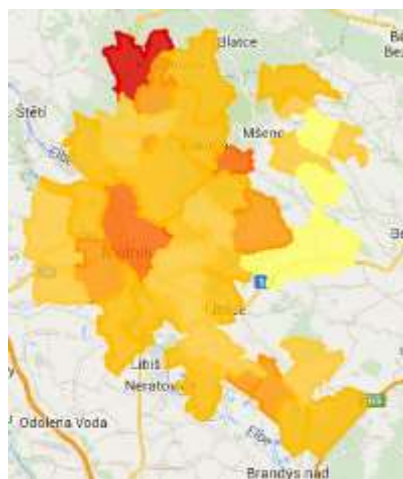
The maps show clearly the differences between the communities but the values of the indexes are not exactly readable. For identification of the inner disparities the real values of the indicators were placed in a table see Table 1, compared (the higher value in bold), and the  $R_{e/e}$  was added.

Fig. 1. Aggregated environmental indexes for communities of the LAG Vyhličky



Source: own work based on <http://moniqua.net-mix.cz/?maska=110&vrstva=0>

Fig. 2. Aggregated economic indexes for communities of the LAG Vyhličky



Source: own work based on <http://moniqua.net-mix.cz/?maska=110&vrstva=1>



According to the  $R_{e/e}$  ratio the communities were divided into three groups:

1. Communities 1-13 with prevailing economic activity: the  $R_{e/e}$  above 1,
2. Communities 32-40 with prevailing environmental qualities: the  $R_{e/e}$  under 0.7,
3. Communities with economy and environmental qualities in balance: the  $R_{e/e}$  between 0.7 and 1.3, communities 14-31.

The improvement could bring application of the concept of multifunctional agriculture (Marsden and Sonnio, 2008) which is based on three paradigms: the *Agro-industrial paradigm* (connecting farms and agri-food into an industrial bio-science dynamic), the *Post-productivist paradigm* (perception of rural areas as consumption spaces to be exploited by industrial capital, and with the growing urban populations), and the *rural development paradigm* (re-emphasizing food production and agro-ecology and reconnects a priority of agricultural production to the wider markets and social possibilities).

**Table 1.** Table description

Community no. + name	$A_{environment}$	$A_{economy}$	$R_{e/e}$	Community no. + name	$A_{environment}$	$A_{economy}$	$R_{e/e}$
1. Kluky	0.1486	0.7835	5.2725	21. Vidim	1.2526	1.3599	1,0856
2. Kanina	0.5574	1.4385	2.5806	22. Hostín	1.0344	1.0650	1,0296
3. Kadlín	0.2401	0.5755	2.3969	23. Hlavenec	1.1501	1.1470	0,9973
4. Nedomice	0.5672	1.2615	2.2241	24. Hořín	1.2655	1.2167	0,9614
5. Býkev	0.3685	0.7573	2.0551	25. Velký Borek	0.9774	0.9152	0,9364
6. Stránka	0.3592	0.7313	2.0359	26. Střemy	0.8110	0.7163	0,8832
7. Cítov	0.5044	0.8934	1.7712	27. Kokořín	1.2067	1.0460	0,8668
8. Řepín	0.6735	1.1514	1.7096	28. Dobřeň	1.2199	1.0345	0,8480
9. Dřísy	0.7576	1.1623	1.5342	29. Lužec nad Vltavou	0.9945	0.8304	0,8350
10. Malý Újezd	0.5433	0.8215	1.5121	30. Lobeč	1.2057	0.9796	0,8125
11. Lhotka	0.7756	1.1039	1.4233	31. Nosálov	1.3097	0.9341	0,7132
12. Všetaty	0.6502	0.9127	1.4037	32. Lhota	1.3858	0.9747	0,7033
13. Sudovo Hlavno	0.5337	0.7268	1.3618	33. Želízy	1.2460	0.8492	0,6815
14. Vysoká	0.8284	1.0354	1.2499	34. Vrátno	0.8781	0.5952	0,6778
15. Mělnické Vtelno	0.4852	0.5752	1.1855	35. Liběchov	1.5475	1.0101	0,6527
16. Liblice	0.8554	0.9796	1.1452	36. Tupadly	1.3701	0.8739	0,6379
17. Obříství	0.9901	1.1216	1.1328	37. Mělník	2.3029	1.4334	0,6224
18. Medonosy	1,7560	1,9490	1.1099	38. Tišice	1.7399	1.0656	0,6124
19. Dolní Zimoř	1.1162	1.2223	1.0950	39. Kly	1.6926	0.9439	0.5577
20. Nebužely	0.9204	1.0069	1.0940	40. Dolní Beřkovice	1.7386	0.9233	0.5311

Source: Own work

In the group of communities with more intensive economic activity are also the communities which are under average in both AI, e.g. Kadlín, Býkev, etc. The local authorities have to decide where lays the local potential for future development by other indicators.

The calculated indexes and ratios can be taken only as one of many indicators for setting the regional strategies. The rural development strategies must take into consideration both the changing role of the countryside and effort for coherent and sustainable development in the whole EU (Territorial Agenda of the European Union 2020). The broader sets of social, cultural and economic change that can be identified as re-shaping and re-defining the organisation of the contemporary countryside (Neal, 2013). The reduction of the significant economic, social and territorial disparities is the primary objective of EU cohesion policy (European Commission, 2011) but the cohesion policy does not necessarily mean removing all disparities.

Due to a considerable diversity between the rural territories no single rural development policy can offer a common, optimal solution at the same time and in the same way (Territorial Agenda of the European Union, 2020). The main objectives of the EU cohesion policy were operationalised according to the priorities agreed under the renewed Lisbon agenda (Mendez et. al, 2011):

- 1) Improving the attractiveness of regions by improving accessibility, quality and level of services, and preserving their environmental potential,
- 2) encouraging innovation, entrepreneurship and the growth of the knowledge economy,
- 3) creating more and better jobs.

The support of the inner disparities in the LAGs (micro region) is from or point of view in line with the EU cohesion policy goals.

#### **4 Conclusion**

The rural communities and micro regions (LAGs) in the Czech Republic now face an important but difficult task: to construct local strategic plans of the development till 2020. The local strategic plans which are in line with regional, state and EU policies represent opportunity for the transition towards more sustainable economic structures. Recognition of the diversity of rural areas is essential for a place-based development. This requires primarily recognition of own position, strengths and weaknesses, and definition of goals.

The proposed methodology based on aggregated indexes and their ratios brings some qualitative data which can support the local decision makers. It remains that there can be also positive disparities and the balanced development does not mean the identical. The proposed indexes as well as any others must not be used thoughtlessly but with respect to local conditions and experience.

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## Predictive ability of financial health assessment in agriculture

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**Annotation:** The true representation of reality is a globally recognized accounting principle. It does not mean that the accounting reflects the real situation such as in statements as a basic for assessment of financial health. There is a space for different ways to determine values depending on the choice of methods of a valuation and depreciation but also on way of an evaluation and an interpretation of results. The freedom of the choice of some methods gives a space for a data manipulation in a way which will be beneficial for the company in the moment. It could be an effort to minimize or maximize the profit, or an effort to influence the indicator of the financial analysis.

There are special risk items which arise from biological, social and other specifics in the field of the agriculture. There is outlined how these values are reflected in the financial health assessment. Different and even legal adjustments to the carrying amounts reported for the accounting period lead to distort the real situation of the company. There is an increasing of informational uncertainty.

In the previous period the issue of classifying and valuing animals was drawn up to describe accounting possible variable values in reporting of selected items important for the assessing the company's financial health in the agriculture.

This paper is devoted to the identification of other risk items of financial statements in the field of agriculture in relation to a possible collision with an objective detecting and the calculation financial health.

**Key words:** financial health, creative accounting, risk items, financial statements, agriculture.

**JEL classification:** M41

### 1 Introduction

The financial health assessment of the company includes many methods. All are used in order to determine the financial situation of the company. These methods should help in a decision making not only the owners and managers but also potential investors and institutions. All assessing methods use data from the financial statements compiled by the end of the reporting period.

The compilation of such statements is governed by legislative requirements but, even so, there is a room for different ways to determine the value. There can therefore be obtained different values depending on the choice of valuation methods, depreciation methods, other methods, but also on your perspective. These values, however, affect the outcome of the evaluation of the financial health of the company. The assessment can be affected not only by chosen method, but also by interpretation of results and the specific conditions of individual sectors. Different values in the financial statements also may occur intentionally, by management interventions.

For the manipulation of financial statements exist the term creative accounting, or creative accounting practices. According to Blake, Bond, Amat and Oliveras (2000) creative accounting is known since the 80s of the 20th century. In their paper some Spanish evidence of creative accounting is described. Creative accounting is defined in many ways. For example according to Marilena and Corina (2012) creative accounting is useful instrument for managers that want

to promote and sustain company image. But for most people creative accounting is a misuse of accounting in order to better presentation of the company in the financial statements.

Creative accounting is also addressed by Manciu and Cotlet (2012), who solved creative accounting in connection with fair view of the economic reality. Creative accounting can affect many areas that have an impact on the financial assessment of the company. Creative accounting and its effect on valuation is addressed in the paper of Voinea and Hromie (2014). In according to them the main reasons for the use of creative accounting are to make the enterprise more tempting for sponsors, to create better image or to grow in the eyes of investors and all information users. Also Demerens, Paré and Redis (2013) solved the question: Why is accounting manipulation committed? According their research main reasons are managers' personal motivation, respect for financial conditions, tax optimization or reducing financial costs and the cost of capital.

Creative accounting is used for many reasons and affects many areas of the financial health assessment. Creative accounting in agriculture has not yet been studied very often. For example Kouřilová and Sedláček (2014) presented a model with environmental indicators. In agriculture, there are specific areas that lead to other uncertainties which may lead to distortions. Therefore, it is necessary to discover all risk items and monitor them.

## 2 Materials and Methods

At this stage of processing the work is illustrated by data of one variant of the chosen company. At later stages of work the database Albertina gold will be used in.

The items of financial statements used for the calculation of the financial health, that may distort financial health evaluation, are designed. As the illustration is used already processed monograph that demonstrates that the difference in profit or loss can be more than 300 percent under the same conditions. Later items of the specific firms, that went bankrupt or had these tendencies, are examined.

The aims in this phase is to get the results of analysis of items of the financial statements, to assess their risk due to their explanatory power and to propose a set of criteria that complement the qualitative indicators characterizing the sector.

## 3 Results and Discussion

Even if the topic is addressed by legislation, different values in the financial statements can arise there. Differences between entities, which can distort the picture of the company's assets, arise due to a choice of certain accounting methods or a obligation to create adjustments and free reserves. The choice gives an extra space for selecting a method that will ensure the company to the desired amount of certain items presented in financial statements, therefore, for targeted manipulation of financial statements.

The main problems are as follows:

- Focus on historical accounting and legislation – Valuation of assets at historical cost has advantages and disadvantages. Benefits include the conclusiveness, the objectivity, the verifiability, ensuring the protection and control of assets, the continuity. Disadvantages include the following: not to take into account changes in prices of particular items of assets (ie. changes in market prices of assets, incl. land

or animals), to ignore changes in the purchasing power of the monetary unit and it leads to distort the outcome of the current year. (Kovanicová, Kovanic, 1995)

- Meaning column correction - adjustment are directed by the company but values from this column are used in the financial analysis.
- Financial leasing - Assets acquired under leases are not shown in the accounts of assets, but only on the off-balance sheet accounts, although it will give rise to benefit in the future. Interests only are shown in a foreign capital, not the actual payment for the asset. To give a true and fair view of the situation of the company, the subject of finance leases should be recorded in the assets and the lease payments should be added to the volume of liabilities. (Kouřilová, Drábková, 2012)
- The comparability of financial statements both in time and with other companies due to differences in adopted accounting policies and the application of generally accepted accounting principles
  - Accounting Depreciation - A frequent cause discrepancies between firms is an accounting depreciation in dependence on time. There are differences in depreciation methods and thus in depreciation rates, depreciation periods or approaches to the inclusion of obsolescence in depreciation rates. Other irregularities arise with option to use depreciation of components. For example, there is the possibility to depreciate an air conditioner separately in a new building, because it has a lower lifetime. In 2010, as part of crisis measures the possibility of using accelerated depreciation arose, for example, the car could be depreciated in two years instead of five years.

Cernusca (2009) presented the influence of the chosen amount of the residual value of an asset. The amount of the residual value has the effect on the amount of the depreciation and thus the amount of the profit.

- The method of classifying current and fixed assets - For assets whose purchase price does not exceed the value of CZK 10 000 and the period of use is longer than one year, the firm decides whether it will lead to inventory account or to fixed assets. If it opts for inventory, its consumption must be displayed on the balance sheet accounts. For fixed assets, the company chooses its own limit for keeping the property as tangible. This leads to a reduction in the comparability of different companies.
- The valuation of inventories and their consumption - This policy affects both the extent to which they are recognized in the balance sheet in a given year, as well as the value of the loss in the profit and loss account. An entity may, in accordance with Czech legislation, choose between two ways of valuing inventories during picking, the FIFO method, or arithmetic average.

Weighted arithmetic average is frequently used and represents the lowest level of price dispersion. FIFO method at the time of inflation leads to the recognition of the highest profit and the overvaluation of assets. If prices fall, the effect of valuation methods FIFO is contrary. (Drábková, Kouřilová, 2008)

- Choice of calculation method prices of its own stocks and other assets – Although many companies consistently use calculations for the valuation

of inventories the value of awards may not always be comparable. The calculation formula chosen by each company may contain different items. The determination of the primary and by-product may also vary, which also affects the amount of the award.

- The principle of prudence - Differences arise by using the possibility of creation adjustments. It is important, in what amount the legal reserves are constituted (the impact worse conditions of its creation) and if the company uses the creation of voluntary reserves. All these factors are reflected in the value of assets and income. To reduce the impact of weather risks in the form of reserves or insurance is not common. Moreover, there are also silent reserves that are not posted in accounting statements.
- The principle of accruals - Differences in the statements of various firms follow from the concept of assigning costs and revenues to the period to which they relate. There has been a conflict between two principles, the principle of prudence and the principle of accruals. According to the principle of prudence, the company would not have shown a precarious profit. But company should show costs at their inception because it is unclear in what financial position the company will be located in the future. (Kovanicová, Kovanic, 1995)

Because of the above mentioned, it is very important to use notes to the financial statements in the financial health assessment. It should show a group of important facts. The purpose of notes to the financial statements is to comment, to specify and to add the information in the balance sheet and profit and loss statement. Notes to the financial statements also contain a number of non-accounting data. Processing of notes to the financial statements the quality content, the explanation of risk groups' manipulation of financial statements requires a detailed accounting of off-balance sheet accounting system in accordance with accounting regulations.

Others differences arise due to specific items in the selected sector. Agriculture is a very specific area among other lines of business. Specifics of the branch are reflected in accounts in various forms. These include specific items in statements that appear in other areas rarely or specifics that affect accounting. Statements of farms therefore reflect the peculiarities of a much higher rate than in other business areas. Specifics are as follows:

- Subsidies - In the balance sheet, subsidies are recorded in several ways according to their nature. Subsidies for investment are reflected in the balance sheet by reducing the value of fixed assets which have been acquired. This leads to a lower value of depreciation, which affects profit. Subsidies for the operating purposes are used to purchase short-term assets. This subsidy is accounted as the revenues. Both types are then projected on the liabilities side. Impacts of subsidies on the balance sheet are often hidden at first glance. If subsidies are considered foreign source, there will not be the precise determination of how the entrepreneur manages his own generated resources. The value of the investment property acquired from subsidies is reduced by the amount of subsidies. The actual value of the property can be seen on off-balance sheet accounts. At first glance, therefore, we do not reveal that the subsidy was used. The use of a subsidy is charged to the income statement, reducing the comparability of profit and loss for the company, which receives subsidies, and the company, which



receives no subsidies. Sometimes it can be seen that subsidies are taken unjustly. On the desktop, on which the company received subsidies for grazing throughout the year you do not see a single piece of cattle, the land is fenced only. (Kouřilová, Pšenčík and Kopta, 2009)

That subsidies may affect the financial health assessment of the company is also demonstrated in the paper by Lososová and Zdeněk (2014) and Řezbová and Škubna (2013). According to Trnková, Malá and Vasilenko (2012) the economic situation is different for companies that receive subsidies and those that do not receive them.

- The soil quality, which does not feature in the valuation of the land at all. The land is valued depending on where it is located.
- The specificity of biological assets (living creatures and plants).
- The variability of earnings associated with the seasonality and different labour participation rates.
- The valuation and the choice of the calculation formula. There may be different valuation costs and different levels of the same costs selected by the entity. Own costs also do not match the value of animals which have valuable genetic traits, their value is much higher.
- The work of the nature, which is not generally quantified, in contrast to some practices in calculation in abroad. (Kouřilová, 2010)

These specificities give rise to other risk areas, since they can not be solved by legislation in detail.

All of the above deficiencies can give space for the creative accounting. An effort of the creative accounting is to influence items in financial statement to achieve a desired objective. The main objectives include minimizing or maximizing profit or best results of indicators of assessment the financial health of a company. Owners may want to minimize the profit to reduce tax liability. Both owners and managers may want to maximize profits. For both groups, it is advantageous to increase the attractiveness of the company for potential investors. The applying of the creative accounting violates one of the basic principles of accounting, the true and fair view.

As an example there will be determined the difference arising due to various valuation of consumed inventories. Choice between the FIFO and the weighted average method affects the amount of the valuation of consumed inventories. The consumption is a part of the costs, and thus is affected the profit. When deciding on the choice of methods that would lead to achieving the objective, it is necessary to estimate how the unit price of stocks will move. The following examples are demonstrated in the consumption values with decreasing unit prices.

It is generally known that if the unit prices are decreasing, using the FIFO method will lead to reduce income compared with the income by using the weighted average method. Company should use the weighted average method by trying to maximize the profit. In our case, it is a calculation of specific numbers for specific years. It must be expected that the situation will change and eventually equalize in coming years.

To demonstrate impact on the assessment of the financial health of the company, this consumption is considered a monthly, so the annual consumption was in the amount of CZK 3,636,600 by using the FIFO method and CZK 3,609 775.2 by using the weighted average

method by a certain simplification. The financial statements of Agropol Rožmitál in the Šumava were used to quantify the influence of the difference in the income. This company showed a similar level of the consumption.

The possibility that the company uses the weighted average method for valuation of stocks consumption was taken as a starting. These financial statements have been used to calculate "Gurčik" model (i.e. G-index) in the case that the company used the weighted average method. When using the FIFO method assets, inventories and the profit decreased by CZK 27,000 and the cash flow increases of CZK 5,130.

**Table 3.** Valuation of consumed stocks by decreasing unit prices

Item	Operation	Amount (pc)	FIFO		The weighted average	
			Unit price	Total price	Unit price	Total price
1	Initial state	150	510	76 500	51	76 500
2	Income	150	507	76 050	50.7	76 050
3	Income	100	505	50 500	50.5	50 500
4	Income	200	500	100 000	50	100 000
5	Income	100	498	49 800	49.8	49 800
6	Issue	200	<b>CZK/pc – 509.25</b>	<b>101 850</b>	<b>CZK/pc – 504.07</b>	<b>100 814</b>
7	Income	100	497	49 700	49.7	49 700
8	Income	100	495	49 500	49.5	49 500
9	Issue	100	<b>CZK/pc – 507</b>	<b>50 700</b>	<b>CZK/pc – 501.77</b>	<b>50 177</b>
10	Income	150	490	73 500	49	73 500
11	Issue	300	<b>CZK/pc – 501.67</b>	<b>150 500</b>	<b>CZK/pc – 499.412</b>	<b>149 823.6</b>
12	Total consumption	850		303 050		300 814.6

Source: own processing

The G-index was created by Professor Gurčik for assessing agricultural enterprises in the Slovakia. Companies, that were achieving profit in years from 1988 to 2000 and their profitability were above 8 %, were included into the group of thriving enterprises. This amount is taken as the threshold, when the capital invested in the company still retains its fair value. The enterprises which achieved loss during the years 1998 – 2000 were included in the group of bankrupt enterprises. The G-index takes the following form:

$$G = 3.412 * NZ / A + 2.226 * VH / A + 3.277 * VH / VYN + 3.149 * CF / A - 2.063 * ZAS / VYN$$

Where are: A            assets  
 NZ            retained earnings  
 VH            the profit  
 VYN          revenues  
 CF            the cash flow  
 ZAS          supplies

According to the resulting value of the G-index companies are divided as follows:

1.8 < G            thriving businesses  
 -0.6 < G < 1.8    the Gray Zone

G < -0.6            bankrupt enterprises (Gurčík, 2002)

The calculation the G-index by using the weighted average method:

$$G = 3.412 * 8\,051/16294 + 2.226 * 1593/16294 + 3.277 * 1593/12767 + 3.149 * (-420)/16294 - 2.063 * 3192/12767 = \mathbf{1.715452}$$

The calculation the G-index by using the FIFO method:

$$G = 3.412 * 8\,051/16267 + 2.226 * 1566/16267 + 3.277 * 1566/12767 + 3.149 * (-415)/16267 - 2.063 * 3165/12767 = \mathbf{1.713182}$$

If a company tries to minimize tax liability to reduce the profit by increasing consumption of inventory valuation, it also leads to a reduction the value of the G-index. So it leads to a worse assessment of the company in terms of financial health. If a company uses a method that leads to maximize the profit, it can cause loss to investors, who have invested in this company with respect to the results of the financial health assessment. This example illustrates the effect of the valuation of stocks to consumption profit. It is contemplated that other problem areas are displayed faithfully. If we assume that there is a combination of options that lead to set goals, distortion can achieve much more perceptible levels.

#### 4 Conclusion

According to initial analysis, there are many factors that lead to different values in the financial statements such as legislative reasons, branch and accidentally or deliberately chosen methods of owners or management. The example can demonstrate how the financial health assessment has been influenced by a targeted choice of methods. There are many possibilities to influence the value in the financial statements. If they are combined, it is very difficult to determine the true state of financial health.

This article builds on the previous analysis of accounting of the animals when a rather significant difference in the result was documented as a result of the chosen method of accounting. Analyzed method of inventory valuation can illustrate the other possible value discrepancies. Although the percentage difference was relatively small (in this case 0.13%) in large volume it could be a significant amount.

It is necessary to look at the problem of influencing the outcome of the financial health assessment comprehensively. Mainstreaming the issue of owned and purchased inventories, compliance of record keeping and the choice of calculation method, aspects arising from leases, are being discussed in. The paper outlined aspects arising from leases and subsidies, which will aim for further analysis.

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## Model AGRO-2014 and problem discrimination of Czech food producers

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**Annotation:** Czech farmers are convinced that domestic food producers are discriminated against foreign producers on the Czech markets. The main argument is that market prices of the Czech food products are higher than the prices of comparable food products from abroad with respect to ownership of the foreign capital. It was necessary to determine whether and how differ trade margins for the domestic and import products. The Czech margins were calculated as the share of the domestic food prices (DP) on the consumer prices (CP) and import margins as the share of the imported food prices (IP) on CP. For these calculations the model AGRO-2014 was used. It is a mathematical model of the agrarian sector which is going out from agricultural production, over processing of agricultural raw materials on food, distribution to stores and subsequent consumption. Calculation of margins for the consumer basket includes such food groups for which there exist all kinds of prices. For that "market basket" there was calculated total "fictitious" sum of the entries in the DP, IP and CP. The results show that the average margin for the Czech food was 35.5%, while filling the "market basket" only for the imported food resulted to the average margin 34.9%.

**Key words:** agrarian sector, mathematical modeling, model AGRO-2014, discrimination of Czech producers, food margins, retail chains

**JEL classification:** Q18, Q15, Q51, C02, C31, C61

### 1 Introduction

Agriculture is an important part of the national economy and food industry finalizes and represents domestic agricultural production in the Czech food market. From this reason the question of enforcement of Czech products in the domestic market is for the Czech producers significant. On the Czech food market, simultaneously enters also the foreign competition, especially from Germany and Poland, which in the case of favorable prices of imported products for Czech consumers can cause extrusion of domestic production from the Czech market. On the EU market can be no custom barriers among Member States, thus the combat between domestic and foreign producers about the Czech consumers can go only on economic basis, i.e. whether the foreign producers can produce a comparable food commodities cheaper than the domestic producers.

In the long term there are in IAEA developed mathematical models analyzing and assessing the economic efficiency and competitiveness of Czech producers in agriculture and food industry (Foltýn et al., 2014a and 2014b; Foltýn, Zedníčková and Chaloupka, 2014; Foltýn, Zedníčková and Humpál, 2013; Mezera et al., 2015; Štiková et al., 2013). In 2014 and 2015 the research focused mainly on modeling the relationships especially between farmers and processors (model AGRO-2014) .

Czech producers are convinced that the above competition between domestic and foreign producers includes discriminatory elements for domestic producers.

Solving this problem with the help of the model AGRO-2014 and description of the model is included in this paper.

## 2 Materials and Methods

### 2.1 Research question

**Statement:** "Retail chains in the Czech Republic prefer foreign food suppliers to domestic producers by higher margins on domestic products."

To prove the validity or invalidity of this statement we have used a mathematical model AGRO-2014 for solving the market equilibrium in the agrarian sector.

### 2.2 Model of the agrarian sector AGRO-2014

Model AGRO-2014 was built on the model principles of the project of the Home Office (model HO), which was aimed at ensuring minimum nutritional needs of population in crisis situations (Štiková, O. et al., 2013). Model AGRO-2014 is an extension and generalization of the model HO for solving standard situations in the entire Czech agrarian sector. The model was created within the Internal Research Project System of IAEI for the year 2014 (Foltýn, I. et al., 2014).

The model includes the main agriculture production, its processing in the food industry, food distribution to retailers and their consumption by the population. Model AGRO-2014, unlike the model HO, includes Czech foreign trade in agricultural and food products (CZSO, 2014).

AGRO-2014 is a model of the partial market equilibrium, which shows what volume of domestic production of agricultural and food commodities is acceptable to domestic consumers in revenue and cost ranges of the Czech Republic and their linkages to the EU market, where there is carried out a crucial part of the foreign trade transactions. The model takes into account the self-sufficiency of the population.

Agrarian sector for the purposes of modeling consists of the following sections (subsectors):

AGRI - section of agriculture, i.e. domestic production, import and export of agricultural commodities;

FIND – section of food industry, i.e. domestic production, export and import of food commodities;

RET - section of retail, i.e. food sales of domestic or imported provenience;

FCON - section of food consumption, where Czech consumers realize their food purchases through the RET section, eventually by the form of self-sufficiency.

In the model AGRO-2014 it is assumed that actors of sections AGRI, FIND and RET are trying to maximize their profits (revenues minus costs). Consumers in the section FCON try to minimize their food expenses, while complying with actual consumption in the Czech Republic (CR) per capita and year, or based on nutritional recommended doses.

### 2.3 Section AGRI

Domestic production of agriculture sector in the model AGRO-2014 is represented by commodities from the production part of the Economic Accounts of Agriculture (CZSO, 2008-2013). EAA includes all the major crop and livestock commodities of Czech agriculture. The value expression of this production for major commodities, which publishes every year CZSO,

it is possible to express as the decomposition of the total volume of the commodity (hectare area / number of animals), the average intensity level (hectare yield / animal intensity) and average farmers' price of commodity (FP). Selected commodities comprise approximately 98% of the total extent of Czech agriculture.

Imports and exports of agricultural raw materials are in the model AGRO-2014 represented through commodity balances published by the Ministry of Agriculture and IAEI annually in the Reports on the State of Agriculture for the Year (MoA, 2010-2013a). The domestic production of the Czech agriculture, together with imports covers domestic consumption and exports.

## 2.4 Section FIND

This section covers commodity processing of domestic production by the Czech food industry which is based on the source "Production of selected products of the food industry" (CZSO, 2013b). The choice of commodities into the model AGRO-2014 is based on a ten figure CZSO code, which covers major commodity of the food industry, divided into 9 main branches 10.1 to 10.9 (MoA, 2010-2013b). Selection of commodities, which were included in the model AGRO-2014 were based on the following criteria:

**Criterion C1:** For a range of selected commodities was chosen lower limit of 1000 t.

**Criterion C2:** There were considered factual contents of commodities so that the selected commodities are traceable to the food sales and consumption in sections RET and FCON.

**Criterion C3:** Selected commodities should cover critical food processing industries that have relations to agricultural production in the section AGRI.

According to the criteria C1-C3 were eliminated e.g. commodities such as leather processing. On the other hand in the selection remained commodities of the feed production industry.

Selection of food commodities in the model AGRO-2014 contains data about the physical form of production and sales of the commodity (in ths.t), followed by the value expression of this production and sales (in mil. CZK) and calculation of the average price of production and sales for the commodity (in CZK per kg), hereinafter referred to as DP, by calculating value expression / physical amount. The total value of production of selected commodities amounts to about 166 billion CZK, which represents 75% of the food industry (MoA, 2010-2013b).

Another important part of the section FIND in the model AGRO-2014 is exports and imports. The choice of exported and imported food commodities was based on the agrarian foreign trade in 2012 from the foreign trade statistics and the corresponding selection methods (CZSO, 2014). The choice of commodities in the food exports and imports is not symmetrical because also in this case the selection criteria C1-C3 were used.

When including customs tariff codes, i.e. HS Code (Harmonized System Description and Coding) and CN code (Combined Nomenclature EU), into groups CPA (Classification of Products) there was primarily used the official converter CN to CPA. In some cases, however, the transfer was carried out using its own methodology (e.g. for new codes). In addition, there was taken into account specifics of the Czech foreign trade, which resulted e.g. for excluding items, which mainly include raw milk.



Selected commodities in imports and exports have like food commodities of domestic origin quantitative indicators (ths.t) and their value expression (mil. CZK). On the base of these indicators there are defined average import prices (IP) and average export prices (EP).

The total volume of import of selected commodities (3.1 mil.t) is smaller than the volume of commodity exports (3.6 mil.t) in physical terms, while in value terms, total imports (104 billion CZK) greater than exports (85 billion CZK). This confirms with the thesis that the Czech Republic imports more expensive products (IP is 33 CZK/kg) than exports (EP is 24 CZK/kg). Thus CR exports products with a lower value added and imports products with higher value added.

## 2.5 Sections RET and FCON

The sections retail (RET) and food consumption (FCON) represent sale and consumption of the food commodities by the population. These sections are interconnected, and differ only by the self-sufficiency for some food products.

The most important indicator of this section is the consumption of food products per inhabitant, which is observed every year (CZSO, 2013a). Through consumer prices (CP) also monitored (CZSO, 2013c) are then calculated the average food expenses per capita and, consequently, total food expenses in CR.

Consumer prices differ from DP and IP only by retail and import margins, respectively, and value added tax (VAT) on food products (in CR is 15 %). Thus, following equations hold:

CP - 15% VAT = DP + DP.margins (for food processed in the food industry),

CP - 15% VAT = FP + FP.margins (for the food products outgoing directly from the agriculture with farmers' prices to retail, e.g. fresh fruit and vegetables)

CP - 15% VAT = IP + IP.margins (for all imported food).

For comparison of margins on domestic and imported food products were constructed two indicators:

DP expenses: Average food expenses per capita in DP (or FP);

IP expenses: Average food expenses per capita in IP.

Comparison of these indicators was used to analyze retail margins.

## 2.6 Retail margins on domestic and imported food

The margins for Czech food products were calculated as share of prices of food producers on consumer prices, while margins for imported food products as share of import prices on consumer prices. Retail margins were calculated according to the following formula:

- for domestic prices:  $(CP - DP) / CP$ ,

- for import prices:  $(CP - IP) / CP$ .

Using the model AGRO-2014 there were calculated differences in financial terms of food consumption by using various types of prices (DP, IP, CP). The volume of individual food products which entered in the model AGRO-2014 was created according with the actual consumption data ("real" consumer basket).

CP are monitoring by CZSO for a wide range, i.e. it is not a problem to calculate adequate food prices in the model. For additional calculations and comparison of different types of prices was deducted 15% VAT from CP.

DP are officially monitoring only for a narrow range of food that does not match the structure of the model-AGRO-2014. For DP and IP there were also used a methodology of the section 2.4

For both cases, it is adopted a theoretical construct of DP and IP, whereas the other data are not available. It means that calculation of retail margins represents a model solution of the situation on the Czech market, i.e. the model simulations of the actual state. Calculation of margins based on the "market basket" is much more realistic than the calculation only for a concrete food product.

For all foods and food groups in the model AGRO-2014 there are not available prices. That's why there was chosen a range of food products for which it was possible to determine all prices. For these commodities there were calculated and modeled retail margins in 3 variants.

Variant 1 includes such food groups, where we have all kinds of prices. For this choice there was calculated the "fictitious" sum of expenses for DP, IP and CP. Based on this model solution there were calculated retail margins. The results show what profit margin would have obtained retailers if the whole range of food products were filled-up for only domestic or imported products. Number of food groups had to be excluded from the model calculations for incomparability of the assortment, or for the inability to price comparison of food supply in the course of the year (e.g. higher import prices of fruit and vegetables in the winter months and lower domestic prices at harvest time).

Similar calculations were made in the fulfillment of the model only for Czech food producers in DP related to the CP (variant 2), and only for imported products in IP prices to CP (variant 3). In variants 2 a 3, where there was available a wider range of commodities and their adequate prices, there were analyzed and evaluated margins in relation to individual food groups.

For all variants, the carried out calculations represent model simulations of price relations in the food chain.

### **3 Results and Discussion**

#### **3.1 Theoretical proof of Statement**

If the model AGRO-2014 calculates the optimal state of the agrarian sector, then for each section AGRI, FIND and RET there was calculated maximum profit. Thus retailers obtained their maximum (i.e. the highest possible) profit by selling domestic and imported food.

If the price of domestic producers (DP) is lower than the import price (IP), then the retailer has a lower profit from the sale of imported food than from domestic food, and thus he has no logical reason for the sale of imported products with lower margins.

If the price of domestic producers (DP) is higher than the import price (IP), then the higher margins on the domestic food would increase CP against IP, and thus domestic food products would be unsaleable.

If the retailer would under these circumstances still wanted to sell domestic food, he would conversely decrease margins on the domestic food, which would reduce his profit. If the margin on the domestic food was the same as on the imported ones, the retailer would have to rely on advertising promoted the quality of Czech food against the foreign competition.

In the solution of the model AGRO-2014, where there are assumed the same margins for both domestic and imported products, the imported product does not enter into the solution (supply) if the IP is higher than DP. In the opposite case, the imported food product enters into the solution, because DP ate higher than IP and domestic producers are more expensive then foreign competitors.

### 3.2 Practical proof of Statement

In this section, there are analyzed model results of variants 1-3 (sec. 2.6). Model results for variant 1 are contained for illustration in the tab. 1.

**Variant 1:** The product selection in this variant is very limited, but it says about the interrelationship among all kinds of observed prices. The calculations show that a slightly higher average margin was achieved for the Czech food. When filling the model by the Czech products, the average margin is 35.5%, while in case of imported products the value is 34.9%.

The most striking difference between total consumption expressed in IP and DP (fictitious revenues) is for potatoes (122.0%), confectionary (56.6%) and pasta (41.2%). For potato imports is the reason for early potatoes Assortment of further 2 products will probably be quite different types of products. Conversely, the biggest difference between at a higher price for consumers expressed in CPV is for cocoa products (41.9%), eggs (27.7%), soft cheese (23.9%) and vegetable oils (14.5%). For these products play a role a different range. The exception is eggs, which are imported at lower prices than Czech products.

**Variant 2:** In this variant, where there are available DP, the average margin is 38.3% (including fruits and vegetables).

The highest margins are achieved for vegetables and fruits. Then also for oils (65.5%), confectionary (62.0%), condensed milk (58.8%) and milk powder (48.5%).

The lowest margins are monitored for bread (6.5%), chicken (18.0%), vegetable oils (21.1%), sugar (22.4%) and flour (22.7%).

The very low margin for bread is probably related to the decrease in consumption of this commodity. Consumption of bakery products on the contrary is rising and therefore the margin is much higher (31.9%).

**Variant 3:** In this variant, from the model calculations with IP comes out the average margin 37.1% (including tropical fruits and pulses).

The highest margins are for pulses and for fruit and vegetables. Then the high margins are also for cocoa products (64.9%), lard (55.2%) and soft cheese (53.7%). The reason of the high margins on cocoa products might be different assortment (DP are significantly higher than IP). Different margins added to the DP and IP represent probably attempt of retailers to reach the comparable CP.

The lowest margins are monitored for butter (9.3%), flour (8.9%). The very low margin for butter is likely caused due to retailers' effort to sell more imported products, because DP is significantly lower than IP (by 20.5%).

It is obvious that in variants 2 and 3, the highest margins are achieved for fruits and vegetables. This is an assortment which is perishable and during the storage and supply leads to the highest losses. The lowest margins are mainly for food with a long shelf life (sugar, flour), where the losses are very rarely.

#### 4 Conclusion

The model calculations show that retail margins at Czech and imported products do not differ significantly (the difference of the average margins is minimal). Negligibly higher margins for Czech products may be due to a higher surcharge (margins), but also in the assortment difference of domestic and imported food products. It is evident that the retail determine margins similar for the Czech and imported food.

Higher Czech margins for some food products are adequate to retailers' effort to remove differences between DP and IP aiming to the same CP appropriate to demand.

The margin level for the Czech food can be a problem for some products. It deals with dairy products (butter, condensed and powdered milk), where we are monitored higher margins than for imported products. This may indicate a problem with the application of domestic products on the market.

On the other hand, higher margins for some imported food products were monitored for cocoa products, pastry, eggs and soft cheese.

From the economic point of view, it is not understandable, nor justifiable the interest of retail to a significant increase of food import with lower margins. Retailers would gain in this case lower profit than in the opposite case, which is in contradiction with the assumption of the profit maximizing.

On the basis of results from sections 3.1 and 3.2 can be stated that Statement does not hold. This means that the domestic producers are not economically discriminated against the foreign competition on the domestic markets.

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**Table 1.** Calculations of retail margins for selected consumer basket (variant 1)

Consumer basket	DP	IP	CP-VAT	DP margins <sup>3)</sup>		DP-IP
	on consum. <sup>2)</sup>	on consum. <sup>2)</sup>	on consum. <sup>2)</sup>		IP margins <sup>4)</sup>	margins
	CZK	CZK	CZK	%	%	% points
Beef meat	360.3	393.6	492.6	26.9	20.1	6.8
Pork meat	1 332.3	1 260.4	1 902.9	30.0	33.8	-3.8
Poultry	1 064.6	1 041.4	1 297.7	18.0	19.8	-1.8
Meat products	1 497.1	1 997.0	2 548.1	41.2	21.6	19.6
Fish	437.5	396.8	738.2	40.7	46.2	-5.5
Milk drinking	611.2	698.6	878.6	30.4	20.5	9.9
Cheeses soft	222.6	169.5	366.0	39.2	53.7	-14.5
Cheeses other	1 228.4	1 246.0	1 911.1	35.7	34.8	0.9
Milk powder	17.3	22.0	33.5	48.5	34.2	14.3
Milk condensed	24.5	30.5	59.4	58.8	48.7	10.1
Other dairy products	921.2	913.3	1 614.6	42.9	43.4	-0.5
Eggs	501.8	362.6	684.9	26.7	47.1	-20.3
Butter	418.0	503.5	555.1	24.7	9.3	15.4
Lard	71.3	92.4	206.6	65.5	55.2	10.2
Vegetable oils eatable	380.4	325.4	482.3	21.1	32.5	-11.4
Sugar	284.1	295.4	366.0	22.4	19.3	3.1
Cocoa products	1 407.6	817.5	2 329.3	39.6	64.9	-25.3
Non-cocoa confectionary	228.5	198.7	380.8	40.0	47.8	-7.8
Potatoes for consum. <sup>1)</sup>	214.7	476.8	621.6	65.5	23.3	42.2
Wheat flour	188.2	221.7	243.4	22.7	8.9	13.7
Pastry fine	1 126.2	808.6	1 456.5	22.7	44.5	-21.8
Pastry current	1 311.3	1 475.0	1 926.6	31.9	23.4	8.5
Pastry durable	344.3	539.1	905.2	62.0	40.4	21.5
Pasta	121.7	171.8	208.4	41.6	17.5	24.1
Total food expenses	14 315.0	14 457.5	22 209.4			
Average margin				35.5	34.9	-0.6

1) If DP do not exist then FP are used.

2) Price for kg multiplied by consumption per capita and year.

3) DP margins are calculated according to the formula  $(CP-DP)/CP$ .

4) IP margins are calculated according to the formula  $(CP-IP)/CP$ .

**Source: Own calculations from the data of Czech Statistical Office**

## Subsidies and Technical Efficiency of Large-Scale Farms in Poland

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**Annotation:** Main objective of analysis was the relationship between subsidization of large-scale farms and their technical efficiency. Besides, research included the identification of the factors that determine this efficiency of farms. Financial support should motivate to increase the production capacity of farms, as it will significantly reduce the cost of capital. It can be verified by determination of the technical performance indicators and economic indicators. The implementation of the Common Agricultural Policy (CAP) instruments changed relationships between the factors of production. Subordination of Polish agricultural sector to the principles of the CAP, led many scientists to analyze the problem of affection of CAP instruments on achievement of objectives outlined in the Treaties of Rome.

Author performed research of 78 large-scale farms (> 100 ha UAA) each year (panel data 2007-2011) and estimated technical efficiency indicators by using Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). The sample was divided into two groups: (1) farms with a dominance (60%) of crop production and (2) other farms (with a dominance of livestock or with the mixed production). Parametric method was supplemented to non-parametric approach. Then it was made an analysis of a set of determinants of technical efficiency by using panel models.

The analysis of the results showed that the parametric approach was more resistant to the heterogeneity of the sample (its inhomogeneity) than the envelope data (DEA). Own research failed to establish a set of determinants of technical efficiency, which largely corresponds with those of other authors. The methods used here are the most popular ways of calculating technical efficiency. Due to the nature of the agricultural sector the superior properties of the SFA method was confirmed.

**Key words:** subsidies, technical efficiency, parametric method, non-parametric method.

**JEL classification:** Q15, Q18, Q24, C5, C23, C33, F15

### 1 Introduction

The CAP objectives enshrined in the Treaty of Rome in 1957 and repeated in the Constitutional Treaty in 2004 include:

- raising agricultural productivity by technical progress and improve production,
- ensuring that the rural population has decent living conditions and increase the level of income,
- stabilization of agricultural markets, ensuring an adequate supply of agricultural products.

Subordination of Polish agricultural sector to the principles of the CAP, led many scientists to the analysis of the problem of affecting of CAP instruments on achievement of objectives outlined in the Treaties of Rome. Author checked, how the first objective of the CAP was realised. The main objective of this publication is analysis of the relationship between subsidization of large-scale farms and their technical efficiency. Tasks within research are:

1. Identify the factors that determine the technical efficiency of the farms;
2. Comparison of results obtained by using parametric method and nonparametric method.

The integration with the European Union changed the conditions of the functioning of Polish agriculture in terms of the possibility of financing the development of farms. The implementation of the CAP instruments changed relationships between the factors of production. Investment expenditures improved the technical equipment of farmland. The direct payments and other subsidies often weakened the incentive to look for other ways to improve efficiency.

L. Latruffe et al. (2008, 2013) have written a lot of publications, but the pioneers in this field were mainly L. Lachaal (1994) and A.D. Hennessy (1998). They analyzed the various aid programs directed to agriculture in the context of improvement of the efficiency, productivity and growth. Investments in new technologies, machinery or increase of the agricultural area, increased production capacity of the farms (Smutka and Steininger, 2013). This suggests that financial support should motivate to increase the production capacity of farms, as it will significantly reduce the cost of capital. It can be verified by determination of the technical performance indicators and economic indicators (Řezbová and Škubna, 2013). Study of literature (comparison 1) has shown both positive and negative impact of grants on the effectiveness of farms.

**Comparison 1.** Impact of subventions on technical efficiency

Author	Country	Impact
Brümmer, Loy, 2000	Germany	negative
Rezitis, 2003	Greece	negative
Iraizoz, 2005	Spain	negative
Hadley, 2006	Great Britain	positive
Ooms, 2007	Netherlands	positive
Zhu, Demeter, Oude Lansink, 2010	Germany, Netherlands, Sweden	negative

**Source:** X. Zhu, R.M. Demeter, A. Oude Lansink, **Technical efficiency and productivity differentials of dairy farms in three EU countries: the role of CAP subsidies**, „Agricultural Economics Review”, vol. 13, no. 1, 2012.

The issue of the impact of subventions on the technical efficiency of farms included more than 555 thousand publications. In contrast, evaluation and impact analysis of the CAP instruments on the technical efficiency of European farms were the object and purpose more than 140 thousand publications.

A review of the literature shows that there remains a certain degree of connection between direct payments and agricultural production (Bhaskar and Beghin, 2007, 2010). This is due to the complexity of the mechanisms of their impact on the agricultural farm and their owners decisions. In no doubt, most of the previous studies focused on the insurance and wealth effect as a consequence of use of decoupled subsidies.

Summing up, in most cases greater degree of dependence on subsidies farms got worse the results of their technical efficiency. Grants can increase this efficiency if they are a stimulus for innovation and enable the transition to new technologies. Otherwise, they reduce the level of this kind of efficiency and weaken the incentive for farmers to improve competitiveness.

## 2 Materials and Methods

Technical efficiency (TE, productive efficiency) is used to indicate the possibility of increased production using the same amount of expenditures (maximizing outcomes for given inputs) or reduce expenditures while maintaining the same level of effects (a reduction in the effects on the data). Therefore in literature is recommended to use one of two solutions:



- parametric – (the Cobb-Douglas production function, Stochastic Frontier Analysis – SFA, Distribution Free Approach – DFA, Thick Frontier Approach – TFA);
- non-parametric (Farrell linear isoquant, Data Envelopment Analysis – DEA, Free Disposal Hull – FDH).

The division into parametric and non-parametric methods is based on the criterion of having definition of the form of analytical functions (production, costs etc.).

Stochastic Frontier Analysis is the most widely used method of evaluating efficiency among parametric methods (Pechrova, 2014). The starting point is the choice of the production function, which is followed by determining the relationship between inputs and outputs.

Normally, this is a logarithmic form or its modification. The parametric approach is further distinguished by deterministic and stochastic models.

For the measurement of the technical performance indicators (TE SFA) parametric method of stochastic type was used. This approach requires the adoption of certain assumptions about the production function or cost and takes into account the existence of statistical noise, which is recognized as an additional random variable. The stochastic model is less susceptible to the influence of outliers.

In summary, the SFA method is used to verify the accuracy of selection in terms of the structure of production consumed in the course of the investment, and to identify the factors that cause the technical inefficiency of the surveyed enterprises. SFA has two important advantages. Firstly, in contrast to other parametric and nonparametric methods, it enables the secretion of a random error. Secondly, like other methods of parametric statistical significance tests, it enables the model parameters on the basis of which is carried out evaluation of the effectiveness of the surveyed companies.

Then it was supplemented by non-parametric method. Author used DEA models with outputs orientation (TE DEA). Data Envelopment Analysis is a non-parametric, deterministic method, assuming the lack of provisions for the random component and the lack of specification of the function, describing the relationship between inputs and effects. The creators based their method on the concept of productivity, formulated by G. Debreu (1951) and M. J. Farrell (1957). They applied the approach of the predecessors while modifying some assumptions (regarding the case of the use of many resources and achieving a variety of effects). In its original version, DEA models relate to solid economies of scale (CRS models), but this assumption allows the repeal of disaggregation efficiency for pure technical efficiency and scale efficiency. Hence, the model with the assumption of variable economies of scale (VRS) adjusts the envelope in a less rigorous way and therefore more units can be considered effective.

However, due to lack of clarity about the results and the direction of these relationships, researchers continue to search for new methodological solutions. Therefore, recently extended methodological framework for semi-parametric approach, was an parameterized impact of the independent variables. For example, this approach applied by Kazukauskas' team in 2014. A. Henningsen and S. Kumbhakar (2009) proposed an eclectic approach to the analysis of the technical efficiency of farms in Poland, with a combination of parametric and non-parametric methods.

When it comes to analysis of the methods of assessing the impact of the payments on the functioning and results of agricultural farms, it should be noted that the studies to date are dominated by panel and dynamic models. Panel models may take the form of: Fixed Effects Model (FEM) or Random Effects Model (REM), but the decomposition of random element may only take into account one factor (one-factor models), or two factors simultaneously (two-factor models). Models of FEM and REM can generally be written as follows:

$$y_{it} = m_i + bx_{it} + e_{it} ,$$

where:  $y_{it}$  – dependent variable for  $i$ -th object in the  $t$ -th period,  $m_i$  – intercept,  $b$  – structural parameter expressing the impact of explanatory variable  $X$ ,  $x_{it}$  – explanatory variable realisation for  $i$ -th object in the  $t$ -th period,  $e_{it}$  – residual value meeting traditional assumptions:  $E(e_{it}) = 0$  and  $Var(e_{it}) = S_e^2$ .

For the sake of simplicity, a model with one explanatory variable was used, but it can also have many explanatory variables ( $X$ ). The choice between the FEM and REM is made using Hausman's test (for  $p = 0.05$  the FEM model is considered more reliable than REM). However, a universal method to be used in models, in which no assumptions are made about the normal distribution of the random component, is the Generalized Method of Moments – GMM. The most popular methods are, in practice, all methods based on GMM and, in particular, the so-called first differenced GMM – FD GMM, introduced by Arellano and Bond and GMM by Blundell and Bond (GMM – SYS GMMs). One of the main advantages of this method is the possibility of its application to parameter estimation of nonlinear dynamic models.

## 2.1 Data

The basic source of data was a random sample of large scale farms (78) surveyed annually by Department of Economics of Farm Holdings at IAFE-NRI. Author built data panel (390 farms) for five years (2007-2011), which became the basis for further analysis and research. At the end of 2007, in Poland there were 8,109 large-scale farms. In 2011, the number of such farms increased to 9,882. Empirical data was derived from surveys, compiled for many years by Department of Economics of Farm Holdings at IAFE-NRI. The sample was divided into two groups: (1) farms with a dominance (60%) of crop production and (2) other farms (with a dominance of livestock or with the mixed production). Next, the author established vectors of variables needed to estimate the technical efficiency:

a) an effect: the sales revenue of agricultural production (sum of items “revenues from sales and equivalent” and “other operating income”);

b) inputs (variables representing the material production factors):

- amount of labour (wage costs and their derivatives);
- area of owned and leased land (in comparative fiscal hectares);
- capital expenditures broken down by:
  - fixed capital (amortisation),
  - working capital (expressed in costs of materials, energy and external services excluding internal consumption).

Then, for each of the farm groups (crop and other) was calculated technical performance indicators. The author used: parametric approach (TE SFA); non-parametric method (TE DEA).

The level of the efficiency (TE DEA) was determined by using CCR (TE DEA<sub>CCR model</sub>) and BCC (TE DEA<sub>BCC model</sub>) models oriented on outputs. Then, the technical efficiency indicators were considered as dependent variables of the panel models. The set of an independent variables was determined on the basis of literature overview and own research experiences (table A.1 in appendix).

Large-scale farms operating as private companies were depicted by a much larger area of agricultural land than individual farms. The analysis referred to the largest units belonging to the group of large-scale enterprises, with an area of over 100 hectares. Basic description was summarised in table 1.

**Table 1.** Key characteristics of large-scale farms

Variables	Average values (2007-2011)
Area of arable land	757.75 hectares
Sales revenue and other operating revenue	705.00 thou. of PLN per 100 hectares
Total subsidies	106.00 thou. of PLN
Share of revenue from crop production in total revenue	67.25%
Share of cereals in the sown area	72.40%
Annual depreciation	46.04 thou. of PLN per 100 hectares
Costs of materials, energy and external services	485.80 thou. of PLN per 100 hectares
Salaries and extra charges	91.85 thou. of PLN per 100 hectares

Source: own calculation

### 3 Results and Discussion

Author separated two independent sets: crop farms and other farms. Then, the technical efficiency indicators (TE DEA; TE SFA) were considered as dependent variables of panel models. The results of performance indicators are showed in table 2. Moreover, in the framework of non-parametric methods two variants of estimates (CCR and BCC) were awarded.

**Table 2.** Technical efficiency of large-scale farms in period 2007-2011 (panel data)

Specification		TE DEA <sub>CCR model</sub>		TE DEA <sub>BCC model</sub>		TE SFA	
		without subsidies	with subsidies	without subsidies	with subsidies	without subsidies	with subsidies
Crop farms	Arithmetic mean	0.72	0.73	0.82	0.84	0.76	0.80
	Standard deviation	0.21	0.20	0.18	0.18	0.12	0.12
	Minimum	0.23	0.27	0.31	0.32	0.27	0.24
	Maximum	1.00	1.00	1.00	1.00	0.96	0.98
	Variability coefficient	0.29	0.27	0.22	0.21	0.16	0.15
Other farms	Arithmetic mean	0.67	0.73	0.78	0.82	0.75	0.78
	Standard deviation	0.2	0.18	0.19	0.17	0.16	0.14
	Minimum	0.17	0.28	0.4	0.43	0.11	0.17
	Maximum	1.00	1.00	1.00	1.00	1.00	0.98
	Variability coefficient	0.30	0.24	0.24	0.21	0.21	0.19

Source: own calculation

The resulting ratios revealed that in all cases the positive impact of the aid on technical efficiency measurement was visible. In the results of the analysis, turned out that the parametric approach (SFA) was more resistant to the heterogeneity of the sample (its

inhomogeneity) than the envelope data (DEA). Next it was made an analysis of a set of determinants of this efficiency (table 3).

**Table 3.** Determinants of technical efficiency

Dependent variables (Y) Independent variables	TE DEA <sub>CCR model</sub>	TE DEA <sub>BCC model</sub>	TE SFA
<b>Crop farms</b>			
Type of model (FEM or REM)	FEM	REM	REM
Constant	0.782*** (0.054)	0.859*** (0.053)	0.682*** (0.021)
<b>I. subsidy rate</b>	<b>-0.717*** (0.139)</b>		
<b>II. subsidy rate</b>		<b>-0.686** (0.312)</b>	<b>0.643*** (0.106)</b>
Soil quality index	0.043 (0.029)	0.022* (0.013)	
Profitability indicator of economic activity	0.042*** (0.009)	0.037*** (0.011)	-0.019*** (0.005)
Fertilizer application (kg NPK per hectare)			
Fixed assets to current assets ratio	-0.004*** (0.001)	-0.003*** (0.000)	
Livestock units per 100 hectares			0.014*** (0.000)
2008	0.023 (0.029)	0.016 (0.025)	
2009	0.106*** (0.031)	0.069** (0.027)	
2010	0.038 (0.028)	-0.003 (0.024)	
2011	-0.022 (0.031)	-0.008 (0.03)	
<i>Number of observations</i>	210	210	210
<i>R<sup>2</sup> or Log likelihood ratio</i>	0.727	0.675	189.286
<b>Other farms</b>			
Type of model (FEM or REM)	REM	FEM	REM
Constant	0.672*** (0.042)	0.672*** (0.036)	0.894*** (0.097)
<b>I. subsidy rate</b>		<b>-0.283* (0.165)</b>	
<b>II. subsidy rate</b>	<b>-1.350*** (0.218)</b>		<b>0.390** (0.157)</b>
Crop production in agricultural production	0.001*** (0.000)	0.002*** (0.000)	
Financial stress index			
Location on the LFA areas (dummy)		0.151*** (0.048)	
Fixed assets to current assets ratio	-0.004* (0.002)		0.003* (0.002)
Age of manager			-0.003* (0.002)
2008	0.011 (0.024)		
2009	0.055** (0.025)		
2010	0.100*** (0.025)		
2011	0.114*** (0.027)		
<i>Number of observations</i>	180	180	180
<i>Log likelihood ratio</i>	59.661	0.731	97.973

\*\*\* 1 percent level of significance; \*\* 5 percent level of significance; \* 10 percent level of significance

Source: own calculation.

The impact of subsidies on the technical efficiency of large-scale farms is uncertain and inconsistent. Own research confirmed the dominance of the negative impact of subsidies on this kind of efficiency indicators. Results from the model TE SFA were the best and this model was the most reliable tool for analyzing the determinants of technical efficiency. Summing up, in most cases greater degree of dependence on subsidies farms got worse results of their technical efficiency. Research conducted by a team: L. Latruffe, L. Bakucs, S. Bojnec, I. Ferto, J. Fogarasi, C. Gavrilescu, L. Jelinek, L. Luca, T. Medonos and C. Toma (2008) showed that the proportion of the grants affected the technical efficiency in a positive way, but some of them - in a negative. Details of these studies are presented in comparison 2.

## Comparison 2. Determinants of technical efficiency

Country	the positive dependency	the negative dependency
Romanian farms	Location/province (dummy), Subsidies for crop output per hectare, Family farm dummy, Share of liabilities in total assets,	Subsidies for seeds and pesticides purchase per hectare
Hungarian farms	Accession to the EU, Legal form (legal entity), Location, Soil quality index,	Time trend, Livestock output to total output ratio, share of operating subsidies in total production value, Land to labour ratio,
Czech farms	Time trend, Share of crop production in total agricultural production,	Share of the farm's area not in Less Favourable Area, Limited liability company dummy, Total operational and investment subsidies,
Slovenian farms	Time trend, Share of hired labour, Share of rented land, Herfindahl specialisation index,	Operational subsidies to revenue ratio, Share of marketed output.

**Source:** Latruffe L., Bakucs L., Bojnec S., Ferto I., Fogarasi J., Gavrilescu C., Jelinek L., Luca L., Medonos T., Toma C., *Impact of public subsidies on farms' technical efficiency in New Member States before and after EU accession, 12th Congress of the European Association of Agricultural Economists – EAAE, 2008.*

F. Lambarraa and Z. Kallas (2009) carried out the impact of LFA payments on the technical efficiency of Spanish farms producing olives. The areas eligible for LFA payments in Spain constitute up to 80% of rural areas. The results showed that LFA and several other factors impacted negatively on technical efficiency indicators. It is worth noting that the LFA payments reduced the indicators the most.

L. Latruffe and S. Bojnec (2013) conducted a study in the later years of Slovenian farms. As a result, it is managed to establish the impact of subventions and the amount of agricultural area for efficiency. It has been found that subsidies had a negative effect on the results of technical efficiency. Enlarging of UAA acreage had its stimulant.

#### 4 Conclusion

Subventions in many ways determine the technical efficiency. Hence, there is justification for analyzing describing these relationships and their scale. With detailed research for each type of farms we must specify a set of determinants of this efficiency. Many scientists already have it established, creating a set of control variables, independent of country, time, research or other characteristics of farms. This collection should be supplemented with information on the external environment, including general economic situation. In previous subsidies many goals were combined (allocative, redistributive, environmental, competitive). It hindered control of the degree of their implementation and evaluate their effectiveness.

In the literature we can find examples of both positive and negative aspects of subsidies' impacts on the technical efficiency. Generally, the direction of this relationship and the scale depend on many factors: direction of production and degree of specialization of farms, the area of farms and their economic size, the region in the country, the geographical location and natural conditions (topography), the level of development of the agricultural sector before the accession to the EU, the current socio-economic situation in the Member States (mainly the situation on the labour market excluding agriculture).

The impact of subsidies on the technical efficiency of large-scale farms was uncertain and inconsistent. Own research confirmed the research hypothesis. Current forms of the CAP subsidies do not realize the objectives of the policy. The financial support reduces farmer's entrepreneurship and competitiveness. That was a reason why many farms were inefficient. Grants can increase this efficiency, if they are a stimulus for innovation and enable the transition to new technologies.

Moreover, own researches show a completely different results from TE DEA and TE SFA models. These results are in opposite to each other. A quality of estimation TE SFA models is much better. The analysis of the results show that the parametric approach was more resistant to the heterogeneity of the sample (its inhomogeneous) than the envelope data (DEA). Own research failed to establish a set of determinants of this efficiency, which largely corresponds with those of other authors.

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Appendix. Table A.1. Description of variables used in the models

Variable name	Unit	Description
Subsidy rate I	[%]	Ratio of all subsidies to operating revenues
Subsidy rate II	[%]	Ratio of direct payments to operating revenues
Legal form of organization	0 or 1	Dummy variable (1 – legal entity, 0 – other forms)
Preferential credits / all credits	[%]	Share of preferential credits and loans in a total sum of credits and loans
HHI	(0;1)	Herfindahl-Hirschman index is defined as measure of production concentration. It is calculated by squaring the crops, livestock and other production share in total production of farm, and then summing the resulting numbers
Leased land / agricultural area	[%]	Share of leased land in the agricultural area
Arable land / agricultural area	[%]	Share of arable land in the agricultural area
Soil quality index		This measure indicates quality of soil
Equity capital / borrowed capital	[%]	Share of equity in borrowed capital
Fixed assets/current assets	[%]	Share of fixed assets in current assets
Crop revenues / sales revenues	[%]	Share of crop sales revenues in total sales revenues from agricultural production of farm
Investment rate	[%]	Gross investment/ annual depreciation
Financial stress index	[%]	Interest and rental fees to sales revenues ratio
Current liquidity		Ratio of current assets to current liabilities
Financial surplus/liabilities	[%]	Ratio of net financial result (increased by amortisation) to total farm liabilities
Mechanization of work	[%]	Ratio of total fixed assets (gross) to average number of full-time workers
Technical equipment of farmland	[%]	Ratio of total gross fixed assets to the total area of farmland (hectare)
Crop insurance	0 or 1	Dummy variable (1 – if a farm buys, 0 – otherwise)
Livestock insurance	0 or 1	Dummy variable (1 – if a farm buys, 0 – otherwise)
Location on LFA	0 or 1	Dummy variable (1 – if a farm is located on LFA, 0 – otherwise)
Agro-environmental schemes	0 or 1	Dummy variable (1 – a farm participates, 0 – otherwise)
Rural Development Programme	0 or 1	Dummy variable (1 – if a farm participates, 0 – otherwise)
Leasing	0 or 1	Dummy variable (1 – if a farm uses, 0 – otherwise),
Age of manager	years	
Work experience of manager	years	
Fertilizer application	kg NPK per ha	
Education level	0 or 1	Dummy variable (1 – higher education, 0 – secondary education or below for a farm manager)
Number of managers (full-time employees)	number	
Livestock units (LU) per 100 hectares	LU per 100 ha	
Cereals in area sown	[%]	The share of cereals in sown area
Location of farm	0 or 1	Dummy variable (one of the 16 regions)
Subsidies	thou. of PLN	Direct payments, LFA payments, sugar payments, refund of excise, subsidies to seeds, 2. Pillar payments, other subsidies, agri-environmental payments, total subsidies.



## Provision of Public Goods in Czech Agriculture

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**Annotation:** Agriculture plays an important role in the provision of a wide range of public goods, such as farmland biodiversity, water quality and availability, soil functionality, air quality, climate stability, resilience to flooding, agricultural landscape, social, economic and cultural viability of rural society, farm animal welfare and food security. This provision of public goods is generally accepted as a justification for public intervention in a market economy. Ever since the reform in 1985, Common Agricultural Policy has been targeted to enhance the provision of public goods. A recent CAP reform introduced the Green Direct Payment – a new policy instrument in Pillar 1 – which remunerates farmers for the provision of environmental public goods. However, there are also instruments in Pillar II that support the provision of environmental goods, including social public goods. The paper addresses these issues and focuses on public goods provided by Czech agriculture. The research question is focused on the possibility of economically valuating all these goods together using one valuation method. The research questions will be answered by designating public goods in agriculture and specifying the most used method of their valuation. A precise literature survey will be conducted, previous studies and scientific publications will be compared, and the results of ecological, biological and economic research will be linked. The final state of art will be used as a basis for calculating a level of subsidy that covers the production of agricultural public goods.

**Keywords:** public goods; agriculture policy; externalities; valuation

**JEL classification:** H41, Q51, Q10

### 1 Introduction

The role of agriculture in the production of public goods has been developing since the late 1990s, when some public assets were perceived as externalities of agricultural production. More precisely, they are those externalities that are united and inseparable goods accompanying the production of agricultural commodities. A unity source of market and non-market output is, according to Shumway et al. (1984) in Lankoski and Ollikainen (2003), mutually technical depending on the input, which is strengthened by fixed or quasi-fixed inputs, such as soil. According to Burrell (2011), there are very few positive externalities whose provision is tied to the production of agricultural commodities. More often, the production of agricultural commodities is connected with negative externalities. For this reason he proposes defining public goods such as the agriculturally separable (independent) output of agricultural activity, whose prevalence may be increased independently of an increase in the production of certain agricultural commodities. The main public goods connected with agricultural production and corresponding with the above-mentioned definition are presented in Table 1.

Some public goods in their content overlap or act as intermediaries in the provision of other public goods, e.g. the quality and availability of water and biodiversity, biodiversity and cultural landscape, soil fertility and cultural landscapes. Many of them are also very complex in character, such as biodiversity, which results from preservation of agricultural land and activities associated with soil and farming practices. At the same time, however, it can be

threatened by agricultural practices, particularly intensive production, animal husbandry, etc., in high concentrations.

**Table 1.** Definitions of primary agricultural public goods

Public Good	Definitions
Climate stability	Climate stability is defined as a measure of how much of an ecoregion will remain suitable (that is, climatic conditions will remain within present parameters) for the species and ecosystems it contains at present (Watson et al., 2013).
Biodiversity	The variability among living organisms, including terrestrial, marine and other aquatic ecosystems and ecological complexes (Bartkowski et al., 2015). The degree of biodiversity (McNeely, 1988 in Cairns and Lackey, 1992).
Water quality and accessibility	Stable supply of unpolluted water (Kaley et al., 2011).
Soil functionality	The capacity of soil to fulfil the requirements assigned to it by nature, i.e. what the soil does in its natural state (Volchko et al., 2013). A result of the soil processes arising out of the complex interactions between living (biological) and non-living (physical and chemical) soil components through the universal driving forces of matter and energy (de Groot et al., 2002).
Air quality	Clean, clear, unpolluted air (British Columbia, 2015).
Resistance against floods and fire	The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain the same essential function, structure, identity and feedbacks (Walker et. al., 2004). Visual phenomenon composed of physical attributes including geomorphology, land surface and cultural development (Moran, 2005).
Cultural agricultural landscape	Unique geographic area (Swanwick et al., 2007). Ecological infrastructure that supports ecological processes and functions, together with the cultural dimension of the long-term exposure of humans and technology (Madureira and Santos, 2012).
Rural vitality	The availability of a certain level of economic opportunity, a minimum level of services and infrastructure, and human capital and functional social networks which guarantee maintenance of the long-term durability and attractiveness of rural areas as places to live, work and spend leisure time (Kaley et al., 2011). The attractiveness of rural life for the rural and urban populations (OECD, 2001). Avoiding animal suffering and maintaining their good physical and mental condition (Webster, 1994).
Animal welfare	The combination of the physical and mental health of an animal, given the harmonious life of an animal in a certain environment (Hughes, 1976 in Carenzi and Verga, 2009). Food availability at any time, in any location (Kale et al., 2011).
Food security	A condition where all people at any point in time have physical and economic access to food, harmless in nutritional quality and quantity, to satisfy dietary needs for a quality and healthy life (OECD, 2001). Reduction in diseases and pathogens, as measured by a decrease in diseases, for which customers are willing to pay additional funds (Stenger, 2000).

**Source:** Own elaboration

The provision of the above-mentioned public goods has become more and more pronounced as the one of the Common Agricultural Policy goals. The historical pinnacle of this agricultural policy goal can be found in the 1985 CAP reform. The recent CAP reform introduced the Green Direct Payment – a new policy instrument in Pillar 1 – which remunerates farmers for the provision of environmental public goods. However, there are also instruments in Pillar II that support the provision of environmental goods, including social public goods. The paper addresses these issues and focuses on public goods provided by Czech agriculture. The aim of this paper is to determine the methods that are used to value the above-mentioned public goods. Our research question is focused on the possibility of economically valuating all these goods together using one valuation method.

## 2 Materials and Methods

In the paper, the authors used methods of analysis and compilation, and a comparative method for documents, scientific articles and professional publications. The primary resource

for scientific publications was the Web of Knowledge and SCOPUS database. The final state of art, gained through a synthesis of knowledge and information, forms the basis for further research into public goods valuation and, finally, calculation of the optimal level of subsidies.

### 3 Results and Discussion

**Biodiversity** is a pure public good with local, regional and international coverage. It can be characterized as a complex (multi-dimensional) public good that occurs at a number of levels of the biological hierarchy, from genes, through to individuals, populations, species, communities and entire ecosystems (Norris et al., 2011). Nunes and van den Bergh (2001), similar to Bartkowski et al. (2015), distinguished four types of biodiversity: gene, species, ecosystem and functional. Madureira and Santos (2012) connected gene and species into one category and distinguished three main components of biodiversity: (1) ecosystem and habitat assemblage and network (ecological infrastructure), (2) ecosystem and habitat diversity, and (3) genetic and species diversity.

All these components have value. This value may reside in the satisfaction that people get from using biological resources, directly or indirectly, now or in the future, or in concerns that future generations have some wider responsibility towards other living things. OECD (2002) differentiates the moral value (or goodness) of biodiversity, which is defined in terms of well-being, into intrinsic (ecocentric) value and anthropocentric (human well-being or economic and higher order well-being) value. Nunes and van den Bergh (2001) added that the economic valuation of biodiversity is based on an instrumental perspective on the value of biodiversity. It is regarded as the result of an interaction between human subjects and biodiversity and its changes.

According to OECD (2002), the economic value of biodiversity can be computed on the basis of the reveal preference, state preference and benefit transfer approaches (including meta-analysis (for example, see Brower et al., 1999, Matín-López et al., 2007)).

Moreover, we can distinguish three valuation approaches based on market value:

- (i) the observed market value approach, which is based on the value of marketable biological resources (e.g. genetic material),
- (ii) the productivity approach, which is based on observing the physical changes in biological resources (as inputs in the production function) and estimating what differences these changes will make to the value of market goods (as outputs of the production function) (e.g. Nunes et al., 2004),
- (iii) cost-based methods, which assess the cost of different measures that would ensure maintenance of the services provided by the environmental asset that is being valued.

Instead of market price, the reveal preferences approach takes into account observed behaviour to infer the value of biodiversity. This approach includes the travel costs model (Maille and Mendelson, 1993; Hanley and Rufell, 1993), random utility model, hedonic model (Evenson and Gollin, 1997) and averting behaviour model (Cooper and Freeman, 1991).

The valuation of biodiversity is based primarily on the state preference method. This method can be subdivided into the contingent valuation method and attribute-based choice

modelling, which includes choice experiment, contingent ranking, contingent rating and pair comparison. Bartkowski et al. (2015) added that 80% of the studies that they reviewed applied either contingent valuation or choice experiment.

Studies which specifically value habitat diversity include, for example, Willis et al. (1996), who used the contingent valuation method (WTP), Moran et al. (2004), who used choice experiment similar to Christie et al. (2006), and MacDonald and Morrison (2010), who used choice modelling. Finally, genetic and species diversity was analysed by Loomis and White (1996), MacMillan and Duff (1998), White and Lovett (1999), Foster and Mourato (2000), White et al. (2001), MacMillan et al. (2003), Hynes and Hanley (2009) and Naald and Cameron (2011). The major method was the contingent valuation method based on WTP. Loomis and White (1996) applied meta-analysis on WTP. MacMillan and Duff (1998) used a discrete choice contingent valuation basis for WTP calculation. Foster and Mourato (2000) used a contingent ranking method, and Naald and Cameron (2011) used conjoint analysis.

Ecosystem and habitat diversity is often evaluated as part of the landscape (see Garrod and Willis (1995), Bateman and Langford (1997), Bullock and Kay (1997) and Hanley et al. (1998)). The method used for valuation of this public good was the contingent valuation method. Hanley et al. (1998) also used choice experiment. Finally, the first component is also valued as part of the agricultural landscape (see Madureira and Santos, 2012).

**Water availability** is considered to be a mixed public good with local, regional and international scope. The previously mentioned methods can also be used for valuation of water availability and water quality. The majority of studies are focused on water quality related to different uses, such as drinking and recreation, and are based on the contingent valuation method, e.g. Viscusi et al. (2004), Welle and Hadgson (2011), Kwak et al. (2013) and Beaumais et al. (2014). From the remaining methods, we can mention benefit transfer, which was used by Barton (2002) as well as Thomassin and Johnson (2008), and conjoint analysis, used by Viscusi et al. (2008). Water quality is sometimes evaluated together with water availability. For example, Latinopoulos (2014) used a choice experiment to obtain WTP for drinking water quality and avoiding interruptions in water service. Water availability was valued by, for example, Jangdhani et al. (2012), who used the contingent valuation method to assess water for irrigation. Madureira and Santos (2012) added that water availability is often valued together with other public goods, such as landscape, farmland biodiversity, soil quality, air quality and flood prevention (e.g. Scropa et al. (2007), who used a choice experiment, as well as Tait et al. (2008) and Baskaran et al. (2009), who applied choice modelling, and Bliem and Getzner (2012), who used the contingent valuation method).

**Climate stability** is a non-rival and non-excludable pure public good with global scope. The corresponding global public “bad” is global warming, including climate change. Climate change causes various damages and risks, including increased storm severity, seawater rise, and species extinction. The costs of climate change include economic losses, loss of life, changes in quality of life and biodiversity losses (Rothman, 2003). On the other hand, there are certain benefits, including reduced heating and increased productivity for some areas of agriculture. Litman (2012) characterizes climate change impacts as indirect, long-term and uncertain. In addition, many impacts do not affect markets. Because the damages involve ecological resources and will occur in future generations, their value must reflect existence value, legacy value and intergenerational value.

Ninag-Djop and Bosh (2011) suggest three main techniques to be applied in economic assessment, including cost-benefit analysis, cost-effectiveness analysis and multi-criteria analysis. In addition to these techniques, more complex models are used. These models can be divided into two groups. The first group of models is based on welfare economics, including partial equilibrium and general equilibrium models. The second group of models combines economics with physics, including physical and Ricardian models (Rothman, 2003). Economists use non-market methods by using 'implicit' or 'surrogate' markets, or by creating 'constructed' markets. Hedonic pricing was focused on stated preference methods by Maddison (2001), Kopp et al. (1997) and Layton and Gardner (2000). Heal (2000) and Bockstael et al. (2000) applied the replacement cost method in their studies. Rotham et al. (2003) mention other techniques that could be used for assessing climate change, including travel cost, factor income, defensive/preventative expenditures, cost of illness/loss of income, and group valuation. Litman (2012) adds two approaches to monetize climate change, including damage costs and control costs (avoidance costs). The damage costs technique was used in studies by Tol (2005), Jakob et al. (2006) and Bein (1997). Stern (2006) and Maibach (2006) applied the control cost technique in their studies.

One prediction points out that if the concentration of carbon dioxide in the atmosphere reaches twice the pre-industrial level, global annual damages would reach 1.5-2.0 percent of world GDP (Conceicao, 2015).

**Food security** is considered to be a mixed public good with local, regional and international scope. For example, food safety, which is defined by Stenger (2000) as "*a morbidity reduction, measured by a decrease in the illness probability, for which the consumer is willing to pay an additional cost*", is mostly valued using the contingent valuation (CV) method (Henson (1996), Latouche et al. (1999), Rodríguez et al. (2008), Sundström and Andersson (2009), Tosor et al. (2009) and more in Stenger (2000)). As Stenger (2000) added, a description of foodborne illnesses (e.g. salmonella in Sundström and Andersson (2009)) and knowledge of the corresponding probabilities are needed in order to value food safety. A similar statement can be found in Kivi and Shorgen (2010). On the other hand, there are also papers which analyse food safety in the context of chemical residues in food. A list of Scopus database publications focused on food safety valuation is provided in Table 2.

**Table 2.** List of publications focused on food safety valuation

Publication	Method	Commodity	Illness
Lee et al., 2015	CV	Beef	BSE
Bruner et al., 2014	Experimental market auction	Oysters	
Chen et al., 2013	CV	Milk	
Ifft et al., 2012	Field experiment	Chicken	Avian influenza
Zheng et al., 2012	CV	Pork	
Theisl and Roe, 2010	Choice experiment		Coliform bacterium
Merghentaler et al., 2009	CV	Vegetables	chemical residue
Roberts, 2007	Estimation method		Foodborne
Posri et al., 2006	CV	Vegetables	pesticide residue
Rozan et al., 2004	Experimental techniques		
Stenger, 2000	Experimental techniques	Vegetables	Heavy metals

Source: Own elaboration

**Community vitality** can be categorized as a mixed public good with local coverage. It has been a concern of researchers since the 1970s. Since then, the definition has been modified

to include psychological aspects, and a political and sustainable dimension has been added (Cotrell, 1976; Smailes, 1995). Shafer and Summer (1998) defined rural vitality as the capacity of a local system to generate income and employment in order to maintain, if not improve, its relative economic position. Koomen (2015) perceives rural vitality rather as a concept that hints at the potential of rural areas to overcome possible problems, including the diminishing importance of agricultural production. Ikerd (2001) proves that there is an effort to explicitly incorporate agriculture into discussion and research agendas addressing community vitality. Empirical studies have measured rural community vitality using several indicators. Reddyreddy and Darling (2001), cited in Koomen (2015), add the indicators wealth index, employment index and personal strength index. In a conducted study, the Maine Development Foundation (2000) included education-related indicators such as perception of educational opportunity, employee-sponsored training and life-long training. Koomen (2015) analyzed three key indicators, including population and demographics, economic activity and available facilities. To analyze these key indicators, the rate of change in the number of residences, age distribution, employment and number of facilities were measured. Ikerd (2012) compared two communities using thirty indicators in six dimensions (safety, environment, education, public safety, economy and art/culture).

**Air quality** is a pure public good with local and international coverage. The emission of air pollutants results from almost all economic and societal activities. Air pollutants include, for example, nitrogen oxide (NO<sub>x</sub>), ammonia (NH<sub>3</sub>), ozone (O<sub>3</sub>), sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO), lead (Pb) and benzene (C<sub>6</sub>H<sub>6</sub>). Poor air quality negatively affects agricultural production, materials and buildings, visibility, the ecosystem, and the health of the population (Rizzi et al., 2014).

Most studies assessing air quality use hedonic pricing or contingent valuation. Hedonic pricing was used by Rosen (1974), Bayer et al. (2009) and Graves et al (1988), among others. Spatial hedonic pricing was also used by Kim et al. (2003). The contingent valuation method was applied to assess air quality by Arrow et al. (1993), Hammitt and Zhou (2006) and Wang and Mullahy (2006).

Other approaches to value air quality were used by Rizzi et al. (2014), who applied a stated choice experiment for trading off visibility against morbidity effects. A choice experiment was also used by Yoo et al. (2008). Bollen (2015) applied general equilibrium models.

**Soil functionality** is a mixed good characterized by rivalry and non-excludability. Functions of this ecosystem can be classified into three categories: provisioning services, regulating services and cultural services. According to de Groot (2002), the evaluation of soil functionality is mainly based on methods of stated preferences, namely avoided cost and replacement cost to evaluate these public goods. In a paper from Dominati et al. (2013), the use of methods for the valuation of soil services is clearly shown. The author describes the methods according to the function of this ecosystem. Market prices, provision cost, defensive expenditure and replacement cost can be considered more frequently used methods.

**Cultural landscape** refers to pure public goods which provide the four most commonly evaluated services: ecosystem, recreational, socioeconomic and cultural (Švejdarová and Cudlínová, 2013). The authors calculated the frequency of studies in prestigious environmental economics journals focused on non-market evaluation of landscape services within the years 2000 to 2012. The ecosystem function of landscape was most frequently valued with the following methods: stated preferences, namely contingent valuation,

and the choice experiment method. Recreational functions are valued mainly with revealed preferences by the travel cost method. Contingent valuation and hedonic pricing follow. The least common method was choice experiment. Socioeconomic and cultural functions are valued by the hedonic pricing and contingent valuation methods.

The socio-cultural and economic valuation of ecosystem services provided by Mediterranean mountain agroecosystems were researched by Bernues et al (2014). For this purpose he used a combination of deliberative (focus groups) and survey-based stated preference methods (choice modelling - WTP).

Economic valuation of tropical forest ecosystem services is provided by Carraso et al. (2014), who uses regression meta-analysis.

Comello et al. (2014) uses in his study two approaches: LCA life cycling assessment and a mechanistic biogeochemical model. He focused his paper on evaluation of wetland.

**Animal welfare** is also a pure public good, which is commonly evaluated on the basis of revealed preferences, namely contingent valuation – WTP methods and cost-oriented methods. A paper by Napolitano et al. (2010) summarizes recently published studies considering consumer willingness to pay more for products in compliance with animal welfare.

#### 4 Conclusion

In the above paper, ten public goods that are unequivocally connected with agricultural activities were defined. The authors included climate stability, biodiversity, water quality and availability, soil functionality, air quality, resilience to flooding and fire, cultural landscape, rural vitality, animal welfare and food safety into these public goods, which have the character of both pure and mixed public goods. From the available scientific papers and publications, the most frequently used evaluation methods of defined public goods and services were determined. It was found that the most frequently used valuation technique is contingent valuation. Choice experiment, travel cost, avoided cost, replacement cost, hedonic pricing and cost benefit analysis are very often applied. It is possible to use the introduced approaches to estimate the price of public goods, which can further serve to calculate optimal subsidies for farmers and public goods production.

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## Availability of food on the Czech market for specific groups of customers and the quality of life

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**Annotation:** The health of each individual depends on the range of determinants associated with both biological (genetic) and social factors. General determinants which, through their impact, define and significantly affect the quality of life of a specific group of customers - consumers with diabetes mellitus and consumers with gluten intolerance are as follows:

- Biological and genetic predispositions
- Healthcare system
- Lifestyle including diet
- Influence of the environment

Consumers themselves can affect their lifestyle and particularly their dietary choices in the decision-making process when buying food. In terms of the content of the presented article, the determinants concerning the diet, particularly compliance to the diet while suffering from diabetes mellitus and being on a gluten-free diet, are very significant. They can lead to improvements in the quality of life, as well as to a better position in a working team and in social life. Therefore, the aim of this article is to answer the question: "Is there a sufficient offer and availability of food on the market in the Czech Republic for selected groups of consumers with certain health limitations to meet their specific needs?"

This issue is addressed on the basis of a questionnaire survey in selected operational units in retail and hospitality. The results are analyzed, evaluated and compared in terms of availability, supply and prices. Compliance to the diet represents the purchase of suitable food whose availability in the market is very uneven and in some operational units of retail or hospitality industries this assortment is not available or is attributed to bio products and healthy diet supplements. The current state of the offer including the prices of the investigated assortment is not sufficient. Conclusions and recommendations are part of the solution of three projects and their researchers deserve thanks.

**Key words:** celiac, customer, diabetes mellitus, food, marketing, trade.

**JEL classification:** D12, M31

### 1 Introduction

An important condition for maintaining one's quality of life is compliance with the right diet. This requirement fully applies to specific groups of consumers with certain health limitations when eating. It concerns consumers with diabetes mellitus and with a gluten intolerance (celiac disease, gluten allergy or Dühring dermatitis). For these two groups of consumers, a diet is a basic prerequisite of how to relieve or prevent the symptoms of the disease. Compliance with a required diet means the purchase of suitable food, including ready meals. Their availability, assortment, presentation and prices were mapped and monitored in selected operational units of the CR internal trade within the IGA projects of the FEM CUA Prague. To answer the target question ("Is there a sufficient offer and availability of food

on the market in the Czech Republic for selected groups of consumers with certain health limitations to meet their specific needs?") The findings from surveys were analyzed, compared and evaluated. The link to the following articles "CSR and Availability of Food for Celiacs in Retail Trade CR" (Hes and Regnerová, 2013b) and "Gluten-free dining options in the Czech Republic" (Šálková and Regnerová, 2014) is logical.

An important and increasingly growing customer group on the Czech market is represented by consumers with diabetes mellitus. In the Czech Republic there are registered more than 800,000 people with severe diabetes mellitus. Moreover, it is supposed that about 300,000 people do not know about their disease. It is often an incidental finding during the examination of another health problem, as stated by Pergl (2011). The population as of 01/01/2015 amounts to 10, 251,791. This means that diabetes mellitus concerns about 10% of the population. In order that consumers with this disease were not excluded from work or a social life, they must comply with a certain diet.

Diabetes mellitus is both in local and foreign literature primarily studied and described from the medical point of view when the experts find parallels between certain functions of organs of a human body and diabetes mellitus (Edelsberger 2011, Simmons et al., 1997). Only a small number of authors deals with the synergistic effect between the supply of food appropriate for a diet and its specific use in the context of a healthy diet (Barrat, 1997).

Technically speaking, this disease concerns metabolic disorder, which leads to the failure of carbohydrates, fats and proteins to be processed in the body. If treatment principles are not kept or if diabetes is not treated, it can lead to the emergence and development of other serious diseases and complications, and thus to the deterioration of the quality of life. Kvapil (2010) pointed out that diabetes mellitus brought a number of work restrictions. Therefore, the accessibility and quality of the supply of food on the market corresponding to the diet is very important, as stated by Barrat (1997). The cause of diabetes is not completely known, however, several possible triggering factors are known such as: genetic predisposition and exposure to external environment (stress, virus diseases, obesity etc.) or constitutional physical factors such as race, sex, age. (MTE spol. s r.o., 2012).

In the Czech Republic, there are about 50,000-120,000 citizens (consumers) with an autoimmune disease of a small intestine, which cannot cope with the protein of gluten, i.e. with gluten contained in wheat grain, rye and barley. It is about 0.5-1.2% of the population. Of this number, approximately 10-15% are treated and others have not been diagnosed yet. Epidemiological studies carried out during the last decade have revealed the fact that celiac disease is one of the world's most common life-long diseases (Jones and Green, 2010).

It is a chronic disease of a small intestine mucosa, commonly known as the celiac disease or gluten allergy or as Dühring dermatitis. Coeliac disease is considered to be a partly hereditary disease that affects nearly 1 in 100 people, while 97% of patients are not diagnosed and treated (Fasano et al., 2008). Although the diagnosis of this disease has progressed in recent years, as said by Nevoral (2015) at the 10th Forum of celiac patients, the detection of this disease is still demanding and complex. The causes of the disease may be different. For example, there can be the relation of the celiac disease and the rickets with children, as pointed out by Saeed (2013). The disease can occur in childhood but also in adulthood. Triggering factors may be different – it can occur after a tense psychological or physical experience, after a sudden change in the life, childbirth, surgery, infectious disease, or with repetitive stress and other emergencies (Kohout and Pavlíčková, 2010).



When eating, this disease requires food that does not contain gluten, or only at low concentrations (Bušínová, 2012). Gluten is a part of a series of common-classical food.

## 2 Materials and Methods

Given the subject, an investigation was carried out through field research using individual interviews as well as a questionnaire survey. Working procedures of scientific research are based on the knowledge arranged by paradigmatically given criteria communicated systematically, primarily through writing (technical and scientific literature). Whereas the procedure of single individual - customer, which is applied in common life in everyday decision-making, is based on the knowledge arranged by subjective importance, as stated by Hendl (2012). Given differences were fully respected in the methodical approach of the presented contribution.

In the field of both qualitative and quantitative research, mainly the following methods were used: analysis and synthesis, induction and deduction and a specific method of comparison. As the main part of the secondary research, analysis based on previously acquired data from internal and external research was used. A methodical procedure of secondary research is based on a structured data analysis, descriptive analysis and compilation methods within publication sources processing. Methods of induction and deduction were used to search for answers whether from the regularly researched phenomena, a general rule can be derived that is applicable to the phenomena in another time and another place.

Gathering information of a primary character for the purposes of exploring in single parts was carried out through field research, questionnaires, personal and written (e-mail) questioning or interview.

Consumer behaviour and availability of food offer on the Czech market was studied by means of a comprehensive comparative research combined with quantitative and qualitative research using in-depth individual interviews. The data for diabetes mellitus was collected from October 2010 until June 2011 in 154 investigations in hypermarkets, supermarkets and small stores. 753 people suffering from diabetes mellitus were asked from February 2012 until June 2012. The data for celiac disease was collected from October 2012 until June 2013 in 126 investigations in hypermarkets, supermarkets and small stores. 177 people suffering from celiac disease were asked from February 2013 until June 2013. Respondents (diabetics and celiatics), who were willing to answer the questions examined in the survey, were selected randomly by means of a query. The information obtained was processed, evaluated and used in individual chapters.

## 3 Results and Discussion

The results of the above mentioned projects of the Internal Grant Agency of the FEM CUA Prague are summarized in two parts. The first part includes the results of examination relating to specific groups of consumers with diabetes mellitus. The second part includes the results relating to consumers with a gluten-free diet.

### 3.1 Customer group with diabetes mellitus

Availability of products suitable into medically treated diet with a group of diabetes mellitus was studied in the 1<sup>st</sup> phase of the project within the IGA FEM CULS 201111210060 "Trends

in the consumer basket of food for customers with diabetes mellitus" in selected self-service discount oriented retail operating units: hypermarkets, supermarkets and superretums (smaller supermarket to 400 m<sup>2</sup> of a sale area).

For a selected assortment, the following parameters were monitored: the width and depth of the assortment, merchandising, promotion, brands and prices. All confirm generally given specifics valid for a given type of operational units. Based on the results, we can say that "dia" products in selected retail operational units (self-service) belong in most cases to their constant and offered assortment, however, these products do not represent a significant portion of the total proportion of sold goods assortment, whose width and depth depends on the type of operational unit. From the obtained results, it is possible to characterize the following relation between the type of operational units and monitored parameters with "dia" products: the bigger the operational unit, the bigger the volume of an offered assortment of these products. However, the assortment of "dia" products was not included in promotional materials of visited retail operational units (Regnerová and Šálková, 2012).

Price level is similar to the price level of the other products according to the type of operational units, the lowest one is in hypermarkets, a bit higher in supermarkets, the highest prices are in superretums. The prices of "dia" products in hypermarkets and supermarkets are visible and assigned to individual products together with the label information about the prices of individual products converted to the selected unit of measurement, such as 1kg or 1liter.

In Table 1, there are presented prices of selected products suitable for consumers with diabetes mellitus. The exception in the trend of prices was sweeteners or some drinks. In comparison with supermarkets, their price in hypermarkets was higher in some cases.

**Table 1.** Prices of selected products

Average price in CZK per 1kg or 1l of a product	Hypermarket	Supermarket	Superretum
Fan sacharin sweetener	1800	1720	2340
Ela biscuits	192	198	240
Milka diet chocolate	270	290	320
Fruit mix /strawberries	108/175	122/184	128/194
Pfaner juice drink	38	40	43

**Source: our own source, 2012**

The part of a survey was a questionnaire of consumer's preferences when buying food appropriate for the diet of consumers with "diabetes mellitus". The following table 2 provides basic information, which is followed by a brief assessment.

**Table 2.** Respondents by age – diabetes mellitus

	Number	in %	to 20	in %	20-40	in %	40-60	in %	60-80	in %	over 80	in %
Women	391	52	23	3.05	80	10.62	137	18.19	129	17.13	22	2.92
Men	362	48	17	2.25	82	10.88	149	19.79	100	13.28	14	1.86
Total	753	100	40	5.3	162	21.5	286	37.98	229	30.41	36	4.78

**Source: our own source, 2013**

The figures in the table 2 confirm a general trend that there are about 35% (35.19%) of diabetics-seniors (60+) and that there are more women with diabetes mellitus than men. Within the age group of 60-80 years, there are more women by about 3.84% than men; (women live longer than men). The survey also showed that consumers - diabetics purchase products suitable for their diet less than once in a week, mostly in supermarkets. They are mostly influenced by a price level by goods and their own experience and custom. The price of "dia" products is due to the total expenditures for food high, discounts only partially influence them ("dia" products at discounts are often absent). They notice brands in choosing products and they mostly prefer Czech products, the assortment is assessed as insufficient. They would welcome a new specialized shop with service or self-service with an assortment of "dia" products (including non-food products) near their place of residence (Šálková et al., 2014).

From the assortment of "dia" products, respondents most often buy drinks of Pfanner and Bolero brands, MilkaDia and Orion Chocolate, biscuits of Sedita and Diabeta (producers) and DiaChrom and Irbis sweeteners. Insufficient species in the assortment are fresh sweet pastries (buns, marble cakes, Christmas cakes), sweetened milk "dia" products of a good quality (yogurts, custards), canned fruit and instant products. Responding to the questions was not welcome in self-service shops. The most favorable behavior (sale conversation) was found out in small specialized shops with the service.

### 3.2 Customer group with a gluten intolerance

Disease caused by a gluten intolerance is a permanent intolerance to gluten (wheat starch-gluten protein) in food. The production of this food is challenging for preparation and processing. It takes place under completely different technological conditions and also under very different operating costs than during the production of conventional food. Producers attempt to achieve similar sensory properties as in conventional food for people without this restriction. As the number of people who have problems absorbing gluten is increasing, the demand for gluten-free food is also increasing. For this reason, the number of manufacturers who produce this food and importers who import this food is increasing too. Food Research Institute Prague compiled a database of products and suppliers who supply these products on the Czech market (VÚPP, 2015). Based on the results of the survey, it can be said that the gluten-free food for the retail dealer is not an unknown concept (Hes and Regnerová, 2013a). With few exceptions, they belong to their assortment of goods as with products for diabetics. When compared conventional food prices and gluten-free ones with comparable products sold in the Czech Republic, they are very different.

As the data in the table 3 indicate, prices of gluten-free products are considerably higher than those of conventional food prices. For consumers buying celiac gluten-free food, it means considerable expenses. Some health insurance companies provide contributions to the diet, for example General Health Insurance Company, but the allowance is intended for the insured under the age of 26 years and a maximum amount of the allowance is 6,000 CZK per year (Společnost pro bezlepkovou dietu, 2013). According to the website of the following insurance companies, they contribute to food for a gluten-free diet in the following way: Czech Industrial Health Insurance Company provides a contribution of up to 1,500 CZK up to 18 years inclusive. The Trade Union Health Insurance Company of Employees of Banks, Insurance Companies and Construction, Revírní Fraternal Health Insurance Company and Škoda Insurance Company introduced financial support for people with the celiac disease too.

**Table 3.** Comparison of selected foods for a gluten-free diet and gluten.

Product gluten-free shop Celiak	Price package (CZK)	Price per 1 kg or 1 l (CZK)	Product with gluten hypermarket Tesco	Price package (CZK)	Price per 1 kg or 1 l (CZK)
White bread 400g	47.00	117.50	Penam white bread 500g	33.90	67.80
Toast bread 300g	49.90	<b>163.33</b>	Penam toast bread 750g	30.90	<b>41.80</b>
Schär müsli 375g	96.00	256.00	Bona Vita müsli 750g	76.90	102.53
4 formagi frozen pizza 300g	89.00	296.67	4 for.Buitoni frozen pizza 300g	60.90	203.00
Ham frozen pizza 320g	89.00	278.13	Ristorante ham fr. pizza 340g	56.90	167.35
Celia beer 11 <sup>0</sup> ;0,5 l	25.00	50.00	Gambrinus Excelent 11 <sup>0</sup> ; 0,5 l	12.90	25.80
Natural spaghetti 500g	35.00	70.00	Rosice spaghetti 500g	18.90	37.80
Gnosi 300g	78.00	260.00	PastaDiCasaMia Gnosi 500g	52.90	105.80
Biscoti biscuits 150g	51.00	340.00	Golden half-coat. biscuits 100g	11.90	119.00
Flour 1 kg	65.00	<b>65.00</b>	Granny's choice flour 1kg	12.90	<b>12.90</b>
Maize breadcrumbs 200g	19.50	97.50	T value breadcrumbs 500g	10.90	21.80

Source: our own source, 2014

The part of the project "Survey of the offer of food suitable for customers with gluten intolerance in retail trade" was a questionnaire survey. The results showed that the offer was satisfactory in individual outlets with hypermarkets and supermarkets where celiacs can also buy gluten-free food, and also in specialized shops for a gluten-free diet. In superreta and shops with the service, the offer is less satisfactory. The largest selection of gluten-free food is in regional and district towns, the smallest one is in municipalities with a population of 10,000. The most criticized elements of gluten-free food sale are the following:

- High prices often exceed the purchasing power of celiac patients.
- Small or improper assortment that should satisfy the needs of celiac patients.
- Poor availability of food for celiac patients - it must be sought in large spatial distances, often beyond the regions where celiac patients live.
- In large stores there are places (racks) with products for celiacs, however ceiling displays that should navigate customers to them are missing.
- Information on the product packaging is in small, often poorly legible letters and do not meet the requirement of EC Regulation no. 41/2009.

Table 4 provides the basic data about the set of questionnaire respondents with their consumer preferences when buying food in retail and while eating in the subsystem of hospitality for a gluten-free diet.

**Table 4.** Respondents by age – celiac

	No	in %	to 20	in %	20-40	in %	40-60	in %	60-80	in %	over 80	in %
Women	142	80.23	19	10.73	89	50.28	32	18.08	2	1.13	0	0
Men	35	19.77	6	3.39	18	10.17	10	5.65	1	0.56	0	0
Total	177	100	25	14.12	107	60.45	42	23.73	3	1.69	0	0

Source: our own source, 2014-5

The data in Table 4 confirm a general trend that celiac disease occurs more often with younger age groups (under 40 years - 74.57%). It is not possible to confirm whether it is more with

women or men because while recruiting and selecting the respondents, women were more open and more communicative. The survey also showed that consumers - celiacs or their parents - buy products suitable for their diet on average once a week, mostly in specialized stores. When purchasing, they are influenced by the assortment and price range, good experience and custom. The product quality is also judged according to their own experience. The price of gluten-free food is high. Gluten-free food occurs rarely in the discount offer. They notice brands in the selection of gluten-free products, but they do not prefer Czech products because the assortment is assessed as insufficient. They would welcome presentations of new products and better representation of price incentives and discounts on food for a gluten-free diet. These activities are implemented by manufacturers or importers of gluten-free foods for celiac meetings at a regional or national level.

#### 4 Conclusion

Currently, it is possible to document an increase of the number of persons – customers with specific needs, which are determined by certain restrictions following for instance from diseases. When purchasing, these customers demand and require, both in retail and in restaurants non-standard or specific types of food and meals. To ensure that these customers-consumers are not discriminated with respect to the selection of food, it is necessary to ensure that they have available in the market basket a relevant amount of foods fully in accordance with their specific needs in relation to their diseases.

In this case, the selected specific types of food products are products for consumers with diabetes mellitus who have a prescribed amount of saccharides and joules in food and consumers with auto-immunity diseases of the small intestine, caused by the fact that their organism cannot process gluten, an ingredient in a range of basic food products. The availability of food products with respect to their amount as well as their spatial location and availability of an operating unit (shopping center) is part of the social responsibility of companies operating on the market and of the consumer protection institute. It can also have a significant impact and contribution to the general Consumer protection policy when buying food in the Czech Republic.

The survey continue in cooperation with professional and special interest organizations. In the next stage, the survey focuses on food and travelling celiac patients in the system of internal trade, specifically in the subsystem of hospitality and tourism. It also examines catering contributions from health insurance companies, and the support from employers and state administration.

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20121027 “A survey of suitable food supply for customers with gluten intolerance in retail” and

20141033 “Availability catering for celiacs (gluten free diet) at the premises of catering services in the Czech Republic and their social responsibility towards the monitored group of consumers”.

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## A general appraisal of empowerment in Peru: A case study of Condoray and its rural promoters

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**Annotation:** Improving the quality of human resources extending from women's role in providing education to their children to their impact on other women reflect female empowerment. In Cañete province, a professional training centre named "Condoray", was chosen for the analysis. The objective of this paper is 1) to gain a better understanding of the relationships between empowerment indicators and 2) to characterize clusters of different rural promoters of the Condoray Institute under the background factors that affect them. A survey was developed and administered to a sample of 31 female rural promoters in February 2015. By means of a Principal Component Analysis (PCA), three main pathway matrixes of female empowerment were extracted: material, relational and perceptual. Additionally, rural promoters were profiled through three clusters: "traditional", "contemporary" and "modern", with relatively similar socio-economic characteristics but different evaluation methods towards the three pathway matrixes. The Condoray Institute should target different training programs according to their different profiles and needs in order to be disseminated in their communities. To add, it is considered relevant to expand the knowledge to other women who live in distant districts of the Cañete province.

**Key words:** Rural women, empowerment, PCA, cluster analysis, ANOVA, Peru

**JEL classification:** I25, J16

### 1 Introduction

Empowering participatory community approaches appear to help build trust, cultivate skills in collaborative decision-making and problem solving. Direct and deliberate strategies to achieve gender balance in homes and communities are necessary to achieve greater advancement of community well-being, including, equity and justice (Kevany and Huisingh, 2013). Women can help improve the "family economy" in many ways, through both an entrepreneurial and an educated workforce (Hani et al., 2012). Furthermore, women's skills must be improved to become the main stronghold of the family. Improving the quality of human resources extending from women roles in providing education to their children (Sharma and Johri, 2014) to how women can take care of the economic system in the family reflect female empowerment.

In Cañete province, part of the area of Lima, a professional training centre that has been working since 1963 named "Condoray", was chosen for the analysis. Its goal is to offer training to rural women from the Cañete valley in rural Lima. This institution is devoted to promote the integrity of rural women through education and to empower their technical and productive competencies. The goal of the Condoray program is to consolidate a sustainable economic development approach for rural families in Cañete. The cornerstones of Condoray's approach are rural promoters, women who became leaders from the efforts of this institution. These women inspire other community women to become more



autonomous and self-reliant. All of this is made possible through proper training and education, then moving forward to make improvements in their own families and communities. These development programs have been working in 18 different communities and benefiting more than 1,800 women in Cañete province during these past years (Condoray, 2015).

In reports from various regions in the world, women are central figures needed in decision-making (Kevany and Huisingsh, 2013). A rural promoter or community development agent is a woman leader who pushes other women to pursue familiar, educational and social improvements in their respective villages. They give training, organization and direct coordination of activities within their community, among other tasks (Condoray, 2015). Based on primary data generated from these women (between the ages of 36 and 60 years old) who are involved in this professional training centre, the objective of this paper is to: 1) gain a better understanding of the relationships between empowerment indicators and 2) to characterize clusters of different rural promoters of the Condoray Institute under the context or background factors that affect them.

## 2 Materials and Methods

The Cañete Province was selected for the case of study. The province of Cañete is located in the southern part of Lima, Peru. Cañete constitutes an important agricultural zone where 16,581 inhabitants are farmers and represent 17% of the labor force in the area (INEI, 2015). In general, Cañete has experienced a considerable economic growth on the basis in the productive diversification: agrarian culture, livestock, agri-industrialization, agri-export, and tourism (Cuadros, 2012). In the Cañete valley, the most important agricultural products are: cotton, potato, corn and grapes (Thiery, 1986). Grapes allow the elaboration of artisan pisco, wines and other products which are sold to the tourists that visit the valley (Peruvian Ministry of Agriculture, 2008).

Rural women play a vital role in rural farming and home system because their contribution will not only help to save their family owned assets but to also increase family income (Sathiabama, 2010). Rural promoters were gathered every Tuesday for their weekly meeting and classes at the Condoray Institute. A survey was administered to 31 female rural promoters in February 2015 during four meetings. The sample size was representative to the total number of the active rural promoters as there were 35 women in total. Data was collected by a designed questionnaire and interviews, either personal or by phone. Topics in the questionnaire were based on the main factors that characterize the rural women empowerment through assistance from Condoray, using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Additionally, questions regarding the profile of respondents in terms of level of education of women, age, family status, etc., were included in the survey. A Principal Component Analysis (PCA) was used as a variable reduction procedure to summarize these rural women's underlying perceptions of empowerment through small components. This procedure entailed grouping variables according to shared variance while retaining as much of the original information as possible. Then, the factor scores were subject to a hierarchical cluster analysis, to group the rural promoters with similar patterns. Lastly, one-way ANOVA was conducted in order to indicate significant differences between the different independent cluster means.

### 3 Results and Discussion

Empowerment is defined as a process of change by which individuals or groups with limited choice, freedom, and power are enabled to gain power that enhances their ability to exercise choice and freedom in ways that positively contribute to their well-being (Kuumuori Gangle, Afriyie and Yao Segbefia, 2015). An assessment of the underlying dimensions of the Cañete rural promoters was conducted. This was done to better understand the perceptions of these rural promoters towards empowerment. For this specific purpose, a first analysis using a Principal Component Analysis (PCA) was selected as it is a factorial method of data analysis of multivariate statistics. It allows the visualization of the system of relations between variables and individuals to assess the underlying opinions of these women and the group variables according to shared variance. Interpretability of factors can be improved through rotation (Field, 2012). Thus, varimax rotation of the factor structure was used in order to have the variables loaded uniformly into the components. The number of factors to be retained was guided by Kaiser's criterion (eigenvalues above 1) and the inspection of the scree plot. Three components were retained<sup>13</sup>. It is important to ascertain how reliable the internal consistency of the scales are<sup>14</sup>, which is why Cronbach's alpha ( $\alpha$ ) was calculated. The cut-off<sup>15</sup> used was 0.5. Table 1 displayed the varimax rotated component matrix for PCA.

**Table 1.** Varimax rotated component matrix for PCA

Item	Description	Material	Relational	Perceptual
Motivation	Feeling motivated to do many things	<b>0.80</b>	0.05	0.19
Food for health	Food purchase for improving my family's health	<b>0.75</b>	-0.04	0.44
Food and education	Focused on the education and health of my kids	<b>0.71</b>	0.50	0.21
Healthy food	Healthy food lifestyle for my kids	<b>0.68</b>	0.43	0.18
Kids expectations	Improvement of my kids future expectations	0.60	<b>0.59</b>	0.22
Knowledge	Learning new technical issues	-0.14	<b>0.83</b>	0.22
Education kids	Access to a better education for my kids	0.44	<b>0.81</b>	0.07
Communication women	Communication improvement with other women	0.30	<b>0.54</b>	0.38
Positive impact	Positive impact on other women's life for good	0.06	0.15	<b>0.82</b>
Time organization	Better time organization between work & family	0.28	0.13	<b>0.75</b>
Self-esteem	Improvement of my self-esteem	0.18	0.30	<b>0.61</b>

Source: own processing

<sup>13</sup> Components explained 45.89%, 10.75% and 9.62% of the variance respectively of the total variance (66.26%). In addition, by using a Barlett's test of sphericity (Chi-square: 179 032, df: 66;  $p < 0.01$ ), an overall measure of intercorrelations among variables in the analysis was obtained. The degrees of correlation among variables and the suitability of factor analysis also were calculated using a Kaiser-Meyer-Olkin (KMO) test (0.771), which measures the sampling adequacy for both the overall test and each individual variable (Field, 2012).

<sup>14</sup> Internal consistencies should be above 0.7, which is considered acceptable for the analysis (Field, 2012). The three components had Cronbach's  $\alpha$  of 0.837, 0.716 and 0.727 respectively.

<sup>15</sup> Field (2012) advocates the suggestion of Guadagnoli and Velicer (1988) to regard a factor as reliable if it has four or more loadings of at least 0.6 regardless of sample size. Stevens (1992) suggests using a cut-off of 0.4, irrespective of sample size, for interpretative purposes (MRC Cognition and Brain Sciences Unit, 2009).

As in developing countries like Bangladesh, women's empowerment in Cañete, Peru, is linked in particular with their economic advancement and self-dependency (Rafiqul, 2011). Three main pathway matrixes of women empowerment were used (Kuumuori Gangle, Afriyie and Yao Segbefia, 2015; Mayoux, 1998) as follows:

1. Material pathway matrix: Encapsulates both measureable and non-measureable material elements, possession and/or ownership of which are deemed necessary in the determination of whether a woman is empowered or otherwise. Rafiqul (2011) stated that if motivated women are able to play an active role in helping their family fulfilling certain requirements, then women can be considered empowered. The requirements are for instance: a house with roof, access to sanitary latrines, all school age children attending school, no food shortages; etc. As Kuumuori Gangle, Afriyie and Yao Segbefia (2015) said, rural women are concerned about making purchases of food and also paying children's school fees. Component 1 represents women's motivation, the household expenditure in healthy food and education for the kids.

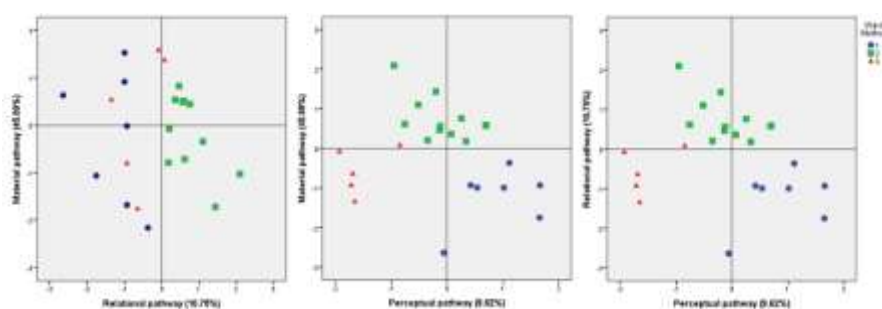
2. Relational pathway matrix: Describes the relationship and interaction between women and other members of their household and community (Kuumuori Gangle, Afriyie and Yao Segbefia, 2015). Rural promoters mentioned that knowledge is the most important asset for their children and relatives as this is also valued the most in rural Thailand's case (Sungsri, 2003). Component 2 addressed the participation of these women in decision-making within the family. This is related to sending children to school and the women's respective decision of acquiring new knowledge through Condoray. These women are eager to send their young ones to study at school (96%). Often educated children who are in agricultural or non-agricultural occupations often send remittances back home, which is an important source of investment capital for their parents (Norton, Alwang and Masters, 2006). Almost 40% of the children who have received schooling have moved to Lima where they have access to a better education level and better paid jobs. Rural Families give support to the rural promoter in their unit because of two factors: rural promoters can fulfill their duties as mothers, wives and a leader role for other women of their communities, and, rural promoters pass their knowledge directly to their family members. As a result, the rural promoter feels the self-confidence to make decisions inside and outside her home. Additionally, 67.7% of the rural promoters said that they received reinforcement from their family members.

3. Perceptual pathway matrix: This is based on a woman's rough assessment of their status in the household, family, and community. This aspect of empowerment seeks to shed light on women perception of well-being (Kuumuori Gangle, Afriyie and Yao Segbefia, 2015) and the changes that they have experienced since their involvement in the Condoray initiative. Rural promoters believe that it is their duty to support other women's learning process in their own communities (Sungsri, 2003). Component 3 studied the variables relating to rural promoters' self-confidence or level of assertiveness, as well as their organization of time and the impact on other women. From the survey results, these rural promoters manifested that they have a vocation to their own communities (60%), followed by their eagerness towards learning new issues (23.3%), and finally, their concern about their community's general improvement (16.7%). Rural promoters show that they experienced a positive inflection point in their lives after being influenced by the training offered by Condoray (96.7%). These Condoray representatives teach various topics and skills to rural women of their own communities, for example, the Catechism of the Catholic Church, cuisine, handicraft, bakery, knitting

and house management. The survey reflects that 25.8% of the rural promoters are satisfied while 74.2% are very satisfied with the training provided by Condoray. Rural promoters explained that they would like to strengthen their skills in handicrafts using Cañete agricultural products which belong to the valley (48.4% of respondents), pedagogy (19.4%), and finally, technology/computers (9.7% of respondents) in order to pass this knowledge to their families and other women.

Following the analysis, the factor scores obtained from the PCA were subjected to a hierarchical cluster analysis for grouping the rural promoters with similar patterns. Three segments were assessed with the dendrogram<sup>16</sup>. Figure 1, below, helps to explain the position of the clusters and their interpretation with the material, relational and perceptual obtained by the PCA.

**Fig 1.** PCA and cluster analysis: Material, relational and perceptual pathways



Source: own processing

Figure 1 shows that the three clusters are scattered between the three pathways components. Cluster 2 (squares) has the most positive evaluation compared to the other clusters in the material and relational pathways. Cluster 1 (dots) has the most positive evaluation in contrast with other clusters in the perceptual pathway while has the most negative evaluation in the relational pathway. Finally, cluster 3 (triangles) has the most negative evaluation in contrast with the others in both, the material and perceptual pathway components. As a final analysis, the clustering variables were profiled for the three-cluster solution to confirm that the differences between clusters are distinctive and significant in light of the research question and to define the clusters' characteristics (Hair et al, 2010). Then, a variance analysis using one-way ANOVA<sup>17</sup> was done. The F statistic provides evidence that each cluster is distinctive (Malhotra, 2008). Table 2 showed the mean values for clusters against socio-economic characteristics of the rural promoters in Cañete.

<sup>16</sup> The dendrogram displays a visual representation of the distance at which clusters are combined. The clusters with the highest similarity (coefficients) are merged to form the nucleus of a larger cluster.

<sup>17</sup> The premise of homogeneity of variances through Levene test was fulfilled.

**Table 2.** Mean values for clusters against socio-economic characteristics

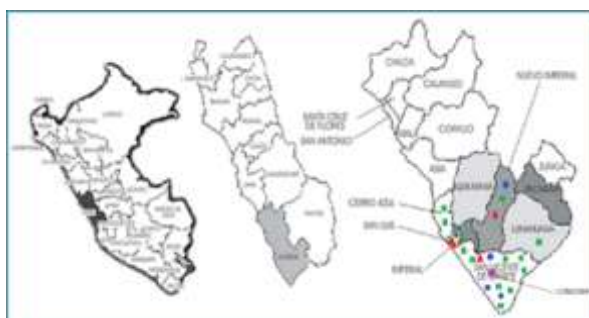
Variables	Mean values for clusters								
	Cluster 1: Modern		Cluster 2: Contemporary		Cluster 3: Traditional		Total		F
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Age (years)	44.60	6.99	52.31	8.31	58.40	16.27	52.00	10.53	0.11N.S.
Education (years)	9.00	4.30	8.63	3.52	8.75	2.06	8.72	3.37	0.98N.S.
Number of children	2.40	2.61	3.83	1.95	4.33	3.33	3.69	2.38	0.39N.S.
Rural promoter (years)	14.86	11.96	14.67	10.49	22.17	13.73	16.16	11.46	0.37N.S.
Food expenditure (PEN/Month)	281.43	210.59	411.88	282.94	244.00	157.10	349.29	252.10	0.32N.S.
Children education expenditure (PEN/Month)	250.00	378.59	127.08	126.30	367.50	314.36	207.82	247.85	0.25N.S.
Sample Size	7		18		6		31		

**Note:** The approximate exchange rate PEN to USD rate at the study rate: 3.093 PEN (Central Reserve Bank of Peru, 2015).

**Source:** own processing

From Table 2 we can notice that none of the variables were significant. This implies that the rural promoters have relatively the same demographic characteristics. Apparently, cluster 3 (“traditional”) is composed of women who are the eldest, have more experience being rural promoters and have more children. Their education expenditure for their children is the highest comparing to the other clusters. Thus, they have a weaker evaluation in the material and perceptual pathway components. Cluster 2 (“contemporary”) are the ones who have less time as rural promoters in average years and spend more in food than the remaining clusters. Cluster 1 rural promoters are called “modern” because they are the youngest and are more educated. As they spend more time studying or working, their relational pathway is weak (Fig. 1). The Condoray Institute should target different training programs according to their different profiles (traditional, contemporary and modern) and needs in order to be disseminated in their communities.

The contribution of women and their role in the family as well as in the economic development and social transformation of their respective communities is pivotal (Sathiabama, 2010). The present research suggests that these indicators fairly approximate the concept of women empowerment in the study of an institution that gives professional training to women (Kuumuori Gangle, Afriyie and Yao Segbefia, 2015). Finally, the three different clusters were depicted geographically. This is important in order to physically know where these women disseminate the knowledge learnt from the Condoray Institute. Figure 2 shows the map of the clusters structure.

**Fig 2.** Map of Cañete province and clusters structure

**Source:** Torres Ramírez et al (2006)

On the right hand of the map (Fig 2), it can be seen that the Condoray Institute is located in San Vicente de Cañete (star in the map). “Contemporary” rural promoters (squares) were present in almost all of the districts that are surrounding San Vicente (capital of Cañete province) compared to “modern” (dots) and “traditional” (triangles). Expanding the knowledge provided by rural promoters to other distant districts of the Cañete province is highly recommended in order to improve rural women lives who live in the valley.

#### 4 Conclusion

A better understanding of the relationships between empowerment indicators and the background factors that affect them was gained through this study. Three main pathway matrixes of women empowerment were used: material, relational, and perceptual. Moreover, three clusters that were profiled as “traditional”, “contemporary”, and “modern” had relatively similar socio-economic characteristics but different evaluation towards the three pathway matrixes. It is recommended that the Condoray Institute should target different training programs according to their distinct profiles in order to be disseminated in their communities. Additionally, it is considered relevant to expand the knowledge received by Condoray to other women who live in more isolated districts of the Cañete province.

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## Cost ratio and profit ratio of sugar beet production in production conditions

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**Annotation:** The paper analyses changes in production and economic indicators of sugar beet that have happened after the reform of CMO (Common Market Organisations) in the field of sugar industry in the agricultural entity Tapos s. r. o. We follow from the achieved 7 - year results in growing areas, harvest per hectare, costs and revenues (table no. 1). Total costs, incomes, revenues and profit were calculated per hectare and ton. The final calculation of economic indicators was done by CODEX software system s. r. o. company. The harvest of roots of sugar beet in years show significant variability: 30.05 t. ha<sup>-1</sup> in 2011 to 73.11 t. ha<sup>-1</sup> in 2010. We used the polynomial model for the analysis of the costs development per 1 ha with the use of dummy variable that specifies the development from 2009 (before the crisis) and after 2009 (after the outbreak of crisis). The development of own costs per hectare was characterized by polynomial trend, taking into account the onset of the crisis in 2009. The own costs vary from 1,247 EUR.ha<sup>-1</sup> in 2009 to the maximum of 1,823 EUR.ha<sup>-1</sup> in 2011. The development of the profit per 1 hectare of arable land in 2007 - 2013 showed a fluctuating course. The average value of profit is 699.50 EUR.ha<sup>-1</sup>. We used logarithmic trend function to describe the development of profit. We assume that the profit in 2015 will move around the level of 935 EUR.ha<sup>-1</sup>. We calculated the loss in the profit ratio of costs without support, - 24.68 % in 2012 and - 53.81 % in 2007. The cultivation of sugar beet was profit-making in the other years. The production of sugar beet using a support policy is highly profitable.

**Key words:** sugar beet, revenues, profit, profit ratio.

**JEL classification:** Q1, Q14

### 1 Introduction

Sugar beet is the only crop in the conditions of temperate zone that is determined for the production of sugar due to its strategic cultivation (Černý et al., 2007). Since the beginning of the marketing year 2006/2007 the reform of CMO has been launched in the sugar field according to the Decree of the Committee no.318/2006, 319/2006 and 320/2006 for the period from 2006/2007 to 2014/2015. The main aim of the reform is the gradual achievement of stable state on the European market with sugar by the means of the reduction of the total production of sugar in the EU (Řezbová et al, 2014). As a result of the reform in the conditions of the Slovak Republic the growing areas were reduced from 35,123 ha in 1989/1990 to 20,000 ha in 2013/2014. (Zelená správa - Green Report 2014). The average revenues of sugar beet in the conditions of the Slovak Republic in 2014/2015 were 75.5 t. ha<sup>-1</sup> with the approximate sugar content 15.5% (Janíček, 2015). In the Czech



Republic in 2014, the sugar beet was cultivated on the area of 37,264 ha. Within the insufficient use of production potential in recent years sugar beet has been a crop that meant the achievement of profit ratio for average Slovak producers (except adverse climatic years). It was especially affected by the positive price development as well as the development of cost ratio in the cultivation technologies resulting from the achievement of bigger harvest (Trubačová, 2012). A decisive factor of the economical and energy stability of sugar beet cultivation is the effectiveness of its production (Hnilička et al., 2009). It is significantly stimulated by support policy, by the means of which the financial availability of companies is partially guaranteed (Chrastinová et al., 2013). After the implementation of the support the profit ratio of sugar beet has even risen. The supports do not only stimulate the economy of companies and individual commodities but also investment process and retrospectively the impact on the effectiveness via the costs reduction and increasing labour productivity (Chrastinová, 2010). The decrease of the prices of sugar beet in the future period will show whether Slovak producers can compete with European market.

## 2 Material and methods

Production and economic potential of sugar beet (ANTEK and GALANTA variants) in the technology of conventional cultivation system was monitored in the operational conditions in 2007/2008, 2008/2009, 2009/2010, 2010/2011, 2011/2012, 2012/2013 and 2013/2014 on the degraded black soil of the agricultural entity TAPOS, Trnavská poľnohospodárska spoločnosť, s. r. o.. The sugar beet production was realized in the conventional system of cultivation. The preceding crop of sugar beet was spring wheat fertilized by farmyard manure in the amount of 30 - 40 t.ha<sup>-1</sup>. The final calculation of costs and revenues was provided by Codex Software systém s. r. o. company. The results are shown in the table no. 1. The selected indicators - we statistically evaluated the development. We used the polynomial model for the analysis of the costs, grants and profit development per 1 ha with the use of a dummy variable that specifies the development after 2009. The profit ratio of the costs with and without support was calculated in a traditional way.

## 3 Results and discussion

### 3.1 Evaluation of production and quality of sugar beet

In the evaluated years sugar beet was cultivated in the agricultural holding TAPOS on the area of 110.79 ha to 131.10 ha, in average 7 years on the area of 124.18 ha. The harvest of roots was characterized by high variability. After the maximum harvest of 73.11 t.ha<sup>-1</sup> in 2010 we registered a significant decrease of harvest in ha, especially in 2012 -30.05 t.ha<sup>-1</sup>, in 2013 - 50.77 t.ha<sup>-1</sup>. The average harvest for 7 years reached 55.20 t.ha<sup>-1</sup>. Saccharinity was characterized by the following values in years: 2007 - 17.26 %, 2008 - 17.27 %, 2009 - 17.28 %, 2010 - 16.2 %, 2011 - 18.5 %, 2012 - 16.9 % and in 2013 - 17.6 %. In the evaluated years, the highest content of sugar was reached in 2011 but at the same time the values of conductometric ash were low (especially Na and  $\alpha$ -amino Na). The measured values of the sugar content are also satisfactory. They are above 16% and this is a good condition of satisfactory extraction of sugar beet juice in the process of sugar beet processing. Differentiated ha of harvest and quality of sugar beet are limited by biological material, quality nutrition and fertilisation, protection against weed and animal pests, technological discipline and good management. In addition, the differentiated harvest is limited by abiotic factors,

especially precipitations and temperature. The fall is evident compared to 50-year average of vegetation rainfall in Trnava region (320.50 mm), especially in the years with the lowest harvest in ha. In this context, it should be added that the water demand of sugar beet is not sufficient and the deficit has to be replenished by irrigation water if possible. The growing trend of average annual air temperature by 1.1 % and the fall of annual atmospheric precipitation by 5.6 % have been registered within the development of climatic conditions in the recent hundred years. Mainly the area of Southern Slovakia, where sugar beet is cultivated, is gradually drying out. It is the result of the growth of potential evapotranspiration and simultaneous reduction of soil humidity. The number of summer and tropical days goes up (Špánik, 2008). We registered in average 56 summer and 31 tropical days within the analysed vegetation years (2007-2013). The rising number of summer and tropical days limits the ha of sugar beet harvest. The lowest sugar beet harvest in ha ( $30.05 \text{ t} \cdot \text{ha}^{-1}$ ) was acquired in 2012 when the number of tropical days was the highest and precipitation was the lowest.

A key factor in the process of sugar beet growth and its biological harvest is balanced nutrition and fertilisation. The successfulness of sugar beet cultivation is in close association with the level of its nutrition that must synchronize the sources from soil supplies and fertilizers. Higher harvest in ha that attributes to the profit ratio of cultivation can be achieved by the rational use of nitrogen with the emphasis on the adequate fertilisation by this nutrient in a pre-sowing period (Bizík, 1989, Vanek, Ložek et al., 2013). In our experiments we apply to preceding crop  $0.2 - 0.3 \text{ t} \cdot \text{ha}^{-1}$  of NPK and  $0.1 - 0.2 \text{ t} \cdot \text{ha}^{-1}$  of nitrogen in urea also using leafy nutrition, apart from 40 t of farmyard manure. Nitrogen is a key element in the nutrition of sugar beet. Its impact is manifested in various ways (Olšovská, et al. 2014).

### 3.2 Evaluation of costs and revenues of sugar beet production

The results of costs and profits are shown in the table no. 1. The total costs in the context of land area of sugar beet in ha were presented by the sum of 114,977 EUR in 2007 to 223,089 EUR in 2013. In the average of 7 years it is 185,361 EUR. The amount of costs and revenues per area unit is limited by the production of sugar beet per 1 ha. The average values of costs per ha were  $1601.79 \text{ €} \cdot \text{ha}^{-1}$ , in the results of Research Institute of Agriculture and Food they were  $1941.14 \text{ EUR} \cdot \text{ha}^{-1}$ . The own costs in the Czech Republic achieved the value -  $64,134 \text{ Kč} \cdot \text{ha}^{-1}$  in 2012 (Baudisová, 2014). The lowest own costs per 1 ton of sugar beet with the value of  $21.00 \text{ €} \cdot \text{ha}^{-1}$  were characteristic for the year 2009 when the harvest of sugar beet in ha was  $60.36 \text{ t} \cdot \text{ha}^{-1}$ . The average values were  $31.61 \text{ €} \cdot \text{ha}^{-1}$  when the harvest of sugar beet was  $55.20 \text{ t} \cdot \text{ha}^{-1}$ . Relatively high revenues per ha, respectively per ton, were highly influenced by the amount of grant for area (SAPS) and grant for sugar. In this context it has to be said that the grant policy of EU has become clearer in relation to the Slovak agriculture (Grznár a Szabo, 2010, Chrastinová et al., 2013). Grants in TAPOS company in the average of 7 years reached  $810 \text{ €} \cdot \text{ha}^{-1}$ . After we deducted 2,295,13 € from the average revenues per 1 ha, we got  $1,485.13 \text{ €} \cdot \text{ha}^{-1}$  and the average costs per 1 ha did not exceed  $1,601.79 \text{ €} \cdot \text{ha}^{-1}$ . Mathematical-statistical evaluation provides more detailed information about the own costs and profit per ha of sugar beet. The selected indicators - we bring the development in the table no. 2. Development - Own costs per ha - fig. 1, development - profit per ha - fig.2. The development of own costs per 1 ha had a declining trend from 2007 to 2009. After the outbreak of the economic crisis the own costs per 1 ha increased, except the year 2012. Therefore, we decided to use the model with dummy variables. We used the polynomial model (Sig. F= 0.033) for the analysis of the costs development per 1 ha with the use of dummy

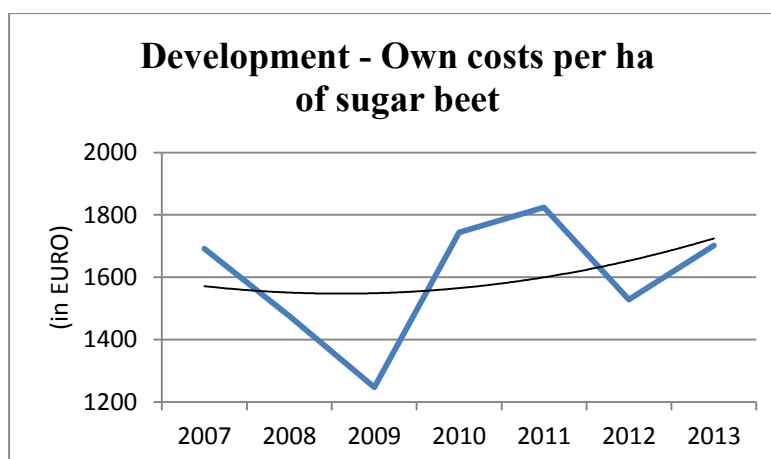
variable that specifies the development from 2009 (before the crisis, the value of the dummy variable is 0) and after 2009 (after the outbreak of crisis, the value of the dummy variable is 1) and we also used the variable connected with the change of the tendency of further development (Dt).

**Table 2.** Selected indicators – development

	2007	2008	2009	2010	2011	2012	2013
<b>Total own costs per 1 ha</b>	1691	1476	1247	1744.3	1823.93	1528.64	1701.67
Growth coefficient		87.3	84.5	139.9	104.6	83.8	111.3
<b>Grants</b>	44521	87298	111159	63196.96	33255.57	67329.53	68133.45
Growth coefficient		196.08	127.33	56.85	52.62	202.46	101.19
<b>Total profit</b>	-17200	123658	139487	82713.94	123416.6	18362.99	98622.71
Growth coefficient		-718.9	112.8	59.3	149.2	14.9	537.1
<b>Profit per ha</b>	-253	1237	1207	661.71	1113.97	141.44	752.27
Growth coefficient		-488.9	97.6	54.8	168.3	12.7	531.9

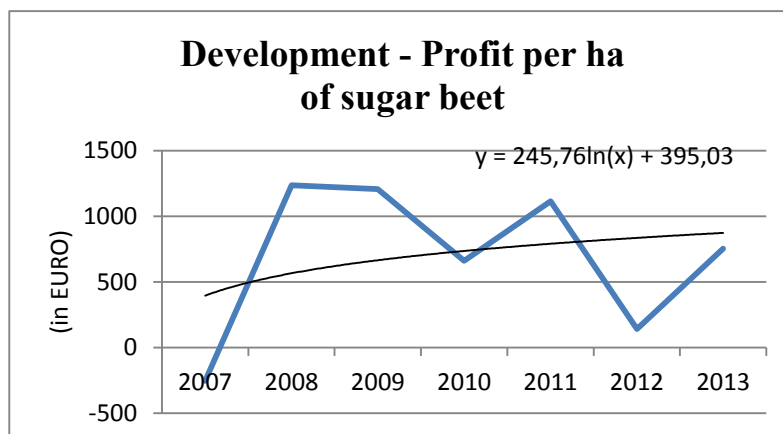
Source: Tapos Ltd.

**Fig. 1.** Development of own costs per ha of sugar beet



Source: Processed by the authors based on data from Tapos Ltd.

**Fig. 2.** Development - profit per ha of sugar beet



Source: Processed by the authors based on data from Tapos Ltd.

$$y = 1756.8 - 58.95 t^2 + 56.89 Dt^2$$

(3.027E-05)      (0.021)      (0.016)

The model explains approximately 81.8 % of the variability of own costs ( $R^2 = 0.8176$ ). The artificial variable related to the onset of the crisis was not statistically significant ( $P$  value = 0.759) and therefore it was excluded from the model. On the other hand, direction of further development after the outbreak of the economic crisis is statistically significant ( $P$ -value = 0.016) and it indicates the average annual increase of own costs by € 2.1 per 1 ha of sugar beet. Based on a selected model we prepared the prognosis for 2014. We assume the average own costs per 1 ha will be 1,624.9 EUR. The development of the economic indicator - profit per ha of arable land had a very fluctuating course during the monitored period of 2007-2013. While the agricultural entity TAPOS made loss (-253 EUR.ha<sup>-1</sup>) in 2007, in the following year 2008 it showed a high growth of 1237.00 EUR.ha<sup>-1</sup>. A significant fall happened in 2010 in comparison to 2009 when there was the fall by 45.2 %. The negative results of profit were also reached in 2012, -141.44 EUR.ha<sup>-1</sup>. The average profit value for the whole monitored period is 699.5 EUR.ha<sup>-1</sup>. We used a logarithmic trend function to describe the development of profit per ha. The equation has the form of  $y = 245.76 \cdot \ln t + 395.03$ . Based on this function we can assume how the value of the indicator will behave in the near future. In 2015 we assume that the profit will move around the level of approximately 935 EUR.ha<sup>-1</sup>. In order to objectively evaluate the production of sugar beet in the monitored subject we calculated the profit ratio of costs with and without support. The results are shown in the table no. 1. The profit ratio of the costs without support showed the loss of -24.68 % in 2012 and -53.81 % in 2007 (extreme climatic conditions, occurrence of the field mouse and low ha of sugar beet harvest). The cultivation of sugar beet was profit-making in the other years. The production of sugar beet using a support policy is highly profitable. Analogous results within the profit ratio of the costs with support were also reached in the works of VÚEPP (Research Institute of Agriculture and Food) with the maximum of - 65.84 % in 2008 and 74.45 % in 2013 (Trubačová, 2013). The profit ratio of the costs without support appeared in three cultivation years with the maximum of 12.14 €·ha<sup>-1</sup> in 2010. At the end of this chapter we have to state that sugar beet belongs to the group of special crops, the cultivation of which is financially demanding and therefore it is necessary to evaluate the development of costs in the long-term.

#### 4 Conclusion

The seven-year analysis of sugar beet production is focused on the changes that happened after the reform CMO in the field of sugar in growing areas, harvest in ha, costs, income, revenues, profit. Sugar beet is economically effective crop in the given soil and climatic conditions. The cultivation in years expressed in profit per 1 ha is economically effective, except the cultivation year 2007 (-253 €·ha<sup>-1</sup>). The profit ratio of the costs in the years without support shows positive values +8.95 %, +44.62 % excluding years 2007 -53.81 % and 2012 - 24.68 %. When the support policy was used sugar beet was highly profitable in all monitored years. It is documented by the results of Research Institute of Agriculture and Food in Bratislava. It is so reasonable to rationally cultivate sugar beet in the conventional system despite higher additional contributions. This follows from the economical analysis of sugar beet production. The most important factors influencing the effectiveness of sugar beet production are the prices of inputs, the prices of production and provided support, the direction of which lies within the authority of managers of agricultural subjects.

Based on the logarithmic trend function there exists an assumption that the profit per 1 ha in 2014 will be 906.1 €.ha<sup>-1</sup> and in 2015 935 €.ha<sup>-1</sup>.

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Table 1. Costs and revenues of sugar beet in the agricultural entity TAPOS, s.r.o. in 2007-2013

Costs and revenues (€/ha <sup>-1</sup> a €/t <sup>-1</sup> )							
Indicator	2007	2008	2009	2010	2011	2012	2013
Consumption of purchased seeds	19983	20198.00	21343.00	22281	21504,-	27636,-	28415,-
Consumption of purchased fertilizers	5440.00	3901.00	9248.00	5239.70	20114.89	14692.50	10846.80
Consumption of chemical protective means	8134.00	29369.00	15712.00	45968.31	54206.50	49490.26	54067.25
Total consumption	33556.00	63478.00	46303.00	73489.01	98704.14	91818.76	93329.05
Other services	39155.00	55302.00	57595.00	87800.32	58999.77	62905.67	67625.88
Taxes and fees - property tax	1809.00	2806.00	3150.00	3268.45	2893.81	4707.97	5073.16
Other fees - Pov. cukor	5330.00	5182.00	4716.00	4845.80	4631.90	3175.64	4883.27
Membership fee - Association of growers	468.00	491.00	486.00	531.59	528.14	323.82	497.84
Other reserves and provisions	-	-	386.00	770.84	-	-	-
Internal expenses	34061.00	30234.00	30756.00	47331.48	36315.31	35531.13	51679.89
Total own costs	114977.00	147493.00	143395.00	218037.49	202073.07	198462.99	223089.09
Total costs per 1 ha	1691.00	1476.00	1247.00	1744.30	1823.93	1528.64	1701.67
Costs per 1 ton	42.00	25.00	21.00	23.86	25.04	50.87	33.52
Income for sugar beet	53256.00	183854	171222.00	237554.47	278036.15	149496.45	253578.35
Grants	44521.00	87298.00	111159.00	63196.96	33255.57	67329.53	68133.45
Income per 1 ha	1271.00	1840.00	1485.00	1900.44	2509.58	1151.48	1934.24
Income per 1 ton	20.00	31.00	25.00	25.99	34.45	38.32	38.10
Total revenues	97776.00	271152.00	282882.00	300751.43	325489.65	216825.98	321711.80
Revenues per 1 ha	1438.00	2713.00	2447.00	2406.01	2937.90	1670.08	2453.94
Revenues per 1 ton	36.00	46.00	41.00	32.91	40.33	55.58	48.33
Sowing area in ha	68.00	99.93	115.60	125.00	110.79	129.83	131.10
Harvest in t	2728.16	5912.85	6977.61	9139.13	8071.30	3901.47	6655.89
Harvest in t.ha <sup>-1</sup>	40.12	59.17	60.36	73.11	72.85	30.05	50.77
Total profit	-17200.00	123658.00	139487.00	+82713.94	+123416.58	+18362.99	+98622.71
Profit (±) per 1 ha	-253.00	1237.00	1207.00	+661.71	+1113.97	+141.44	+752.27
Profit ratio of costs in % (without support)	-53.81	+24.63	+19.13	+8.95	+44.62	-24.68	+13.67
Profit ratio of costs in % (with support)	-15.16	+83.89	+96.30	+37.94	+61.08	+9.25	+44.21

Source: Costs and revenues of sugar beet in TAPOS company in 2007-2013 and own calculations

## Deterministic Decision Making in Agricultural Production

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**Annotation:** The aggregation of weights in multiple criteria problems is a critical stage of the whole agricultural decision making process. In some decision situations the use of subjective preferences is either difficult or undesirable. This paper proposes a method for the determination of objective weights which is based on the design of experiments (response surface model) and the congruence theory of competence between the means of production and its operator.

The results of the paper are following: (1) to identify the key industrial fertilization parameters (rotation of the disc, the disc height from the ground, the angle of the fertilization disc) which influence the uniformity of fertilization; (2) to identify the process parameters which influence the variability in the fertilization quality; (3) to determine the optimal settings of the fertilization process parameters which can meet the objectives (1) and (2); (3) to use congruence theory for: subsequent objectification of weights in multiple criteria problems for fertilization process operator's competence.

**Key words:** multiple criteria problem, fertilization parameters, agricultural decision making, Simplex Lattice design

**JEL classification:** M11, Q 16

### 1 Introduction

There are two approaches to decision making in economics, namely, a rationality approach (Švecová and Fotr 2010) and a behavioral approach (Brocas and Carrillo, 2008). The latter approach was developed and based primarily on findings in psychology because the rationality approach had limitations (e.g. Hogarth and Reder, 1987; Camerer et al, 2004; Altman, 2006; Maital, 2007). Even though the development of contemporary economics tried hard to disengage from psychology by introducing, for example, the revealed preference and ordinal utility function to get around the subjectivity of the utility function, the utility function still prevails as a major instrument in economic theory, including some behavioral models. (e. g. Gruber and Köszegi, 2001; Laibson, 1997).

In other words, economics and psychology which were once married, became separated, and now they are becoming reconnected again. Behavioral economics has flourished by applying, among other approaches, "behavioral decision research" to the study of how economic agents make choices (Camerer et al, 2004). Most recently, as neuroscience and neurobiology advance, assisted by the development of brain imaging technology to measure brain activity, not only we are informed of what brain regions are affected when different emotional and cognitive processes are involved, but also of the processes by which economic agents reach their decisions – the biological mechanisms that transform sensory perceptions into voluntary actions (e. g., Brocas and Carrillo, 2008; Camerer et al, 2004; Glimcher and Rustichini, 2004). 7 Interestingly, some brain processes have been found to support certain economic constructs. For example, research shows that neurons (the neural



cells), when processing information during the decision-making process, compute approximately the “expected value” associated with individual alternatives by reacting to both the probabilities of gains and the magnitudes of gains (Glimcher and Rustichini, 2004). “Affective neuroscience” was developed in the 1990s to explore the important role played by emotions in the decision making process (Davidson and Sutton, 1995; Brocas and Carrillo, 2008). For example, emotions are found to offer guidance toward designated goals in neuronal processes and the neural circuitry underlying emotions is also actively involved in processing information (Rustichini et al, 2005). One of the most cited neuroscientific theories is the “somatic marker model” developed by Damasio (1994) which articulates the essential ideas in two tenets. First, emotions affect decisions by way of adjusting neuronal thresholds in such a manner that favors information that supports current beliefs. Second, this neuronal threshold adjustment, which is dictated by somatic disposition, improves decision-making (Bechara and Damasio, 2005).

Some authors relate this information concept to the contrast intensity characterizing each separate criterion. The standard deviation or an “entropy” measure of importance has been proposed for quantifying contrast intensity and thus deriving objective weights of criteria. Both techniques assign weights that are higher, the more differentiated are the scores of the examined alternatives.

## 2 Materials and Methods

Response surface methodology (RSM) is a collection of mathematical techniques useful for the modeling and analysis of problems in which a response of interest is influenced by several variables and the objective is to optimize this response. Thus, RSM allows one to optimize a response of interest by determining the best settings for the controllable factors. The first step in RSM is to find a suitable approximation for the true functional relationship between  $y$  and the set of independent variables. The basic goal in RSM is to identify the optimal settings of the key factors.

After performing a screening experiment and obtaining a linear model of the response with only main effects, it is necessary to move in a direction that quickly improves the response.

In the case that an experiment has only two main factors and the interaction between factor  $x_1$  and  $x_2$  is not significant. The model equation for this experiment is:

$$\hat{Y} = f(x) = b_0 + b_1x_1 + b_2x_2 + \epsilon \quad (1)$$

where  $b_0$  is the intercept estimate and  $b_1, b_2$  are the coefficients for factors  $x_1$  and  $x_2$ , respectively.

If the experiment employs  $k$  number of significant factors, then the formula (1) is modified into the following general form:

$$\hat{Y} = f(x) = b_0 + b_1x_1 + b_2x_2 + \dots + b_kx_k + \epsilon \quad (2)$$

According to the previous formula, the steepest ascent is proportional to the signs and magnitudes of the regression coefficients in the fitted first-order model. If there is curvature in the system, a polynomial of higher degree must be used, such as the second-order model:

$$\hat{Y} = f(x) = b_0 + \sum_{i=1}^k b_ix_i + \sum_{i=1}^k b_{ii}x_i^2 + \sum_{i<j} b_{ij}x_ix_j + \epsilon \quad (3)$$

After obtaining this model equation:

1. One process variable can be chosen as the “base factor” and indicate the step size or increment ( $\Delta x_i$ ) for the base factor.
2. The increment in the other process variables can be determined using the following equation:

$$\Delta x = \frac{b_j}{b_i} \Delta x_i \quad (4)$$

3. The increments can be transformed from coded to uncoded units.

### 3 Results

The interaction of machine and human being the human being is more unstable part, therefore, for the partial competence of the human being, we often use a subjective way for estimation of factor weights. For objectification of these factor weights, we have performed a mixture design of tree-factors experiment. Before it, we performed factorial screening that identified following significant factors of human competence (for the position of agricultural mechanical engineers):

F1: Organizing and managing technological operations

F2: Planning of machine needs

F3: Evaluation of the utility of using machines from the economics point of view.

**Table 1.** List of process parameters for the experiment carried out with the machine (tractor: Rauch fertilizer spreader)

Process parameter	Units	Low level setting	High level setting	Lower level setting (coded units)	High level setting (coded units)
A: rotation of disc	1/min	540	620	-1	+1
B: ground speed	km/h	6	8	-1	+1
C: angle of fertilization	categorical unit settings	D3	E3	-1	+1

Source: own processing

**Table 2.** List of process parameters for the experiment conducted on humans (agricultural mechanical engineer)

Process parameter	Units	Low level setting	High level setting	Lower level setting (coded units)	High level setting (coded units)
F1: Organizing and managing technological operations	time of activity (h)	5	10	-1	+1
F2: Planning of machine needs	time of activity (h)	5	10	-1	+1
F3: Evaluation of the utility of using machines	time of activity (h)	5	10	-1	+1

Source: own processing

The quality characteristic of interest for this analysis was uniformity of fertilization measured as decimal value of total level of uniformity = 1 (where the variability of fertilization is equal to zero). Beside this, the quality characteristic of human competence was labour productivity at 95% level of confidence (and or accuracy) in the performance schedule (with a maximum of 5% error rate).

Having identified the quality characteristic and the list of process parameters, the next step is to select an appropriate design matrix for the experiment. The design matrix shows all the possible combinations of process parameters at their respective levels. In order to minimize the effect of noise factors induced into the experiment, each trial condition was randomized. Randomization is a process of performing experimental trials in a random order, not that in which they are logically listed. The idea is to evenly distribute the effect of noise across (those that are difficult to control or expensive to control under standard production conditions) the total number of experimental trials.

### 3.1 Results from the analysis

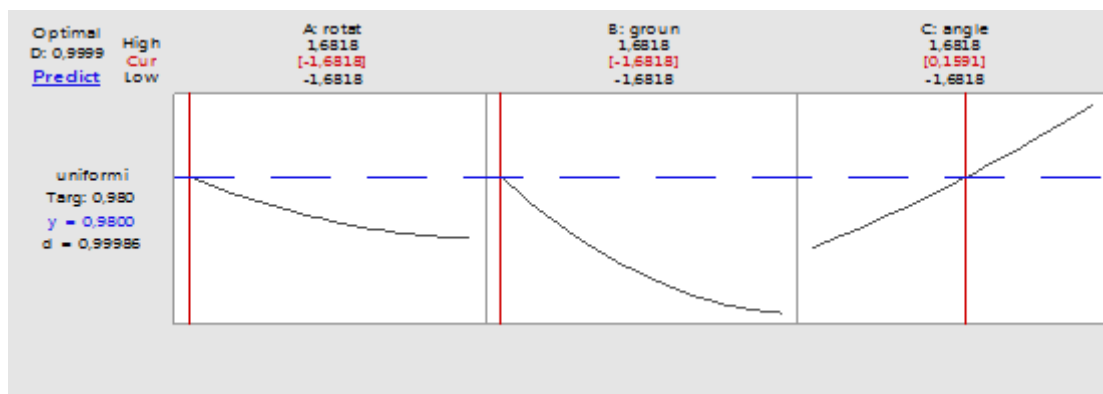
The first step in the analysis was to identify the factors and interactions which influence the means of fertilization uniformity and of labour productivity. The results of the analysis are shown in Table 3 and Table 4. For significance test, it was decided to select significance levels of  $\alpha = 5$  per cent (0.05). If the p-value is less than the significance level (0.05), the factor or interaction effect is then regarded to be statistically significant. For the present experiment, main effects rotation of disc (A), ground speed (B), angle of fertilization (C) and (AB), (BC) interaction effects are statistically significant.

Regression model for prediction of fertilization uniformity is given following formula:

$$\begin{aligned} \text{uniformity of fertilization} &= 0,88018 + 0,00243A - 0,01644B + 0,02183C + 0,00410A^2 \\ &+ 0,00940B^2 + 0,01125 AB - 0,00875 BC \end{aligned} \quad (5)$$

The optimum provide by the response optimizer of fertilization uniformity is depicted by figure 1. The optimum yield belongs to these settings: has A = - 1.6818, B = -1,6818, C= 0.1591.

Fig. 1. The response optimizer for fertilization uniformity



Source: own processing

For objectification of determining factors weights work performance we performed mixed simulation (design). Mixture experiments are a special class of response surface experiments in which the product under investigation is made up of several components or ingredients. Designs for these experiments are useful because many product design and development activities in industrial situations involve formulations or mixtures. In these situations, the response is a function of the proportions of the different ingredients in the mixture.

In the simplest mixture experiment, the response (the quality or performance of the product based on some criterion) depends on the relative proportions of the components (ingredients). The amount of components, measured in weights, volumes, or some other units, add up to a common total. In contrast, in a factorial design, the response varies depending on the amount of each factor.

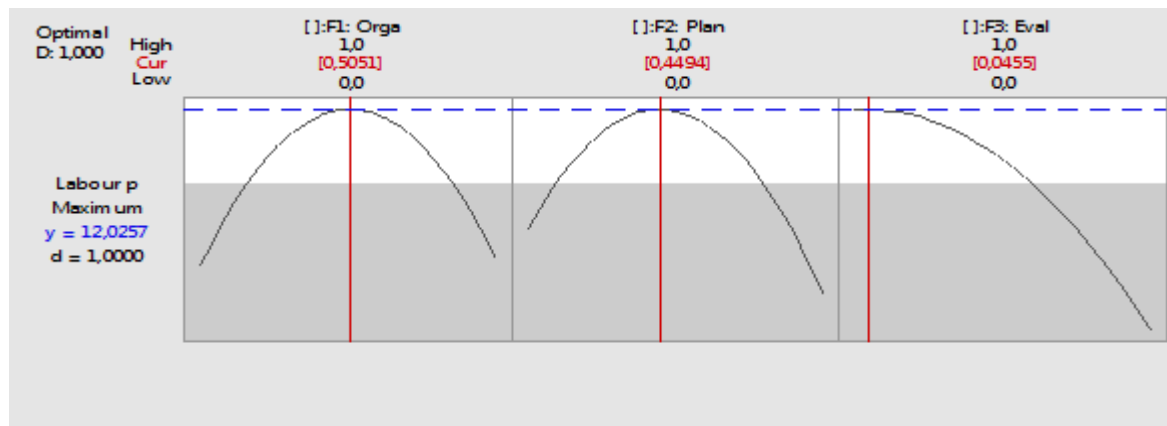
**Table 3.** Simplex Lattice design (own calculation)

Components:	3	Design points:	6			
Process variables:	0	Lattice degree:	2			
Mixture total:	1,00000					
Number of Boundaries for Each Dimension						
Point Type	1	2	0			
Dimension	0	1	2			
Number	3	3	1			
Number of Design Points for Each Type						
Point Type	1	2	3	0	-1	
Distinct	3	3	0	0	0	
Replicates	1	1	0	0	0	
Total number	3	3	0	0	0	
Bounds of Mixture Components						
	Amount	Proportion	Pseudocomponent			
Comp	Lower	Upper	Lower	Upper	Lower	Upper
A	0,0000	1,0000	0,0000	1,0000	0,0000	1,0000
B	0,0000	1,0000	0,0000	1,0000	0,0000	1,0000
C	0,0000	1,0000	0,0000	1,0000	0,0000	1,0000

Source: own processing

The optimal weights settings provide by the response optimizer of labour productivity is depicted by figure 2

**Fig. 2.** The response optimizer for optimal weights settings

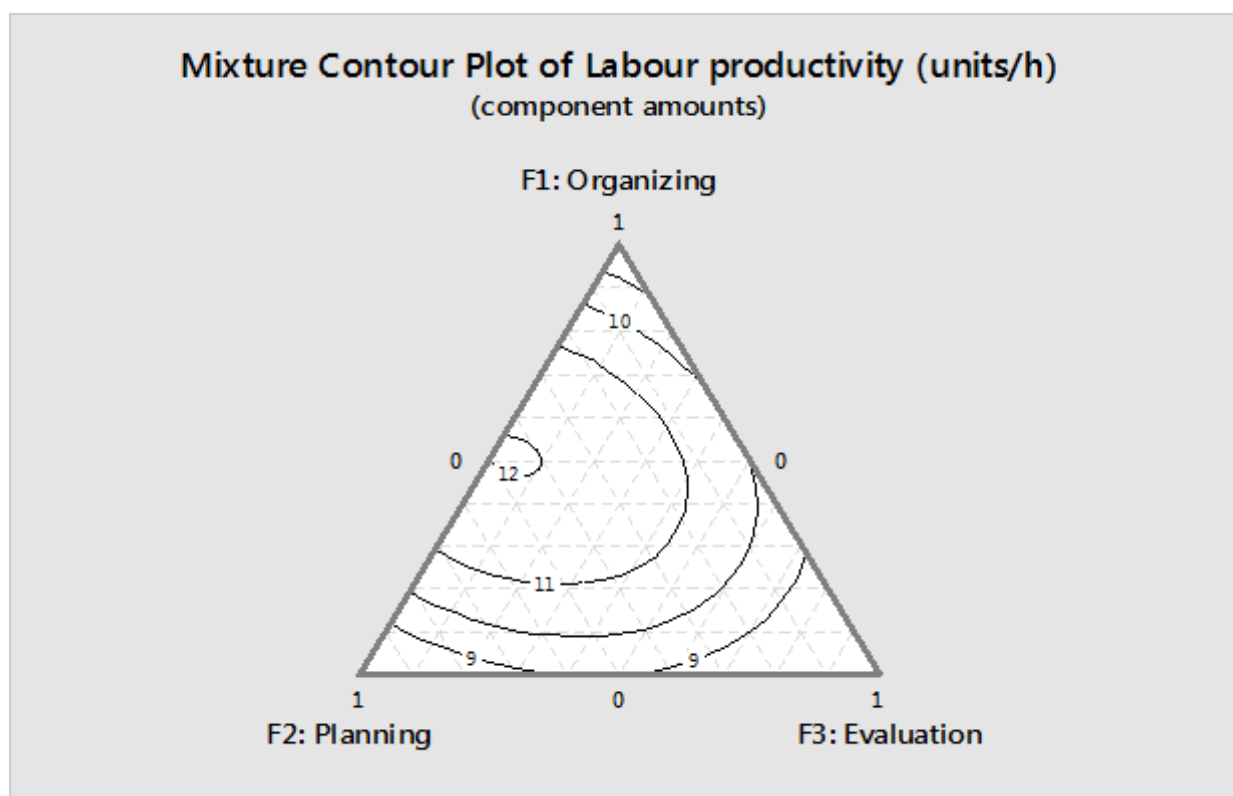


Source: own processing

With the triangular coordinate system, we can visualize the relationships between the weights of factors F1, F2, F3, in a three-component mixture. In a mixture, the weights are restricted by each other in that the weights must add up to the total amount or whole. Triangular coordinate systems in this section show the minimum of the  $w_1$ ,  $w_2$ , and  $w_3$  weights of factors F1, F2, F3 as 0, with the maximums at 1.

The following figure shows the usual layout of a triangular coordinate system. The components (weights) in mixture models are referred to in terms of their proportion to the whole, with the whole as 1. The vertices of the triangle represent pure mixtures (also called single-component blends).

**Fig. 3.** The triangular coordinate system for mixture experiment of weights setting



Source: own processing

#### 4 Discussion

The main objectives of this paper lie in creating such kind of procedure which allow to remove subjectivity in determining the weights of significance in managerial decision making. The developed method will be based on a mixture design simulation (specifically Simplex lattice method) for determining the significance weights of factors of human competence (for the position of agricultural mechanical engineers).

The second main objective of the paper was to explore the factors of managerial decision making not in isolated (autonomous) form, but rather in their mutual influences.

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# Rural Community Schools in the Czech Republic and their Activities within the Context of Rural Development

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**Annotation:** The paper is focused on the specific activities of Rural Community Schools promoting rural development through various forms of education (in the broadest sense). Rural Community Schools are a relatively new phenomenon in the Czech Republic – they were established in 2005 and have mainly been functioning since 2010. Therefore, the questions are whether Rural Community Schools are now firmly rooted within other organisations promoting rural development and what comprises their key activities. The main aim of the paper is to evaluate the various activities of Rural Community Schools within the context of rural development, to create a typology of these activities and mainly to answer the research question: whether and to what extent these activities are in accordance with the concept of community-led rural development. Attention is also paid to the regional perspectives of these activities. From the general perspective, the paper is based on concepts of local endogenous development and community education. The paper consists of the first results of sociological research, which combines the techniques of document study and questioning – in particular, semi-standardised interviews. The semi-standardised interviews were conducted with the main actors (Community Coordinators) of chosen Rural Community Schools in the Czech Republic. The first results of the sociological research have a mainly qualitative character, whereby it is possible to classify three basic types of activities of Rural Community Schools in the Czech Republic – the first are activities to increase opportunities on the labour market, the second have the mission of promoting active citizenship (local development) and the third are focused on the personal growth of participants. The third type primarily seems to be the most important within the context of rural development, but is still the least represented within Rural Community School activities.

**Key words:** community education, endogenous development, learning society, rural community school, rural development

**JEL classification:** R580, I250

## 1 Introduction

The attention paid to community education in rural areas in general stems from the concept of the learning society (Maskell and Malmberg, 1999; Lam, 2002; Morgan, 2007), as well as from concepts emphasising social innovation and investment in human capital in the context of endogenous rural development (Atterton, 2007; Lee et al, 2005; Shucksmith, 2000). From these concepts, the concept of community education is derived (Coleman, 1987; Heers et al, 2011; Sanders, 2003) which is the third theoretical concept used within the paper.

Community education is considered as a modernisation trend in education. Its main mission is to provide opportunities to disadvantaged adults, working class people, minority learners, women and also to members of rural communities who are disadvantaged due to the decreased availability of other educational possibilities (Staykova, 2012). Lifelong learning and adult learning as part of community education are the main characteristics of education for sustainable rural development.

In this context, it is necessary to include environmental, economic and social issues in rural community education. These are also connected with the process of social learning that brings people with different backgrounds together as one of the specific results of community education (Pitoska and Lazarides, 2013; Laudams, 2013). From the above-mentioned concepts, it is clear that Rural Community Schools are an important part of rural education, which is a key factor in endogenous rural development. The activities of Rural Community Schools could guide local communities, facilitate the capacity-building of local communities, catalyse interactions among community organisations, local inhabitants and the organised private sector (Biriescu and Babaita, 2014).

This paper, based both on secondary and primary research, deals with the ensuing research question — whether and to what extent the activities of Rural Community Schools are in accordance with the concept of community-led rural development. The main aim of the paper is to evaluate the various activities of Rural Community Schools (RCSs) within the context of rural development, and to create a typology of these activities including their spatial dimension.

## 2 Materials and Methods

The above-mentioned aim of the paper is to be fulfilled through both primary and secondary research techniques. A secondary analysis is used of RCS websites and also of websites of the National Network of Rural Community Schools (NNRCS, 2011). Attention is focused on information provided by particular RCSs on their various activities — mainly the courses supplied and other activities in which RCSs are involved. It is necessary to mention that the quality of information provided by RCSs differs, as some of the websites of RCSs are poor regarding the relevant information on their activities. However, there is also some important information about the contribution of these particular RCSs to community-led rural development. It can be assumed that efficient action by RCSs within rural development and the educational process in rural areas is based on the openness of information towards potential clients and local inhabitants. Despite this assumption, we conducted additional telephonic surveys with RCSs which have outdated websites to obtain the relevant information on their activities.

The primary research (in addition to the above-mentioned telephonic survey) consists of 6 semi-standardised interviews. The semi-standardised interviews were conducted with the main actors (Community Coordinators) of chosen RCSs in the Czech Republic. The RCSs were selected on the basis of secondary research, as being RCSs with a large number of provided courses or other activities and also with regard to the establishment of these RCSs (see below). The interviews consisted mainly of the issue of the activities and the promotion of RCSs within the locality, both from the supply and demand perspectives. As semi-standardised interviews and case study approach were used, the produced data have a rather qualitative character.

One of the authors of the paper has for a long time been focused on education in rural areas within his research. Firstly, he paid attention to education as an emerging need for leading rural development, using the endogenous approach (2010–2011). Between 2012 and 2013, we conducted a case study on the creation and the initial experience of the establishment of a network of RCSs within the Pilsen Region (specifically LAG Pošumaví). This case study is also one of the research sources that this paper stems from. Besides the creation of the network



of RCSs within LAG Pošumaví, we also paid attention to the activities of these newly established RCSs. For this reason, this paper also provides a comparative analysis of activities of RCSs established within a specific EU-funded project (RCSs within LAG Pošumaví) and the activities of RCSs established by means of a different method. Changes in the activities of RCSs within LAG Pošumaví are also in the spotlight.

### 3 Results and Discussion

Thirty-seven RCSs are registered in the Czech Republic. According to the valid rules (NNRCS, 2011) they may operate within municipalities of up to 5 000 inhabitants. One of the RCSs which is located in Telč is an exception to these rules, because Telč has a population of 5 490. Research confirms that one of the RCSs is in fact only a Community Centre and there is a lack of any information about one of the RCSs, as well as a telephonic survey having been unsuccessful. Therefore these cases were excluded from the ensuing research and the paper is based on secondary research in 35 RCSs and primary research in 6 RCSs.

RCSs in the Czech Republic were established in 2005, primarily since 2010, and their methods of establishment differ. Some of them were established with the support of EU projects, some of them were established with foreign inspiration and some with inspiration from already existing Czech RCSs. As the application of the concept of community education in foreign countries differs especially in the activities realised, we assume that it is similar in the Czech Republic. Therefore attention is paid to the key activities of RCSs in the Czech Republic and a typology of these activities. It is typical of RCSs to combine education for young students with adult education and also with activities aimed at community development and community planning.

Various activities of the RCSs in the Czech Republic were identified. On the basis of the nature of these activities, their typology was created. The first type are activities to increase opportunities on the labour market (1); the second type are activities with the mission of promoting active citizenship and aimed at local development (2); the third type are activities focused on the personal growth of participants (3).

The first type of activities (labour market) comprises mainly language courses, PC courses, accountancy courses and other less represented courses to promote job skills.

The second type of activities (local development) mainly includes courses supporting traditional local handicrafts, activities for seniors or local mothers with young children, markets supporting local production, community discussions on problematic issues and other activities promoting local identity and cooperation (e.g. communal celebrations of traditional local festivals, balls and carnivals).

The third type of activities (personal growth) include mainly painting courses, ceramic courses and other leisure activities supporting personal skills, with limited use in employment. Some RCSs provide only one type of activity, some provide a combination of activities. These also differ according to municipality size and with regard to the regional approach.

**Table 1.** The proportion of RCSs with certain types of activities according to size of municipalities (%)

<b>Municipality size/type of activity</b>	<b>Labour market</b>	<b>Local development</b>	<b>Personal growth</b>	<b>Combination</b>	<b>Unidentified</b>
Up to 500 pop.	25.00	0.00	0.00	25.00	50.00
500 – 1000 pop.	0.00	0.00	18.18	81.82	0.00
1001 – 2000 population	0.00	0.00	25.00	58.33	16.67
2000 + population	25.00	0.00	0.00	50.00	25.00
Total	8.33	0.00	14.29	60.24	17.14

Source: own processing

Table 1 provides information on the types of activities of RCSs within municipalities according to their size (number of inhabitants). The data are based on RCS websites and are supplemented by information from additional telephonic surveys. However, not all RCSs provide this information (see methodological section). Most RCSs provide a combination of all type of activities and are not specialised in any of them. This is common for RCSs located in middle-sized municipalities or municipalities with more than 2 000 inhabitants. On the contrary, RCSs in small rural municipalities are either specialised or do not provide sufficient information on the nature of their activities. Information about their actual activities is also important, because it should be based on information openness towards potential clients and local inhabitants. From the community-led rural development perspective, it is important that no RCS provides courses and activities only to promote local development. This does not mean that RCSs do not provide these activities, but merely that they are not specialised in it.

**Table 2.** The proportion of types of activities according to size of municipalities (%)

<b>Municipality size/type of activity</b>	<b>Labour market</b>	<b>Local development</b>	<b>Personal growth</b>
Up to 500 pop.	66.66	33.34	0
500 – 1000 pop.	36.00	24.00	40.00
1001 – 2000 population	30.00	25.00	45.00
2000+ population	50.00	16.67	33.33
Total	38.33	23.34	38.33

Source: own processing

Table 2 provides information on the proportion of the different type of activities according to the size of municipalities. The data are based on the assumption that one RCS could provide several different types of activities (see comments for Table 1). It is possible to see that activities promoting local development (which are in perfect accordance with the concept of community-led rural development) are under-represented within the structure of activities. The highest relative proportion of local development activities is in small municipalities. This corresponds to the importance of RCSs in small municipalities, where the RCS is often the only institution to promote rural development. On the other hand, in municipalities with more than 2 000 inhabitants, the role of local development activities is rather small, as a result of strong competition with other institutions promoting community-led rural development

(e.g. community centres, community plans) and also as a result of a lack of the “community” nature of these municipalities.

Table 3 provides information about the proportion of different types of activities according to Regions (NUTS 3) in the Czech Republic. Column and row relative frequencies are depicted — the proportion of different types of activities among the Regions and the proportion of three types of activities within one of the Regions.

The highest proportion of labour market and personal growth activities is in the Vysočina Region (the Region with the most active RCSs) and is fairly balanced in the rest of the Regions. The highest share of local development activities is also in the Vysočina Region, but these activities are also very significant in the Pilsen Region. This is as a result of the establishment of the most RCSs in the Pilsen Region under the EU-funded project (see below).

Considering row relative frequencies, the position of local development activities in the Pilsen Region is the most important. It is also possible to see that in exactly half of the researched Regions, local development activities are not represented. Therefore, we may conclude that activities directed at community-led rural development (local development activities) are not a common part of RCS activities and are provided only in addition to other activities.

**Table 3.** The proportion of types of activities according to Regions (NUTS 3) – relative frequencies

Type of activity frequencies / Region (NUTS 3)	Labour market Column (%)	Labour market Row (%)	Local development Column (%)	Local development Row (%)	Personal growth Column (%)	Personal growth Row (%)
South Bohemian	13.04	60.00	0.00	0.00	8.70	40.00
South Moravian	4.35	100.00	0.00	0.00	0.00	0.00
Hradec Králové	4.35	50.00	0.00	0.00	4.35	50.00
Moravian-Silesian	0.00	0.00	0.00	0.00	4.35	100.00
Olomouc	4.35	25.00	7.14	25.00	8.70	50.00
Pardubice	13.04	28.57	14.29	28.57	13.04	42.86
Pilsen	13.04	27.28	28.57	36.36	17.39	36.36
Central Bohemian	4.35	50.00	0.00	0.00	4.35	50.00
Vysočina	39.13	37.50	42.86	25.00	34.77	37.50
Zlín	4.35	33.33	7.14	33.33	4.35	33.33

Source: own processing

Regarding the spatial dimension of RCS activities, there are significant differences in the prevailing types of activities within Regions. This fact is also evaluated by case study research using semi-standardised interviews. As mentioned above, Community Coordinators (persons responsible for the functioning of RCSs) were chosen for the semi-standardised interviews from RCSs in the Pilsen, Pardubice and Vysočina Regions, where RCSs are the most active.

The interview results showed that RCSs provide a stable number of courses and other activities and also the number of participants is stable. On the other hand, increasing efforts to promote

various RCS activities lead to increasing interest in the functioning of RCSs within municipalities. Most commonly used for the promotion of RCSs are their websites, local periodicals and promotion at Primary Schools. These promotional channels are used regularly.

The above-mentioned conditions for the activities of RCSs are common to all the researched subjects. We also identified differences among RCSs with regard to some features of their functioning according to the method of establishment of the RCS.

The first difference is in the development of types of activities provided by RCSs established with the support of an EU-funded project (RCSs in the Pilsen Region) and those RCSs established without this specific support and based mainly on an endogenous approach to rural development (RCSs in the Pardubice and Vysočina Regions). The proportion of different types of activities of RCSs located in the Pardubice and Vysočina Regions is stable. However, in RCSs located in the Pilsen Region, it is possible to see a significant shift from activities promoting local development and labour market activities to activities promoting personal growth. Therefore the role of these RCSs in community-led rural development is decreasing.

The second difference concerns the opinions of Community Coordinators on self-financing of RCS activities. Community Coordinators from RCSs established without specific EU project support consider (and this is verified in the practice of these RCSs) that RCS activities are self-financed from the resources provided by participants. On the contrary, Community Coordinators from RCSs established with specific EU project support think that self-financing of RCS activities is impossible. This could be explained by being accustomed to the higher standards provided by an EU project and by less enthusiasm of Community Coordinators. Therefore these RCSs could be more important for community-led rural development in the first phase of their existence, but in the long-term perspective, their significance to rural development seems to be inferior to that of RCSs established without EU project support.

The activities of RCSs directed at rural development are rather less frequent compared to activities aimed at the development of personal and job skills. The use of local potential and local resources could be increased. It is important to strengthen local identity as a key factor in the endogenous approach to rural development.

Heers *et al.* (2011) compared activities of Community Schools in different countries. They state that activities promoting the local identity of both students and adults are crucial for the successful functioning of a Community School within a municipality. Other activities are somewhat supplementary and often marginal. From our research results, the situation of RCSs in the Czech Republic is shown to be the reverse. Nevertheless, Rural Community Schools have only existed in the Czech Republic for between 5 and 10 years and this is a fairly short time in which to compare them to those in other countries.

#### **4 Conclusion**

The paper is focused on the activities of RCSs in the Czech Republic. RCSs provide various activities and, with respect to their content, it is possible to identify three types of activities. The first type are activities aimed at increasing opportunities on the labour market; the second type are activities aimed at local development, which perfectly conform to the concept of community-led rural development, and the third type are activities focused on the personal growth of participants.

Activities promoting local development are fairly under-represented, with no RCS specialising specifically in them. This is valid mainly for municipalities with more than 500 inhabitants and for RCSs after the end of EU project support. The highest proportion of local developmental activities is in the Vysočina Region, with these activities also very significant in the Pilsen Region. However, it is possible to see a decreasing tendency in the latter Region due to the end of the EU project support.

It is possible to conclude that RCS activities are only partly in accordance with the concept of community-led rural development. Activities have a higher significance for community-led rural development where RCSs were established based on the enthusiasm of a local Community Coordinator using a “bottom-up” approach. Despite the potential which community education has for rural development, RCSs are still on the fringes of the attention of community-led rural development.

The question which could arise from the results of our research is whether lack of attention paid on community education in context of community-led rural development is based more on Rural Community Schools or on potential participants at their activities. This is the reason that ensuing research using a questionnaire technique (to be conducted at the end of 2015) will be focused on participants in RCS activities.

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## Corn and soy in Russia: the latest fad or a new cash cow?

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**Annotation:** Statistical data shows a considerable development of corn and soy production in Russia: from 2000 to 2013 the acreage of these two crops increased by 10.2% per year. One of the highest growth rates, along with a significant share in the national output, can be found in the Central Black Soil Region, which is one of the main agricultural regions of Russia. The question arises whether this change is a temporary occurrence or whether a fundamental shift in cropping patterns lies ahead. To answer this question, possible reasons for such a shift in the production pattern have been investigated. To collect the data a survey was conducted among farmers in the Voronezh region. Findings revealed mostly economic reasons of the agricultural pattern change. Additional reasons for the crop pattern shift are the existence of necessary infrastructure. However, future plans for discussed crops depend heavily on the market situation and decisions about current rotation are revised by farmers every year. In comparison to corn, the likelihood to extend the soybean acreage is higher in this region due to the lower production cost.

**Key words:** Russia, corn, soy, survey, cropping pattern.

**JEL classification:** Q130

### 1 Introduction

The breakup of the USSR was the starting point of the transition from a planned to a market economy. The change of the economic and political system substantially affected the agricultural sector: from 1991 onwards production significantly declined, but after the year 2000 a rapid recovery has been observed, primarily in crop production (Liefert and Liefert, 2012). The establishment of markets forced farmers to revise crop preferences, depending on prices and price-ratios generated by markets. New options that have generated some interest are corn and soybeans.

Statistical data shows a considerable increase of corn and soy production in Russia: from 2000 to 2013 the acreage of these two crops increased by 10.2% per year. One of the highest growth rates, along with a significant share in the national output, can be found in the Central Black Soil Region (CBSR): corn acreage increased from 2000 to 2013 by 17.3% annually, soy acreage gained 32.8% annually in the same period<sup>18</sup>. The question arises whether this change is a temporary occurrence or whether a fundamental shift in cropping patterns is to be expected.

There have been several debates in the media about further expansion of these crops (Vorotnikov, 2012; Munro, 2013; Doran, 2014). However, no scientific research or detailed analysis of these changes has been carried out. For this reason this paper aims to:

- identify drivers for a crop pattern change;
- determine opportunities of further corn and soy expansion.

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<sup>18</sup> own calculations based on UniSIS (2014)

The possible causes for the alteration in crop patterns are divided into two parts: market and non-market factors. Such division is based on the assumption that, on the one hand, in well-established markets, profitability plays the most important role in decision making. On the other hand, non-market factors (for instance, regulatory levers by public authorities) may also play a significant role and rule the agribusiness towards achievement of political targets, such as self-sufficiency.

Thorough investigation of the Food Security Doctrine of Russia (FSDRF, 2010), which is the main political document regarding the self-sufficiency level and core of agricultural development for the near future, revealed a lack of any special targets for soy and corn set by politicians. Therefore, the economic reasons will be investigated first.

Economic causes on a farm level can, in principle, be identified by official profit and loss figures, which farms report to local authorities. However, they cannot be used exclusively due to the following limitations:

1) The information is too general – collected data<sup>19</sup> is summarized at a regional level and does not represent the farms information separately. A general finding of several authors points out that the variability of farms is enormous and remains hidden when averages are used (Nivjevskiy, von Cramon-Taubadel and Grueninger, 2008; Rylko et al., 2008; Slaston and Larsén, 2010; Byerlee, Lissitsa and Savanti, 2012);

2) Such figures entail an inherent risk of being biased because they have been created for reports to tax authorities. Under such conditions there is a strong incentive for producers to lower profits. Therefore, it is most likely they do not reflect the true economic conditions.

Understanding economic reasons for a change in cropping patterns requires detailed information on cost and returns for individual crops. Furthermore, one needs to also take into account possible interactions between crops because of agronomical benefits and cost caused by individual crops (Albrecht, 2015). Thus to identify economic reasons and blocks influencing the corn and soy acreage expansion, a survey will be used as the source of information.

This paper is organized as follows: the second section describes the methods which will be used in the paper to analyze the issues. The third section provides economic analysis of corn, soybeans and winter wheat and a review of existing farm infrastructure. Conclusions will come at the end of the paper.

## 2 Materials and Methods

The survey may provide empirical information – discloses information on all relevant inputs and outputs in terms of quantities and prices. Strength of this approach is a consistency of figures: data is relevant to particular farms, as opposed to regional averages. Moreover, this concept allows the inquiry of motivation and qualitative issues associated with the shift in cropping patterns on a farm level and better understands “soft factors” of farmers’ decisions regarding corn and soybean production. Nevertheless, the disadvantages of the survey method are: the inability to verify the data provided, the study is time consuming

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<sup>19</sup> Total profit, level of profitability, assets and debts of agricultural sector



and has relatively high financial costs, as well as the possible lack of representativeness of the sample group when transferring the findings to a larger group.

In respect to the aforementioned annual growth rates, the CBR has the most prominent position in corn and soy production. Therefore, this region seems the most suitable for the study. Given financial restrictions to collect the data a survey was conducted among farmers in the Voronezh region, which is one of the key regions in terms of production and acreage of CBR: the total crop acreage in 2013 reached 2.6 million hectares (27% of the CBR acreage).

Because the data which is to be collected is rather delicate (cost, revenue, existence of sufficient infrastructure and etc.) face to face interviews with farmers are preferred. Details of farmers from 89 farms were found using a list of names and phone numbers of corn and soybean growers provided by the Voronezh Region Agricultural Policy Department<sup>20</sup>. The interviews were conducted from March 27 to April 12, 2014. It was not possible to contact all farmers on the list and even fewer expressed the readiness to participate in an interview. Only those farmers growing corn and/or soybeans for three years or more were interviewed to exclude farmers who just test these crops and have not adjusted the production system yet. Ultimately, the interview was conducted with 15 correspondents and each lasted for about 1 hour. The total acreage of participating farmers is 391 thousand hectares, which represents 15% of the total Voronezh region acreage.

In the first phase preliminary calls were made to farmers in order to get acquainted and to explain the research, as well as asking about the opportunity to meet for interview. Once agreed, the next step was face to face structured interviews with the responsible person (manager or agronomist). The main targets of asking questions were: to get economic data for crop net-return comparison; investigate farmers' experience and their impression of growing corn and soybeans; plans for growing in the near future. Questions represent a combination of open and closed questions<sup>21</sup>.

Most popular crops among farmers in the CBR are small grains, among them – winter wheat. This is the only crop grown in all studied farms and the most common so far (in 2013 it accounted for 24% of total crop acreage of the Voronezh region). For this reason, corn and soybeans will be compared to winter wheat.

### **3 Economics and farming conditions of major CBR arable crops**

#### **3.1 Farm economics**

As stated above, 15 interviews were conducted to obtain more insight on the ground level. It should be noted that not all respondents were able to answer all the questions, especially regarding economic indicators (cost, price etc.). Thus, only the performance of those farms that had sufficient data to calculate the results has been presented.

The overall composition of the respondents can be described as follows: 1 private farm, 12 independent enterprises or members of agricultural holdings and 2 headquarters of agricultural holdings, which manages a number of farms. In terms of arable land, the private

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<sup>20</sup> State executive authority of Voronezh Region

<sup>21</sup> questionnaire is available upon request from the author

farmer has around 650 ha, the 2 agroholdings have 60,000 ha and 250,000 ha respectively and land belonging to other farms is somewhere between 3,000 ha and 12,000 ha. Farm data is coded using letters to secure its confidentiality. The share of corn in rotations among farms varies from 5% to 50% and soybeans – from 2% to 23%.

In order to compare the economic performance of selected crops information about cost and revenue is required. The questions asked aimed to find out the normal, expected farming conditions and eliminate possible biases of specific conditions in one year. Therefore, farmers were asked to indicate answers related not to a particular year, but to the average for the 2011-2013 period. Respondents were asked about the average for the selected time frame farm gate prices per ton, yield per ha under standard moisture and total cost per hectare to calculate the economic indicators. It is very important to mention that the selected time frame is characterized by relatively low fluctuation in the mentioned criteria.

Market revenue per ha in this paper is calculated as crop yield per ha multiplied by the farm gate price per ton. The difference between the market revenue and the total cost is the profit. All economic data is in the local currency but for comparison was recalculated to USD using the annual average ratio of the Russian Ruble to USD. As economic performance is a rather sensitive question, in this part of the interview farmers were able to give a 'non-response' which, for corn growers accounted for 40% of responses and 33% for soybean growers. The main reason used by farmers for 'non-response' was the absence of such information.

**Table 1.** Revenue and cost for the focus crops in surveys farms, USD per hectare

Farms	Crops	Total cost	Market revenue	Profit
A	Wheat	474.3	1092.1	617.8
	Corn	550.8	1373.6	822.8
	Soybeans	541.6	1133.7	592.1
B	Wheat	459.0	856.8	397.8
	Corn	612.0	841.5	229.5
C	Wheat	489.6	856.8	367.2
	Corn	612.0	1049.6	437.6
	Soybeans	336.6	884.3	547.7
D	Wheat	452.9	918.0	465.1
	Corn	673.2	1072.2	399.0
	Soybeans	428.4	881.3	452.9
E	Wheat	367.2	979.2	612.0
	Corn	612.0	1224.0	612.0
	Soybeans	397.8	1248.5	850.7
F	Wheat	218.8	765.0	546.2
	Corn	372.4	1453.5	1081.1
	Soybeans	292.4	814.0	521.6
G	Wheat	550.0	610.5	60.5
	Corn	900.0	1468.8	568.8
H	Wheat	428.4	820.1	391.7
	Corn	520.2	936.4	416.2
	Soybeans	306.0	918.0	612.0
I	Wheat	489.6	840.0	350.4
	Corn	550.8	1468.8	918.0
Mean	Wheat	436.6	859.8	423.2
	Corn	600.4	1209.8	609.4
	Soybeans	383.8	980.0	596.2
Standard Deviation	Wheat	95.5	134.5	170.3
	Corn	140.9	243.8	278.5
	Soybeans	93.5	170.9	136.7

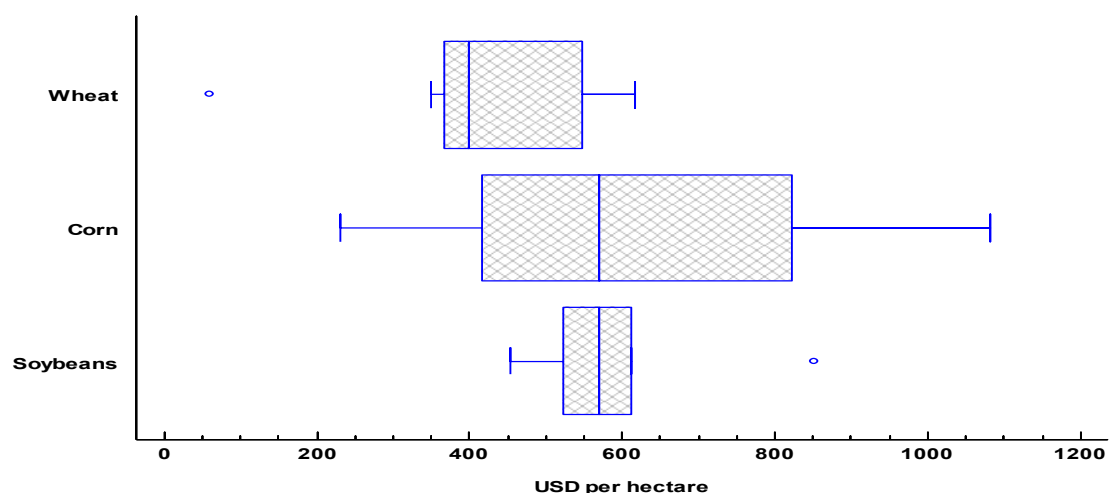
Source: own processing

The main indicator of crop preference for farmers in free market conditions is profit per hectare. From Table 1 one can conclude that investigated farms do not have a common denominator. But with regard to the general trend, the calculation of the mean profit per hectare for this sample shows that corn brings the highest average return with 609 USD/ha, followed by soybeans with 596 USD/ha, in third place was winter wheat with 423 USD/ha. Corn was more profitable than winter wheat for 6 out of 9 respondents, one farm (E) had equal profit for two these crops and for 2 farms (B and D), wheat gained more profit than corn.

For soybean producers this comparison shows that for half of them (three out of six) winter wheat was more marginal, but the difference is rather small: from 3% to 5% of profit. However for the other half, profit from soybeans exceeded that of winter wheat by about 50%. Such a large difference in values can be linked to the relative newness of growing corn and soybeans which requires each farm to adjust its production system.

Box-and-whisker plot of profit (Fig. 1) allows to better understand how profit values are spaced out in different sets of crop data. The left whisker of the boxes represents the 25<sup>th</sup> percentile, while the right represents the 75<sup>th</sup>. The whiskers extend to the highest and lowest observation unless they are more than 1.5 box-lengths long. Observations outside this range are plotted as circles. The vertical line inside of the boxes is the median.

Fig. 1. Box-and-whisker plot of profit for the focus crops

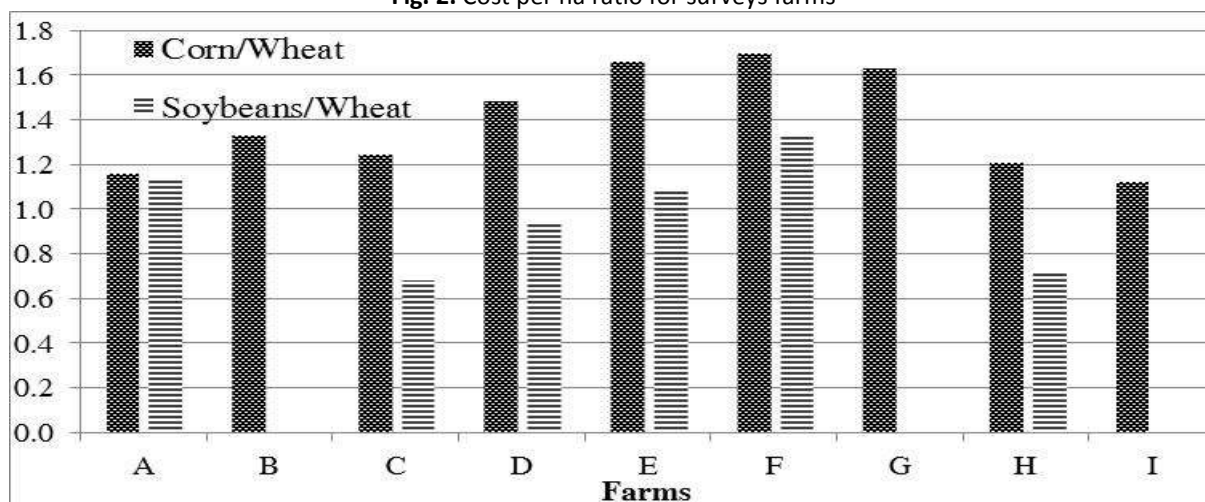


Source: own processing

The profit data sets have different coefficients of variation: 40.2%, 45.7%, and 22.9%, respectively for wheat, corn, and soybeans. They indicate that profit from soybeans is less spread out. Of particular interest is that the coefficient of standardized skewness for profit distribution are negative for wheat and positive for corn and soybeans. This indicates that the left side tail of wheat distribution is longer or fatter than the right side and opposite is true for corn and soybeans.

The cost ratio comparison for corn, soybeans and wheat can be beneficial in understanding the farmer's decisions. Firstly, more expenses can be associated with a larger loss in the event of failure. This risk may be mitigated by insurance, which is a commonly used instrument all over the world (Vilhelm, 2011). But the market for such service is underdeveloped in Russia – in 2014 only 17.7% of the total acreage was insured (NAAI, 2015). Secondly, these expenses demand larger sums of investment which increases the financial burden for farmers and requires additional resources.

Fig. 2. Cost per ha ratio for surveys farms



Source: own processing

Figure 2 shows that corn requires more financial input than winter wheat. The difference varies from 10% to 70% of cost per ha. The difference of total costs between corn and winter wheat can be mainly associated with the higher cost per ha of fertilizers and wheat seeds (this is notable in Russia, where farmers use high-yielding corn hybrids which are purchased each year and the use saved wheat seeds). The total cost of soybeans is not as consistent as that of corn. For half of respondents the cost of soybeans surpasses that of winter wheat, while for the other half the ratio is under 1.

### 3.2 Framework conditions for corn and soybean expansion

Establishment of new crops in the production system requires farmers to assess not only the outcomes, such as profit per ha, but also necessary infrastructure and additional investments for its construction. Conducted interviews included questions about infrastructure. Existing facilities of infrastructure can serve as motivation for growing and the lack of it may become a deterrent for the reorganization of the production pattern.

Questions for the respondents included narrowly focused questions to clarify the power of influence of hypothetical factors, as well as open-ended questions to identify potential issues during the establishment of corn and soybean production, which could have slipped by the interviewer. Before the interviews, the next factors were determined as potential restrictions:

- 1) Storage – corn usually has a higher yield in comparison to wheat and requires a higher capacity of warehouses;
- 2) Drying capacity – the harvesting period of corn and soybeans occurs in autumn (in comparison with summer harvesting of small grains), when the temperatures are less likely to allow grains to loose moisture naturally. For storage and trading purposes the moisture content has to meet a conditional level that often demands additional drying;
- 3) Transport – again, because of the higher yield, corn requires additional transporting capacity.

The respondents' answers indicate the presence of the necessary infrastructure. Lack of storage facilities was only noted by 1 farmer out of 15. The remaining farmers have storage capacity for more than half of the output. These warehouses were often built in Soviet times

with the bulk storage method. Agricultural holdings, as vertically integrated companies, have their own elevators in assets.

For drying, many interviewees invested in special equipment. Out of 15 corn growers 12 have drying equipment, 2 more farmers expressed their willingness to purchase such equipment in the near future. According to the farmers, availability of one's own drying capacity allows for the accumulation of larger margins for the farm and increases flexibility with regard to the changing weather and market conditions.

The issue with transportation of larger quantities of grains according to farmers is not an uphill task. Vehicles for grain shipping are often produced domestically and relatively cheaply. All farmers expressed that there is a high supply of contractors and in the case of a capacity shortage, especially in peak periods, hired contractors with low costs can be hired.

Initial assumption that corn and soy growing can be promoted by politicians was also tested during the interview. Answers show the absence of any administrative levers. Existing subsidies have a very low share in costs and are not allocated to a particular crop, but on a hectare basis. Therefore, author assumes the absence of external factors which can potentially distort farmer's decisions regarding crop acreage allocation.

Additional issues which author has not taken into account are that several farmers expressed the need to purchase harvesting equipment. Further expansion of corn as a production threshold is a deterrent for farmers with regard to the current production system.

For future prospects of the studied crops, respondents were asked about the intention to increase corn and soybean acreage. Among respondents no-one had the specific intent to increase land for corn production. The reasons were: shortage of sufficient equipment and a focus on improvement and adjustment of current production technology rather than acreage expansion. Two farmers were going to decrease corn acreage due to the expansion of sugar beet production. However, most of the respondents had difficulty in citing a reassessment of planted areas every year on the basis of market prices.

The situation with soybeans is more obvious. Among respondents, 7 out of 15 farmers grow soybeans and 3 of them expressed intention to increase the crop acreage. The remaining 4 in the short term will keep the amount of crops at the same level. In addition to this, out of the 8 respondents who had never grown soybeans, 4 intend to plant it in the coming season.

With regard to possible opportunities, further increase of soybean acreage can be expected as it requires less cost in comparison to corn and at the same time provides high returns. Further corn expansion can be slowed down by significant cost demands not only for planting, but also for establishing efficient infrastructure with modern storage methods and drying. Agroholdings, as agricultural units with sufficient financial resources, will drive corn expansion, but further expansion is unlikely for small-scale farms.

Low interest rate could also stimulate large investments for new highly profitable crops, but current situation in Russia is not in favor of taking credit (CBR, 2015). However, another factor is beginning to play a role – establishment of export fee for wheat (Gov, 2015). Such fee will make wheat planting less attractive, and meanwhile increase opportunities of further soybean and corn acreage expansion.

## 4 Conclusion

The CBSR is a new hotspot for corn and soybean production. Findings revealed that corn and soy acreage expansion are rooted to economic reasons. Neither administrative levers nor subsidies promote the growing of corn and soybeans.

Findings have revealed that economic reasons were responsible for the change in the agricultural pattern. Farmers reap more profit per hectare from corn and soybeans in comparison to winter wheat. The cost for corn is greater than for winter wheat (the mean cost of corn production is 600 USD per ha, whereas for winter wheat it is 437 USD per ha) that puts additional pressure on the financial situation of farmers and in the event of crop failure it would lead to higher losses. It requires farmers to manage risks more carefully. The introduction in a production pattern of soy requires less cost (mean cost of soy production is 384 USD per ha) and can generate higher returns than wheat, which is so far the most important cash crop in this region. Such a superior condition of soy encourages farmers to invest in this crop. From an agronomic point of view soy has better manageability in existing rotations in comparison to corn. The likelihood of expanding the soybean acreage rather than that of corn is higher in this region due to the lower production cost.

One reason for the crop pattern shift is the existence of infrastructure. However, as is evident from farmers' attitudes, future plans for discussed crops very much depends on the market situation and decisions about current rotation are revised every year. Current factors influencing Russian crop production are ambiguous and future perspectives are difficult to determine.

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## EU Legal Regulation of State Aid In Agriculture - Selected Issues

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**Annotation:** Text Part of the EU competition law is the prohibition of provision of State aids by states and regulation of exemptions from this general prohibition. Integral part of the special regulation form rules for State aids in the agricultural sector. The aim of the paper is to analyse the main changes of agriculture State aid rules that follow the revision of legal instruments applicable to the agricultural sector.

The paper deals with the legal framework of State aid rules in the agriculture sector. As first, it discusses the extent to which the State aid rules have been generally applied in the agriculture sector by the EU Council under Article 36 of the Treaty, together with the extent to which they have been specifically applied under the regulations which govern both the common organizations of the market and rural development. Following chapter analyses the agriculture *de minimis* Regulation, which sets out circumstances in which agricultural aid is of such amount that Article 107/1 TFEU will be not applied. Finally the paper focuses on the Agricultural Block Exemption Regulation (ABER), No. 702/2014. As the main features of the new rules are emphasised the extension of the block exemptions by widening the scope of ABER, widening the scope of the Guidelines and the introduction of the so called “One window approach” together with the reduction of administrative burdens.

**Key words:** Competition law, State Aids in agriculture, agricultural *de minimis* aid, Block Exemptions in agriculture

**JEL classification:** K21

### 1 Introduction

EU State aid rules in the agriculture sector have been generally applied by the EU Council under Article 36 of the Treaty, together with the Council regulations which govern both the common organizations of the market and rural development. However, due to the changes of the general scope and structure of the State aid regulation in the EU law the revision of legal instruments applicable to the agricultural sector occurred in the years 2013 and 2014. It resulted into adoption of new legislative acts - Agricultural *de minimis* Regulation, No. 1408/2013, Agricultural Block Exemption Regulation, No. 702/2014 (ABER) and EU Guidelines for State aid in the agricultural and forestry sectors and in rural areas 2014 to 2020 (Doc 2014/C 204/01).

The aim of the present paper is to provide a more detail view on some specific features of the new regulation of State aids in agriculture and their background in other secondary EU law rules. In assessing the State aid measures, the Commission distinguishes between horizontal and sectoral State aid. Horizontal aid concerns schemes potentially benefiting all undertakings regardless of their industry. Sectoral aid is targeted at specific industries or sectors and, accordingly, on undertakings in those sectors (cf. R. Barents, 2008). If, in 1992, sectoral aid accounted for 48 % of EU State aid notified to the Commission, then in 2009 this number has dropped to 15 % only, excluding agriculture, fisheries and transport (see data available on the EU-Commission website).



## 2 Materials and Methods

The paper analyses the overall framework of State aid rules in the agriculture sector. The State aid to promote the economic development of the agricultural and forestry sectors and of rural areas is embedded in the broader Common Agricultural Policy ('the CAP'). As first we discuss the extent to which the State aid rules have been generally applied in the agriculture sector by the Council under Article 36 of the Treaty, together with the extent to which they have been specifically applied under the CAP regulations which govern both the common organizations of the market and rural development. Thereafter we analyse the Agriculture *de minimis* Regulation, which sets out circumstances in which agricultural aid is of such amount that Article 107/1 is deemed not to apply. Following part compares the provisions of the ABER with the general TFEU rules on the State aids. And, finally, we summarize the specific features of agricultural aids that fall to be notified to the Commission.

## 3 Results and Discussion

The agriculture and fisheries sectors have always been subject to special treatment under the TFEU, set out in its Title II (Articles 38 to 44). This reflects the special status granted to farmers in the Union, the justification for which has developed over many years. The special treatment of this sector extends, in principle, to the rules on competition as well. Article 42 TFEU therefore provides that the Treaty rules on competition "shall apply to production of and trade in agricultural products only to the extent determined by the Council ... account being taken of the objectives of the common agricultural policy".<sup>22</sup> In order to discuss and analyse the extent to which the State aid rules have in fact been applied to the agriculture sector by secondary legislation, it is necessary first to understand the basic principles underlying the common agricultural policy (CAP). The objectives of the CAP are described in Article 39, para. 1 TFEU as follows: to

- to increase agricultural productivity by promoting technical progress and ensuring the rational development of agricultural production, as well as the optimum utilization of the factors of production, in particular labour;
- to ensure a fair standard of living for the agricultural community, in particular by increasing individual earnings;
- to stabilize markets;
- to assure the availability of supplies and
- to ensure that supplies reach consumers at reasonable prices.

Where these objectives conflict, it is for the EU institutions to identify such conflicts and, where necessary, grant to one or more objectives temporary priority in order to satisfy the demands of economic factors or conditions.

A further important milestone of the CAP is the recognition of regional differences within the EU. Article 39 para. 2 TFEU provides that such differences must be taken into account in working out the common agricultural policy and its application. This general

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<sup>22</sup> See also Community guidelines for State aid in the agriculture and forestry sector 2007 to 2013 ('Agriculture Guidelines') [2006] OJ C319/1, para I: 'Recourse to State aid can only be justified if it respects the objectives of this policy'

principle has been particularly relevant for the State aid rules, which frequently differentiate according to the region in that the aid is to be granted.

Following substantial reforms under Agenda 2000<sup>23</sup> the regulatory framework of the CAP has been divided into two pillars:

1. price support and market management (with key elements being the Single Common Market Organization and the regime providing direct payments for farmers),
2. rural development.

Specific State aid rules apply under both pillars (for more details see Janků and Mikušová, 2012)

The Single Common Market Organization ('Single CMO') has in principle applied since 1 January 2008. It brought under one umbrella the 21 common organizations of the market which were previously in force.<sup>24</sup> These included, in particular, the common organizations of the market in beef and veal, milk and milk products, sheep meat and goat meat, cereals and the sugar sector. This amalgamation of earlier measures constitutes a central plank in the ongoing process of simplifying common agricultural policy legislation.<sup>25</sup> However, certain products are still unregulated by any common organization of the market, such as potatoes (other than starch potatoes). In accordance with the Art. 34 para.2 TFEU, the Single CMO governs, in particular, the regulation of prices, aids for production and marketing of the various products, storage and carryover arrangements and common machinery for stabilizing imports or exports.

The regime which provides direct payments for farmers was substantially reformed by the mid-term review of the CAP, agreed on 26 June 2003. Most of the direct payments were comprised within a single farm payments (for more details see M.Cardwell, 2004). This is understood to be separated from production, in that no specific form of production, or indeed production at all, is required for its receipt. All direct payments (not only the single farm payment) are, nevertheless, dependent upon the observance of three conditions:

1. farmers must respect statutory management requirements in the areas of public, animal and plant health, environment and animal welfare;
2. farmers must maintain all agricultural land in good agricultural and environmental condition;
3. Member States are to ensure maintenance of the land under permanent pasture. (J. A. McMahon, 2007)

### **3.1 Application of State aid rules in the agriculture sector**

As set out above, under Article 42 TFEU the Treaty rules on competition apply to production and trade in agricultural products only to the extent determined by the Council. In the case of State aids, the determination has been made that, as a general rule, Article 108/1 and the

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<sup>23</sup> Agenda 2000: for a stronger and wider Union, COM (97) 2000

<sup>24</sup> Council Regulation (EC) 1234/2007 establishing a common organization of agricultural markets and on specific provisions for certain agricultural products ('Single CMO Regulation') [2007] OJ L299/1

<sup>25</sup> See eg. Communication from the Commission on simplification and better regulation for the common agricultural policy, COM(2005) 509; and Single CMO Regulation

first sentence of Article 108/3 of the TFEU shall apply to aid granted for production or trade in the products listed in Annex I to the Treaty.<sup>26</sup> That means that, under Article 108/1, the Commission will keep under constant review the systems of aid existing in Member States and shall propose appropriate measures required by the progressive development or by the functioning of the common market. Under the first sentence of Article 108/3 TFEU the Commission must be informed, in sufficient time, to enable it to submit its comments of any plans to grant or alter aids. This is a relatively light degree of control by comparison with the full provisions of Article 108 applying to other sectors.

In addition, the State aid rules were applied in full to the individual common organizations of the market, and this approach was continued on enactment of the Council Regulation (EC) 1234/2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products ('Single CMO Regulation'). Thus, Article 180 of the Single CMO Regulation stipulates that, save as otherwise provided in the Single CMO Regulation, Articles 107, 108 and 109 TFEU shall apply to the production of and trade in the agricultural products specified therein as well as a miscellany of 'other products' specified in Part XXI of Annex I to the Single CMO Regulation. Specific provisions apply for the milk and milk products sector and, sugar beet growers. In addition, by provisions outside the Single CMO Regulation, the State aid rules are applied to the fruit and vegetable and wine sectors.<sup>27</sup>

The Annex to the Rural Development Regulation sets out the maximum aid intensity for individual measures (for example, setting up support for young farmers is limited to €55,000). Detailed provisions govern the circumstances in which these maximum aid intensities may be exceeded. Thus, while aid for the modernization of agricultural holdings is not to exceed the percentages or amounts set out in the Annex, this prohibition is relaxed in the case of investments undertaken preferentially in the public interest and related to the conservation of traditional landscape shaped by agricultural and forestry activities or to the relocation of farm buildings, investments relating to the protection and improvement of the environment, investments relating to the improvement of the hygiene conditions of livestock undertakings and animal welfare, and those with regard to occupational safety at the workplace. (Rural development Regulation, Art. 88/2) Specific rules also govern rural development measures relating to compensation for natural handicaps in mountain areas and in other areas with handicaps (Art. 34), agri-environmental and animal welfare commitments (Art. 39 and 40), and meeting standards based on both the Union and national legislation in the fields of environmental protection, public health, animal and plant health, animal welfare and occupational safety (de Sadeleer, 2002).

Any State aid that intends to provide additional financing for rural development for which EU support is eligible must be notified by Member States and approved by the Commission as part

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<sup>26</sup> Council Regulation (EC) 1184/2006 applying certain rules of competition to the production of and trade in, agricultural products [2006] OJ L214/7

<sup>27</sup> Council Regulation (EC) 1182/2007 laying down specific rules as regards the fruit and vegetable sector [2007] OJ L273/1, Article 43; and Council Regulation (EC) 479/2008 on the common organization of the market in wine [2008] OJ L48/1, Article 127. This separate application of the State aid rules was necessitated by the fact that, on establishment of the Single CMO, the fruit and vegetable and wine sectors were subject to ongoing reform

of its rural development programming (Art. 89). Under these circumstances, the procedure under the Article 108/3 TFEU does not apply.<sup>28</sup>

### 3.2 De minimis rules

Due to its specificity, primary production the agricultural sector is still governed by separate rules, although here too there is an increasing tendency to align them as far as possible with the horizontal rules. The Agricultural *de minimis* Regulation allows grants of up to € 15,000 per holding in any three years in the agricultural sector and within overall limits per Member State. The amounts that each Member State may grant per three-year period have been calculated by the Commission and are set out in the annex to the Regulation. They are based on the average agricultural production output for a given Member State. As such, defined aid does not fulfill all the criteria of Art. 107( 1) TFEU; the Member States may grant it without the Commission's prior approval, but the aid must be transparent and accounted for and Member States must provide information certifying compliance with the two ceilings.<sup>29</sup> Member States may grant *de minimis* aid for almost any objective they deem appropriate, including operating aid, but the Regulation lays down a few limitations in order to avoid distortion of the common organization of the markets in agricultural products: no export aid may be granted and aid may not be linked to the price or quantity of products put on the market or made contingent on one the use of domestic products.

It must be borne in mind, however, that beneficiaries active in the processing and marketing of agricultural or non-agricultural or products, as well as other non- agricultural activities, are not prevented from profiting from the so-called general *de minimis*, which currently amounts to € 200,000 per fiscal year (there is no accumulation of two *de minimis* aids for the same undertaking, activity).

### 3.3 Compatibility rules applicable to the agricultural sector

Even if an aid is granted in amounts exceeding the relevant *de minimis* threshold, it may still be exempted from the notification duty provided that it satisfies the conditions of one of the State aid block exemptions. The exemptions are contained in the General Block Exemption Regulation (thereinafter "GBER") of 2014<sup>30</sup>, including the exemptions for aid to small and medium enterprises (SMEs), applicable to aid for the processing and marketing of agricultural products. However, most aid for SMEs active in the production of agricultural products is governed by the specific Agriculture Block Exemption Regulation<sup>31</sup>.

The ABER applies to 14 categories of aid: investment in agricultural holdings, conservation of traditional landscapes and buildings, relocation of farm buildings in the public interest, aid for setting up of young farmers, aid for early retirement, aid for producer groups, aid

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<sup>28</sup> Where State aid has to be notified to the Commission, notifications are proceeded by the Directorate General for Agriculture and Rural Development (DG Agri).

<sup>29</sup> This construction allows the Commission to monitor the respect of the WTO obligations imposed by the Agreement on trade in agricultural goods

<sup>30</sup> Commission Regulation (EC) 651/2014 -General Block Exemption Regulation,('GBER') (2014) OJ L214/3

<sup>31</sup> Commission Regulation (EC). 702/2014 on the application of Articles 107 and 108 of the Treaty to State aid to small and medium-sized enterprises active in the production of agricultural products ('Agriculture Block Exemption Regulation') (2014) OJ L358/3

in respect of animal and plant diseases and pest infestations, aid for losses due to adverse climatic events, aid towards the payment of insurance premiums, aid for land reparation, aid to encourage the production of quality agricultural products, the provision of technical support in the agricultural sector, support for the livestock sector and aid under certain Council Regulations.

The State aid compatibility rules contained in the block exemption regulations applicable to primary production and processing and marketing of agricultural products make it simpler for the Member States to grant State aid to this sector. When their conditions are met, a Member State may grant aid immediately, without first notifying it to the Commission. Member States only need to inform the Commission of the aid, using a simple information sheet, and only after having granted the aid.

The ABER covers both aid for setting up young farmers and aid for early retirement. In the case of aid for early retirement, it is expressly provided that the cessation of commercial farming activities must be permanent and definitive, and in both cases the detailed criteria set out in the Rural Development Regulation must be satisfied.

Among further types of aid covered by the Regulation we find

- Aid for land reparation,
- Aid to encourage the production of quality agricultural products,
- aid for the provision of technical support in the agricultural sector, including. i.a. aid for the education and training of farmers and farm workers and farm replacement services,
- Support for the livestock sector.

The various aid ceilings apply whether or not the support for the aided project or activity is financed entirely by the Member State or is partly financed by the Community. Aid exempted is not to be cumulated with other State aid, financial contributions provided by the Member States or financial contributions by the Community in relation to the same eligible costs, if such accumulation would result in an aid intensity exceeding the maximum laid down by the ABER. Further, aid exempted by the ABER is not to be cumulated with *de minimis* support in respect of the same eligible expenditure or investment project, if such accumulation would again result in an aid intensity exceeding the maximum laid down by the ABER.

## 4 Conclusions

The State aid shall be fully consistent with the basic guidelines of the EU law regarding the support for agriculture. The secondary EU rules governing the requirements for allocation State aid in the form of subsidies undergo fundamental amendments within the framework of simplification of regulatory enactments forming part of the CAP. The amendments relate to both the content and procedures of the State aid allocation. The goal is to speed up the conformation and approval of the notified State aid payments and to simplify the requirements for allocation of subsidies. The amendments do not aim at affecting the targets of State aid but they provide more flexible and state support. State aid rules in the agricultural sector are based on three different perspectives:

1. general principles of competition policy.
2. coherence with the EU's common agricultural and rural development policies.

3. compatibility with EU international obligations, in particular the WTO Agreement on Agriculture.

The specific and enhanced scope of exemptions from State Aid prohibition that apply to agriculture is given by the sensitive nature of the agriculture as production activity dependent on natural conditions and many other factors, that connect the interventions of farmers to the landscape, ecological systems and rural environment with the public interests of the State and society in the fields of, spatial planning, urban development, industrialisation etc. Because of these limitations to the growth of agricultural production provide states compensation to the farmers for restrictions they have to sustain due to the needs and interests of the society. And it is for the same reason that the EU State Aid rules provide a slightly more generous criteria for exceptions to the prohibition of State aid within the EU Internal market. If, on the one hand, the states modify the rules of the competition in the agricultural sector in the framework of free competition by the public interest and overall needs of the society - and the CAP tolerates this as a right of the States to set restrictions for farmers as elements of the EU Internal Market, then, on the other hand, it logically must allow that the compensation to farmers for these restrictions, represented by State aids in its various forms as direct or indirect support, enjoys in this case, an exception from the general State aid prohibition.

As the most recent example we may refer the public support that the Czech Republic provides to the milk producers in order to subsidise granted price of milk. The production of milk represents, on the one hand, part of the agricultural production, which is to great extent influenced (and restricted) by social priorities (including the requirements arising from the CAP). On the other hand, it is necessary compensate the preservation of these restrictions by granting of State aid in situations where the functioning of the internal market, by itself, does not ensure the competitiveness of this production sector of the market. In this case applies only the notification obligation of the State to the EU Commission when increasing the annual amounts of aid per 1 dairy cow. From the amount of 3400 CZK per 1 dairy cow in 2015, an increase in the amount of aid The Czech Republic notified the increase to more than 5000 CZK in 2016 (Hospodářské Noviny, 20.7.2015). Moreover, the negative impact of the situation on the milk market cumulates here with the abolition of milk quotas from April 1, 2015 and the pressure caused by this measures to the competitiveness of milk producers in individual Member countries

Generally, these specifics have led to a specific legal regime concerning the State aids rules. The regime is created by legal instruments that have been analysed in our paper:

- a) Agricultural *de minimis* Regulation
- b) Agricultural Block Exemption Regulation
- c) Community Guidelines for State aid in the agriculture and forestry sector

Specific forms for State aid in the agricultural sector are contained also in the Regulation on notification forms of 2014. All these instruments together create tolls for a specific approach of the Union towards one of the most sensitive areas of the economy of all Member States. They represent a fair compromise between the efforts of Member States' in protecting their farmers' interests and the aims of the EU to minimise the state influence and intrusion to the competition on the internal market.

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Commission Regulation (EU) No 1408/2013 De minimis Regulation in Agriculture (2013) OJ L337/35

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## Taking the managerial decisions at the enterprise in the age of agriculture globalization in Russian Federation

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**Annotation:** The following article is aimed to demonstrate current state of the agriculture in Russia in the age of the globalization process and offer the benchmarking evaluation method of agricultural manufacturers in order to take managerial decisions. The article describes the level of dependence on the other countries and European countries as well. The influence of Russia being member of WTO and measures taken to support local manufacturer are investigated in the article. Offered benchmarking method was used for evaluation of 24 Russian agricultural companies. The companies were taken randomly from the regions with both good and uncongenial climate conditions. The results identify low rate and poor status of Russian agriculture. The improving measures are presented in the conclusion.

**Key words:** food security, benchmarking, agricultural enterprises

**JEL classification:** G31, G32, Q12, Q14

### 1 Introduction

Currently Russian agriculture has no management culture. The vast majority of the managing specialists prefer traditional USSR principals influenced by political situation in the country. These principals do not satisfy modern life conditions and it causes the need in up-to-date way of taking managerial decisions. It is extremely important for the agriculture which suffers from the shortage of experienced specialists. The following article offers one of the evaluation methods of taking managerial decisions.

Overall area of agricultural lands in Russia is 386,1 million ha but its significant part is uncared and unusable for cultivation or belongs to risky agricultural areas. For this reason a problem of agricultural products import is quite actual in Russia. Net cost of some agricultural products produced in Russia may be higher than the cost of the same products purchased abroad. The solution of this problem is getting extra important in the age of economical globalization and moreover Russia is the part of WTO now. An important aspect here is taking reasonable managerial decisions concerning revealing of reserves in agricultural products manufacturing efficiency taking into account all internal factors and internal competitive environment.

The article has the following objectives:

1. Evaluation of the modern status of the agriculture and its dependence from the import/export
2. Analysis of the government programs of the agricultural support and the evaluation of their efficiency.
3. Analysis of 24 randomly taken agricultural companies by means of benchmarking method.

The methods of effective management of the agricultural company can be different and include tax optimization (Soliwoda, 2013) and reasonable risks evaluation (Savitskaya,



2014). Adrián Nagy offers operating and financial leverage and presents the best ratio of their cooperation in order to decrease risks in managing activity (Nagy, Tarnóczy and Fenyves, 2011)

We offer benchmarking method of evaluation of taken companies.

Benchmarking is a continuous analysis of strategies, functions, processes, products or services, performances, etc. compared within or between best-in-class organisations by obtaining information through appropriate data collection method, with the intention of assessing an organisation's current standards and thereby carry out self-improvement by implementing changes to scale or exceed those standards. (Kodali, 2008)

The benchmarking is the process of identification, understanding and adjusting of available patterns of effective operation of the company in order to improve the operational process in own company. (Rosen, Tyshevych and Inshekov, 2012).

The benchmarking can be used for managerial objectives and estimation of the operation mode of both the company and its competitor. This method is especially important for investigation of the information from the comparative analysis and identification of the weak and strong points of the company's operation.

Anyway the choice of methods and indicators for the benchmarking is defined by managerial process objectives.

## **2 Materials and Methods**

### **2.1 Analysis of the agriculture state in Russian Federation**

The share of export and import for the last decade is 55% exported products and 45% imported products in Russia. The biggest share of exported products (70%) are mineral products (oil, gas, minerals). The share of exported agricultural products was only 2% from the whole amount of the export for the investigated decade. In 2011 the share of exported agricultural products was 2.2% that is 11,964 mln. USD.

As for the import the situation is the following - 45% of the whole amount is for machines and the other equipment, and 14% is the share of agricultural products in 2011. In accordance with the statistics the share of import is decreasing from 26% in 1999 to 14% in 2011 (Web-site of the government statistics of RF)

As for monetary equivalent the situation is not so optimistic - the import is twice bigger than the export. This situation is threatening for the food security of the country. Being the main exported item the grain was supplied in amount of 24.4 mln. t, i.e. 31.5% of its whole production volume.

Russia has big agricultural potential capacities and it is sustainable in the main types of production and keeps the fourth place in grain export but the country has to import significant volume of the agricultural products, raw materials and food products of the kinds which can be produced for internal needs and even imported. The share of local products consumption is 67% in the overall consumption. The overall food security is considered violated if the imported products share exceeds 30%. The doctrine of food security states that the overall share of imported products should not exceed 20%.

The government supports local manufacturer by means of different programs. The main significant program is "Government program of the agriculture development and regulation

of the market of the agricultural products, raw materials and food in 2013-2020". It provides annual financial investments in amount of 40 mln. USD and has such goals as sustainable development of the rural areas (provision with the drinking water, the gas and the housing), soil fertility support, priority development of the agricultural sub-branches and in particular breeding, crop areas increasing, improving of the financial stability of agricultural companies and making share of Russian agricultural products up to 70% and profitability of the companies up to 15% in 2020.

Similar program was realized in 2008 - 2012 and resulted in decreasing of the unprofitable companies number from 21.7% to 20.3% and increasing of the profitability of the agricultural companies from 2.2 to 4.8%. The overall profitability of the agricultural companies in 2009 and 2010 was negative without investments. The profitability of the agricultural organizations is traditionally quite low and doesn't exceed 15% even in case of investments (Ministry of Agriculture of Russian Federation, 2012). It almost eliminates profit of agricultural activity especially taking into account exchange inflation. Increasing of the prices of the agricultural products doesn't provide needed results. The retailers and the agricultural holdings get more profit from importing of some agricultural products than purchasing the same products from local suppliers. In this case some agricultural companies become bankrupts as their products are not competitive with similar imported products.

The condition of the agriculture is characterized by salary level of the specialists. In the beginning of 2013 the salary is 1,5 times less than average salary in the industry (450 USD and 670 USD respectively). The share of food cost is 30-40% and it is 2-3 times more than the similar costs in European countries. The increasing prices of material and technical resources significantly limit modernization and competitiveness of the agricultural products.

Becoming a member of WTO Russia faced new customs tariff regulation which resulted in increasing of imported kinds of the agricultural products. However the overall market security level was kept. Decreasing of the customs tariffs was 2.2%. In order to adjust Russian agriculture to WTO conditions and provide its competitiveness the government developed the provisions of customs tariff and non-tariff regulation of the agricultural products import which provide monitoring and methods of keeping the most sensitive kinds of products in save position.

## **2.2 The method of the rate evaluation for taking managerial decisions**

Obvious advantage of the benchmarking is that the information for its implementation is free and available for each interested person.

During benchmarking implementation the actual financial deliverables of the company must be compared with standard recommended indicators of the definite branch. If the sample company is missing in the branch the average calculated indicators may be used for the analysis Sviridova (2007).

Analytical indicators are calculated in conformance with Russian Legislation.

Taking into account big number of financial processes, variety of the financial indicators, difference in critical evaluations, deviation of actual values and difficulties in the overall estimation of the financial conditions of the organization Dontsova L.V. and Nikiphorova N.A. recommend numerical scoring with subdivision of the companies into 5 groups i.e. excellent, good, normal, unsatisfactory and critical. (Dontsova, 2008)

We consider this approach quite reasonable and it can be used with some modifications for the rate estimation. The main essence of this method is the classification of the companies by the level of the financial risk i.e. definite class may be given to the investigated company in accordance with its actual financial coefficients.

The overall (integral) estimation of the financial condition of the organization consists of financial status and estimation of the operational efficiency of the company 60% and 40% respectively. The calculation of the integral rate is presented in the Table 1 where the column 1 contains indicators used for calculation and their weights are in the column 2. The column 6 shows average value of the indicator for 3 years. The rate evaluation of the financial status is calculated in the following way:

(The rate evaluation 1. x 0.6) + (The rate evaluation 2. x 0.4) =X

**Table 1.** Integral rate evaluation calculation in case of  
Integral Agricultural Production Company named after Michurin

The name of the indicator	The weight of the indicator	Evaluation			Average evaluation (gr.3 x 0.25 + gr.4 x 0.6 + gr.5 x 0,15)	Evaluation with respect of the weight (gr.2 x gr.6)
		2011	2012	2013		
1	2	3	4	5	6	7
I. The Indicators of the financial status of the company						
Equity ratio	0.25	0,005	0.004	0.005	0.004	0.001
Ratio of the net assets and the registered capital	0.1	2.000	1.800	2.000	1.580	0.158
Equity in working assets (ratio)	0.15	0.200	0.200	0.400	0.210	0.032
Current ratio	0.15	0.900	0.800	0.900	0.750	0.113
Quick ratio	0.2	0.700	0.700	0.800	0.680	0.136
Cash ratio	0.15	0.900	0.800	0.800	0.735	0.110
Total	1	Total evaluation (gr.7 : gr.2):				0.549
II. Key performance indicators (financial results) of the company						
Return on equity (ROE)	0.3	0.003	0.004	0.004	0.004	0.001
Return on total assets (ROTA)	0.2	0.045	4.000	0.046	2.416	0.483
Return on sales	0.2	0.000	0.002	0.003	0.002	0.000
Change in cash flow	0.1	0.800	0.800	0.800	0.680	0.068
Speed of current assets movement	0.1	13.00	12.50	13.00	10.750	1.075
Ratio of the cash flow from the other kinds of activity and the cash flow from the main activity	0.1	0.030	0.030	0.020	0.024	0.002
Total	1	Total evaluation (gr.7 : gr.2):				1.630

Source: Own processing

After the calculation of the integral evaluation the company gets definite number of balls. Depending of the number of balls the company is classified as follows:

The rate "AAA"- "AA" means excellent (very good) financial state of the company. It is liable for its short term and long term debts.

The rate "A"- "BBB" means good (positive) financial state of the company. It is liable for its short term debts.

The rate "BB"- "B" means normal (satisfactory) financial state of the company which main indicators belong to standard values. Such companies may be good contractors but the relations with such companies need careful risk management.

The rate "CCC"- "CC" means unsatisfactory (poor) financial state of the company and its financial indicators do not belong to standard values. The reasons of such state may be objective (the company gave the resources to a big project, large-scale deals, decreased economic state of the country or the branch etc.) or caused by non efficient management.

The rate "C"- "D" means very poor or critical state of the company. The vast majority of the indicators are much worse than standard values. The rate "D" may point at great possibility of closing the company in short-term period (great possibility of the failure).

We evaluated 24 randomly taken companies in 2014. The map below presents the location of these companies.

**Fig. 1.** The location of the taken agricultural companies on the map of Russia, 2014



**Source:** Own processing and Ministry of Agriculture of Russian Federation

The investigation covered the regions with good climate conditions (1-11, 13-17, 19-24) and the regions with risk agricultural conditions (12, 18) in the middle of the country. Northern regions with bad weather conditions were not taken into account as their agricultural conditions extremely differ from conditions in taken regions.

### 3 Results and Discussion

The information about investigated companies is presented in the table 2.

The described method of the rate evaluation of the financial state may be used to the date of the balance (on the basis of the information in the end of the period), initial indicators are calculated on the basis of the balance and financial reporting in the end of the period. When the rate evaluation is investigated in dynamic mode the indicators are calculated as growing coefficients: the value in the beginning of the period is divided by the similar value in the end of the period or the average value of the indicator in the beginning of the period is divided by the average value of the indicator for the previous period (or the other basic information for the comparison). In this way we get not only the evaluation of the current state of the company to the date but the evaluation of the company's operation and its ability to change this state in dynamic mode. This evaluation is the reliable measurement of the competitiveness growth in this branch. This evaluation also defines more effective utilization of the manufacturing and financial resources of the company.

According to the data presented in Table 2 Russian agriculture has low rate and poor condition.

**Table 2.** Results of the rate evaluation of the agricultural companies

Finan-cial results in 2013	The rate inside and out	The financial state of the company (each investigated company has own order number)																			
Excellent (AAA)	2-1.6	X																			
Very good (AA)	1.6-1.2																				
Good (A)	1.2-0.8		X																		
Positive (BBB)	0.8-0.4																			X	
Normal (BB)	0.4-0				X			X													
Satisfactory (B)	0-(-0.4)			X			X			X					X				X		
Unsatisfactory (CCC)	-0.4-(-0.8)				X	X		X		X			X	X	X			X			
Poor (CC)	-0.8-(-1.2)								X		X						X				
Very poor (C)	-1.2-(-1.6)							X				X						X			
Excellent (AAA)	2-1.6																				

Source: Own processing

To increase the rate of the company we recommend to take part in the government programs i.e. taking credits with reduced rate, leasing of the equipment in accordance with the government program of agricultural companies support.

To evaluate efficiency of the grants they were divided according to aims i.e. investment aims and general aims for getting more precise view. Zoltan Bacs (2008)

The benchmarking may be used for evaluation of the HR resources. Before 1991 this method was named "socialist competition". The main objective of this method was making achievements of the best workers the property of all workers involved in the branch and increasing of the overall labor efficiency. Currently the benchmarking of HR resources is the analysis of the reward structure. The manager may estimate labor efficiency, competitive salary level, profitability of the investments into the personnel according to the information from different sources such as official statistics, reports from the magazines, analytical reports of different HR or consulting agencies and an advertisement.

In order to get accurate rate evaluation in accordance with presented method each company should make accounting (financial) reports with reliable information about assets, liabilities and financial deliverables. The management of each company should make systematic monitoring of both internal and external environment to reveal, identify and control the risks or to eliminate them completely. All these activities will significantly increase the financial status of the company. The government budgetary funds should be controlled and evaluated in appropriate manner. (Kontsevaya, 2009). Presented method allows the agricultural companies to control and evaluate funds.

#### 4 Conclusion

Russian agriculture is sufficiently independent in the age of the globalization process. The country provides more than 70% of the agricultural products for internal needs. The benchmarking analysis identified satisfactory and worse financial status of 24 companies. It is caused by generally low economic development of the companies, uncompetitive salaries making experienced specialists leave the companies and insufficient support from the government.

Presented method of the rate evaluation is the scientifically proved basis of the development and realization of the algorithm of making reasonable managerial decisions for managers of the agricultural companies in terms of economic globalization and the international competition. In order to take part in the government support program Ministry of Agriculture is recommended to select investment projects with financial, economic and social criteria of economic efficiency.

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# Development of Rural Communities and the Factors Forming Local Political Representation

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**Annotation:** The municipal electoral system is relatively complex mechanism. Its complexity is the limit which to some extent prevents the understanding of its effects. Conference paper examines the factors that influence the formation of councils small rural communities in the Czech Republic. Attention is specifically dedicated to the projection of voter knowledge of local politics in the composition of the municipal council. The aim of the article is to judge the usability of the data on preferential votes for candidates seeking mandates in municipality elections in the Czech Republic while studying the voting behaviour of the electorate. The thesis was created on the basis of the data on elections into local governments in 2010 and 2014, acquired thanks to the Czech Statistical Office (available at [www.volby.cz](http://www.volby.cz)). The exclusive set that we are working with consists of the small municipalities of district České Budějovice (municipalities that have fewer than 500 voters). The data has been subject to an analysis using a simple statistical method and mutual comparison. The analysis of preferential votes to election parties in the small municipalities of the district České Budějovice it appears that the displacement and deformation effects of the electoral system are not as significant as we could first expect. Analysis of preferential votes is a useful tool for understanding voting behavior. Based on the results of this analysis can be argued that the composition of councils small rural municipalities due to real interests of the electorate. Setting the choice of electoral system does not substantially influence political representatives.

**Key words:** municipal council, voting behavior, preferential vote, elections, electoral system

**JEL classification:** R58, D72

## 1 Introduction

Political decision making in the context of territorial autonomy of municipalities in the Czech Republic is entrusted mainly to elected political authorities – municipal councils. Personnel composition of the councils is therefore one of the key factors of endogenous local development. Their importance is magnified by the fact that Czech municipalities are characterized by a relatively high degree of autonomy against the institutions of the state. This also applies to the handling of municipal property. In this context, it is clear that the election of the council is among the key elements of territorial autonomy and thus regional development in the Czech Republic.

The system of election of municipal councils is normatively set in such a way that it allows relatively variable selection of preferred candidates and political parties. Within the voting a voter is enabled to prefer candidates from different lists of candidates, up to a maximum number of mandates that are distributed in the electoral district. With regard to the construction of the entire electoral system, whose purpose is to transform electoral votes to a form of a local political force, however, the question arises whether voters can significantly influence the composition of the municipal council. The article in this context deals with the issue of electoral behavioural patterns, which means patterns of electorate deciding in the framework of elections to municipal councils, as well as the effects



of the applied electoral system in the conversion of votes for candidates for political mandates. Attention is paid to the voters living in rural communities in order to gain an insight into the impact of preferential voting on the composition of the municipal council.

In the case of the election of national political group it was demonstrated, for example, a close relationship between the position of the individual in the social structure and voting behavior (e.g. Matějů and Vlachová, 2000 or Vlachová and Řeháková, 2007) or the existence of long-term emotional bonds of voters to political parties (e.g. Vlachová, 2003 or Linek, 2009). The geographical context of voting behaviour which demonstrated the heterogeneity of the electoral behaviour of the Czech electorate (e.g. Bernard and Kostelecký, 2014 or Pink and Kabát, 2002) was also explored. However, the subject of interest was also the electoral system itself and its effects (e.g. Lebeda 2007 or 2009).

In terms of municipal council elections in the Czech Republic, the electoral behaviour in a wider context was also an issue of several works. Conclusions of virtually all of them were derived from an analysis of the election results themselves. One of the ways to understand the reasons for the electoral decision is to study the inclination of voters to candidates based on their personal characteristics. Voting behaviour is to some extent affected (considered are especially voters with low levels of awareness) by elementary information about the personal characteristics of the candidates. These characteristics may serve voters as the criteria for their electoral choice (Lutz, 2010). They include e.g. the party affiliation of the candidate (Cutler, 2002). In the municipal elections of the Czech Republic a candidacy of candidate for a political party does play a role (Bernard 2012). In small municipalities (up to three thousand inhabitants) candidates standing for the mandate of the lists of independent candidates have the greatest chance of being elected. In large cities (over 50,000 inhabitants), the most successful candidates are those of the parliamentary parties. In mid-range communities there are common lists of independent candidates still most successful, but only slightly compared with the candidates of the lists of political parties. In a simplified way we can say that in the municipal elections, the importance of candidates of political parties increases with the growth of the community, and the importance of independent candidates standing for election on joint lists of independent candidates increases with a decrease in the size of the community.

Besides party affiliation, Bernard paid attention also to the characteristics of gender, age, political affiliation and incumbency. The characteristics of gender, age and political affiliation (whether the candidate is or is not a member of a political party) do not play in voters' decisions crucial role. More significant in this respect are the remaining characteristics. It was demonstrated greater inclination of voters to election support of candidates that obtained university degrees<sup>32</sup>. An important criterion for deciding the election is incumbency<sup>33</sup>. The election of candidates from the unelectable places of the list of candidates<sup>34</sup> is rather unlikely, as it goes for the various size categories of municipalities too. Conversely,

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<sup>32</sup> Achieved academic and scientific degrees belong among significant long-term status variables in the Czech company and they are commonly referred to as a part of the name in the Czech Republic.

<sup>33</sup> Term incumbency is usually used in connection with so-called incumbency effect. This means a favouring of the candidates elected to political groups in the past in filling positions on electoral lists nowadays.

<sup>34</sup> Unelectable place of the list of candidates is such position on the list which does not gain the mandate for a candidate (assuming that there will not be a shift in the candidate list to its upper floors).

the previous holding of a political office will likely lead to gaining a mandate (Bernard, 2012). Nevertheless, the importance of preferential votes cannot be completely overlooked. Preferential votes have, in addition to contributing to the re-election of former councillors, also stabilization effects in terms of personnel. They often contribute to the re-election of candidates who were previously members of the municipal council but now they are standing for a mandate from unelectable place of the list (Šedo, 2009; Balík, 2009; Balík, 2012). Preferential votes for party candidates were also used in the case of an analytical work aimed at estimating techniques used in the event of voting in municipal elections. It turned out that in small communities there prevails a tendency to support more candidates from various lists, while in the case of larger municipalities the electorate is increasingly voting for the entire party lists (Kopřiva, 2011).

The issue of electoral behaviour is also closely linked with electoral participation. Based on the election results, this area was paid attention to in the case of municipal elections in the Czech Republic. It turned out that the important factors of voter turnout include the size of the municipality (Čermák and Stachová, 2008). It is usually also related to the competitiveness of the election. With increasing competitiveness of the election, interest in participating in the elections also grows (Ryšavý and Bernard, 2012).

Despite the above mentioned it can be argued that relatively few works that would pay attention to the communal electoral system and its effects have been carried out in the Czech Republic. Normative aspects of the development of the municipal electoral system were studied by Outlý (2003). Its specificity was discussed by Lebeda (2009). The election system of municipal councils is relatively complicated. It is this complexity that imposes certain restrictions on the ability to understand its effects. The system is primarily built on openness for election of individuals, but in fact it distributes mandates primarily based on the position of the candidate on the list. The consequence is that relatively small or even smallest number of preferential votes can lead to the election of a candidate, while the largest number of votes for a candidate may not lead to his election. In addition, this fact is not generally known to the electors (Lebeda, 2009) and they do not adjust their electoral behaviour to it, thereby giving space for deformation of voter interests in their conversion for the staffing of the municipal council.

A characteristic feature of the system of municipal council elections in the Czech Republic is the variability of expression of electoral preferences. Voters may choose different candidates from several lists of candidates, but they can also give all available votes to a single electoral entity<sup>35</sup>, or combine both prior techniques of voting, which means to give some votes to one of the possible political parties and the remaining votes to different candidates from different lists of candidates within elections.

Regardless of the voting technique the votes for candidates are always primarily votes for an electoral party. Mandates that party on the basis of their distribution via d'Hondt's method received are allocated to candidates according to their positions on the list sequentially from the first. The order of candidates can be changed only if one of the candidates achieved so many voices that their number is at least 110 % of the votes compared to the average of the votes per candidate of the list. Such a candidate (candidates) then shifts (shift) on the first

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<sup>35</sup> If the list of candidates is not fully occupied, the party receives from the voter just as many votes as candidates running for the mandate from this party's list of candidates.

place (places) of the list. A voter who is familiar with the nature of the system and can imagine consequences of his action will likely displace from his election candidates who stand for mandates from unelectable places of the list<sup>36</sup>, and even more so if there are some candidates that he do not wish to be elected standing for mandate on electable places of the list. In case of informed voters we can expect more frequent tendency to support the entire lists of such parties, on whose electable positions there are candidates aspiring for mandate who he deems appropriate representatives of political interests. With regard to the normative setting of system components of municipal elections in the Czech Republic we can argue that there is the deformation of the interests of all voters, not just those who do not know the effects of electoral systems (and they are probably a significant majority).

## 2 Materials and Methods

The research of voting behaviour in the municipal elections is limited by the lack of data on basis of which it would be possible to evaluate it. From the election results, recorded and published by the Czech Statistical Office, we can derive electoral support for individual municipalities or their districts and also the number of preferential votes for individual candidates. An analysis of preferential votes is the one of few opportunities to understand electoral behaviour in the case of municipal council elections. The conclusions of these analyses, however, lead to an approximate conclusions. Freedom that is given to voters during the election does not allow us to know exactly to what extent a support for the candidate arises from his 'direct' choice and to what extent it is determined by the election of the party on whose list of candidates one is standing for a political mandate.

In accordance with the abovementioned Lebeda's assumption that most voters cannot assess the effects of the municipal electoral system, one may consider that they prefer candidates with the assumption that their electoral support will increase the chance of the election of the candidate in proportion to the weight of the vote. Similarly, one can assume that voters who prefer one of the parties standing for election elect it as a whole. The prevailing method of voting in support of electoral bodies can be indirectly evaluated according to the distribution of votes for candidates on their lists of candidates. It is evident that with a considerable variance in the number of votes for individual candidates on the list we can expect, for such a party, the prevailing election via support for some of its candidates. Otherwise, assuming a small scattering of preferential votes in the list of the reference entity, it can be expected that the support for candidates arises from the prevailing support for a subject standing for election as a whole. Based on the analysis of the distribution of preferential votes for candidates on the list we can indirectly assess not only the predominant technique of voting, but also a real political interest of the electorate compared to the staffing of the municipal council.

Scattering of preferential votes in the document is the basis of the following analysis. Low rate of variation coefficient value indicates supporting list as a whole. High rate, on the contrary, indicates the prevailing support only for some of the candidates on the list. When analysing the preferential votes for candidates of the lists on the occasion of municipal elections of bigger amount of municipalities it can be assessed whether we can found any predominant

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<sup>36</sup> Unelectable place means the position of the candidate on the list that would not lead to any representative mandate if mandates were allocated only according to the order of candidates on the list.

patterns in the behaviour of voters and generalize the findings. The article is in this context focused on the rural population of the Czech Republic and an effort to understand the nature of its voting behaviour. The aim is to assess the applicability of the data about preferential votes in studies of voting behaviour. The work is created based on the results of municipal council elections in 2014, which were obtained thanks to the Czech Statistical Office (available at [www.volby.cz](http://www.volby.cz)). A chosen sample with which we work are rural municipalities with fewer than 500 registered voters in České Budějovice District, which is located in the South Bohemian Region.

### 3 Results and Discussion

In the case of elections, which took place in 2014 in the rural villages of České Budějovice District, the rate of the use of preferential votes can be assessed by calculating the variation coefficients of preferential votes for individual candidates and parties. In České Budějovice District, there are located 67 municipalities that have fewer than 500 registered voters. Already a first glance at the data concerning the results of elections in these municipalities shows (understandably) that the party systems of small rural communities are not richly fragmented. In the municipalities concerned, political power is delegated always to the hands of a few political entities, in a number of them to even a single political entity. In nine municipalities, there make up the local party system three entities. In only one of the total number of municipalities, the local council is shared by four political parties. The most common type of council in the chosen sample is a council represented by representatives of only one election subject (25) or two election subjects (13). A separate category of municipalities can be also constituted from those in which the mandate of the municipal council is stood for by candidates that stand for election separately on its own list. Although within the conditions of the Czech Republic it is a relatively rare phenomenon, which is caused by disfavour of the system against such candidates, it is found in more cases in České Budějovice District. In some municipalities only independent candidates stand for election (13), in one municipality there are independently standing candidates apart from a political entity with multiple candidates on the list. While in the case of mere self-candidacy of independent candidates, the electoral system turns into majority system and preferential votes will gain a decisive role in the redistribution of local council seats, in case of the municipality where there is also other entity with multiple candidates apart from independent candidates separately running for political mandates, the result effect of the electoral system is considerable disadvantage for this entity. Regarding the first viewpoint on the calculated variation coefficients of preferential votes within the individual lists of political parties in these communities, we cannot give similarly unequivocal conclusion as the one about the number of parties forming the local party systems.

From the survey data about variation coefficients we cannot generalize that voters tend to one form of electoral behaviour. Some generalized conclusions can be derived from an analysis of preferential votes within the comparison of municipalities in which the same number of electoral parties stands for a representative mandates. Interesting in this context is the village where only one political entity stands. One would assume that this type of village is associated with an uncompetitive party system and the voters will not have, for this reason, the need (and opportunity) to choose candidates from multiple lists. Therefore, they will focus their vote on a single entity standing for elections and will vote it as a whole. However, from the values of calculated coefficients, it is evident that the competitive environment arises

even in some of the villages with only one party candidate. It is so due to the given number of candidates on the list. If the number of candidates exceeds the number of elected representatives, even if only by one, the variation coefficient value achieves medium or higher levels. Only in one of these cases, the variation coefficient value, resulting from a rate of deviation of preferential votes from the average to one candidate on the list, achieves a value slightly below 0.2. It is thus clear that voters in these municipalities elect predominantly by selecting candidates from a possible list. Equally, in municipalities with a single candidate list, whose number of candidates corresponds to the number of elected representatives, voters in most cases cross party as a whole, which is certainly not a surprising finding. The variation coefficient values are in these cases far below 0.2.

The analysis of municipalities with one electoral body standing for election shows that a plurality of political environment leads voters to a preference of candidates to political entity. In this context, the question arises whether the increase in the number of political parties will lead voter to prefer entire subjects standing for election or party candidates. In the case of municipalities, in which political mandates were stood for by two full lists of political parties, we met the typical vote for party in one case (the village Doubravice). The coefficients of variation of both parties are so small that it can be assumed that most voters choose whole party at the expense of using preferential votes and selecting different candidates from different lists of candidates within elections. We cannot, however, assume that it is the result of local cleavages that divide the electorate into two irreconcilable camps, considering the fact that the total support for a party is relatively small. In about half the cases, when two political parties stand for election in a community, one of them reaches a relatively low value of variation coefficient, while the variation coefficient calculated from the preferential votes for candidates on the list of the other party has a medium or high value. Additionally, it is not always true that the low rate of the variation coefficient value belongs to the party more successful in the elections.

Propensity to support the full lists of political parties cannot be traced even in the case of municipalities where three elected bodies stood for political mandates. Among the eight such municipalities we can find only one (Hůry) where the variation coefficient achieved a low value by some of the parties running for the election. In the case of this village, there are two parties, based on which we can assume that the majority of electorate inclines to support one or another as a whole and thus conclude that the electoral behaviour is shaped by the conflicting environment.

Based on the analysis of election data it can be argued that the majority of voters participating in the election of local councils of rural communities in České Budějovice District selects candidates from multiple lists. The prevailing support of the entire party lists can be found in a small number of cases and these are usually municipalities, where only one political party with a number of candidates equal to the size of an elected council stands for election, or municipalities with two subjects standing for election, one of which is elected by majority as a whole. The very fact that the majority of electorate tends to candidate selection leads to the consideration about the inappropriateness of the electoral system. Since voters choose candidates, it is clear that they are not satisfied with all the candidates proposed by a party or that they find other candidates on the lists of other parties better. That implies, voters understand preferential voting as a personal choice. This, however, is not supported by an election system, for which preference votes are primarily votes for a party as a whole (as mentioned above).

## 4 Conclusion

Political bodies in rural communities, which are one of the key endogenous factors in the development of municipality, arise, as shown at least by the results of the survey about rural municipalities of České Budějovice District, mostly on the basis of preferential voting of the electorate. Electoral behaviour of people in these small communities is obviously shaped by neighbouring influences and personal knowledge of the candidates.

However, it is certainly true that the electoral system favours candidates from the front places of the lists. Due to the aforementioned majority preference of using preferential votes and selecting different candidates from different lists of candidates within elections, it is true that the distraction of preferential votes for candidates on the list is considerable. It also usually leads to the election of the more preferred candidates because they manage to get a number of votes which amounts to at least 110 % compared to the average number of votes per candidate on the list. However, candidates who would have gained seats in the local council if mandates had been distributed solely on the basis of mere number of preferential votes are, due to the electoral system, not successful and are replaced by those who stand for election on the front places on the lists.

Discussions regarding the municipal electoral system are obviously not easy, and that's due to the heterogeneity of the settlement of the Czech Republic, various interests of the electorate of variously sized municipalities etc. The results of the work, however, encourage us to reflect on the reform of the electoral system that would be able to better take into account the interests of the electorate. One of the options is to adjust the system for rural communities alone. In addition, it appears that working with preferential votes can be useful, despite certain limitations that stem from the lack of information about the way of voting of a particular voter. On the basis of the work with preferential votes, the way in which voters predominantly vote for the given electoral bodies can be assessed precisely. This knowledge could provide information about the voting behaviour and thus about the interests that residents of communities in the Czech Republic have.

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## Factors influencing the use by farmers of disaster loans - empirical research

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**Annotation:** Disaster loans are a form of public support funds to mitigate the effects of unfavourable events, such as drought, hail, rain, early spring frosts, floods, hurricanes, lightning, landslides, avalanches, excessive precipitation or destruction by frost, contributing to resumed production on farms. The main objective of the study is to identify links between the use of disaster loans and selected hallmarks of farms in the region of Middle Pomerania. The study used secondary data sources and primary data obtained in the course of empirical studies. The population consisted of farms in the region of Middle Pomerania. In the research problem process, the authors used a literature analysis and a data analysis – a descriptive and graphical method of data presentation and survey research. The measurement technique was a survey. The research tool was a questionnaire. The purpose of the study is to identify connections between the use of disaster loans and the selected features that characterize arable farms in the Middle Pomerania region. To realize the abovementioned goal, a multidimensional analysis of correspondence was also used. This analysis allows one to obtain an answer to the question: what factors imply the use of disaster preferential loans by farmers in the Middle Pomerania region? Based on the results obtained, it can be found that farmers in the Middle Pomerania region do not use very willingly loans with preferential interests (as little as 11% of the respondents used this form of public support). The analysis demonstrated that farmers aged below 45 with secondary or higher education and who run farms which specialize in plant or animal production did not use any disaster loans. Close to 30% of farmers who received funding were of the opinion that the compensation was insufficient to cover the losses caused by natural disasters.

**Key words:** Up to 7 key words. disaster loans, farmers, Middle Pomerania

**JEL classification:** F34, H53

### 1 Introduction

Due to the specific nature of the agricultural activity, this activity is particularly exposed to the natural hazards, whose character, force and frequency of occurrence is not permanent and results from weather and climatic determinants. The occurrence of natural hazards is independent of humans, it is predictable to various degrees, and sometimes it is difficult to predict them and thereby to control them. Many of these hazards can assume the form of a cataclysm (a natural disaster). Natural hazards have an influence not only on the households of farmers and production and marketing connections, but they also have an impact on the social and economic development of a region. The effects of natural disasters have a direct or indirect influence on agricultural production. The direct effects of natural disasters include water pollution, physical damage to crops or farm animals, loss of perennial plants, an increased susceptibility to diseases and a destruction of the agricultural infrastructure. Indirect effects are related to the loss of the production capacity or a decrease of the production, a reduction of the volume and quality of production sold and an increase of production costs.

An involvement of the government as well as financial support on the part of public institutions is required because the agricultural activity is burdened with a high level of risk,



and it is affected by numerous unfavourable phenomena: not only natural ones but also social and economic ones (Rosa, 2011a). In the event of a natural disaster, farmers may apply for aid from public funds. This aid serves the purpose of a reduction of risk, a limitation of its effects and a restoration of the original production capacity of the farm.

In Poland, public support in agriculture is provided on the grounds of national legislation regulations and is based on EU regulations. It is granted on the basis of decisions issued by public administration bodies as well as by other entities from the sector of public finances (agencies, funds, local government entities or economic institutions). It consists of three pillars. The first one refers to the support instruments of the family's living conditions family. The second one is related to aid connected with agricultural activities (agricultural tax reliefs, reliefs related to farmer social insurance contributions, loans with preferential terms to resume production, deferments, payments by instalments, remittance of a part or the whole of payments related to contracts of sales and lease of the real property of the State Treasury Agricultural Property Stock, subsidies in relation to specific sowing material used for sowing or planting, subsidies to the contributions of agricultural producers related to insurance against the occurrence of acts of God, advancements of payment dates for direct payments related to areas with unfavourable farming conditions, financing or co-funding of the costs of crops, transport and utilization of dead animals). The third pillar is related to support within the framework of the Programme of the Development of Rural Areas covering the years 2007-2013, Measure 126: "Restoring the potential of agricultural production destroyed as a result of the occurrence of natural disasters and implementation of appropriate preventive measures" (Kurdyś-Kuajwska, 2014).

Preferential loans are one of the instruments of public support for farms in those areas where natural disasters have occurred causing losses in production property and in agricultural production. In Poland, the preferential loan is an important tool of domestic support. It had been widely used for intervention in agriculture since the beginning of the transition process to market economy until the accession to the EU (Daniłowska, 2009). These loans are included in the instruments of government support and are offered by the Agency for Restructuring and Modernization of Agriculture. The financial support system consists in subsidies from the Agency to interests on loans that are granted from the funds of both commercial and cooperative banks (those that cooperate with the Agency). Those interested in being granted preferential loans from banks, sign contracts with the ARMA, which make precise the terms and conditions of loans, procedures, rules of control and limits of subsidies that are at banks' disposal (Daniłowska, 2008).

Financial aid is realized on the grounds of the Ordinance issued by the Council of Ministers of 30 January 1996 on detailed directions of the activities undertaken by the Agency for Restructuring and Modernization of Agriculture and manners to realize these<sup>37</sup> [Journal of Laws No. 16 Item 82 as amended] and the Ordinance issued by the Council of Ministers of 22 January 2009 on the realization of some of tasks by the Agency for Restructuring and Modernization of Agriculture<sup>38</sup> [Journal of Laws No. 22 Item 121 as amended]. After

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<sup>37</sup> Ordinance by the Council of Ministers of 30 January 1996 on detailed directions of the activities of the Agency for Restructuring and Modernization of Agriculture and manners to realize these [Journal of Laws No. 16 Item 82 as amended]

<sup>38</sup> Ordinance by the Council of Ministers of 22 January 2009 on the realization of some tasks of the Agency for Restructuring and Modernization of Agriculture [Journal of Laws No. 22 Item 121 as amended]

Poland had acceded the EU structures, the terms and conditions of loans were adapted to the EU regulations. The Polish national aid system became compliant with the Community guidelines on government aid in agricultural and forest sectors covering the years 2007-2013 (O.J. EU C 319 of 27 Dec. 2006 page 1) and the Ordinance issued by the Commission (EC) No. 1857/2006 of 15 December 2006 on the application of Art. 87 and Art. 88 of the Treaty in relation to the government support for small and medium sized enterprises that run activities connected with the production of agricultural produce, and which amended Ordinance (EC) No. 70/2001 (O.J. EU L 358 of 16 Dec. 2006 page 3) (Rosa, 2011b). Since 1 January 2007, preferential loans have been offered in accordance with the EU guidelines (Rosa, 2011c).

Preferential disaster loans are aimed at resuming production in arable farms and in special sections of agricultural production where damage occurred caused by a drought, hailstones, heavy rainfall, negative effects of overwintering, spring slight frosts, flood, gale, lightning, ground sliding or avalanches. The disaster loan is offered in two loan lines, i.e. an investment loan (KL/01) for the reconstruction of fixed assets destroyed, and a working capital loan (KL/02) to restore production capacity in an arable farm by the purchase of inventories for agricultural production.

The purpose of the study is to identify connections between the use of disaster loans and the selected features that characterize arable farms in the Middle Pomerania region. To realize the abovementioned goal, a multidimensional analysis of correspondence was used. This analysis allows one to obtain an answer to the question: what factors imply the use of disaster preferential loans by farmers in the Middle Pomerania region?

## 2 Materials and Methods

In the present study, empirical material was used that was obtained in the course of the implementation of the project entitled: An increase and allocation of financial and tangible assets of farmers (agriculture companies and households) of the Middle Pomerania (Decision by the Ministry of Science and Higher Education No. 3577/B/H03/2011/40). Arable farms from the Middle Pomerania region constituted the population goal. The Middle Pomerania region forms an integral part of two provinces: Pomorskie and Zachodniopomorskie. In the study, secondary data sources were used (public statistics, i.e. from the Central Statistical Office and the Agency for Restructuring and Modernization of Agriculture) together with the sources of original data obtained in the course of empirical research carried out. The data was collected from owners and those who manage arable farms in the year 2012.

An analysis of literature, an analysis of data: a descriptive and graphical method of data presentation, and a survey method were used to realize the research problem undertaken. The survey form constituted the measurement technique, and a questionnaire form was the research tool. From among the respondents, 10.89% used preferential loans including 5.74% of those who applied for preferential disaster loans. The majority of beneficiaries (82.75%) received financial support. The farmers applied more frequently for funding disaster working capital loans rather than investment loans. Out of all the disaster loans granted, 21.43% of the amount granted was sufficient to cover losses in the arable farm. In the remaining cases, the amount of the loan granted covered an average of 80% of losses.

A multidimensional analysis of correspondence was used to realize the research problem undertaken.

The research algorithm was according to the following steps (Stanimir, 2005; Machowska-Szewczyk and Sompolska-Rzechuła, 2012):

1. Determination of the Burt matrix  $\mathbf{B} = \mathbf{Z}^T \mathbf{Z} = [b_{ij}]_{J \times J}$ , where:  $\mathbf{Z} = [\mathbf{Z}_1, \mathbf{Z}_2, \dots, \mathbf{Z}_Q]$  –

a compound matrix of markers for  $n$  objects and  $Q$  features,  $J = \sum_{q=1}^Q J_q$ ,  $J_q$  – number of the category of  $q$  feature.

2. Determination of the matrix of the relative frequencies observed whose elements constitute the value of the quotient of the numerical strength and the sum of the numerical strength of all the features of the Burt matrix

3. Determination of line (column) profiles as the quotients of the relative frequencies observed of the line (column) and the sum of the frequency of a given line (column).

4. Conversion of  $\mathbf{P}$  matrix in  $\mathbf{A}$  matrix of the weighted deviations of profiles from the line

(column) centre:  $\mathbf{A} = [a_{ii}]$ , where:  $a_{ii} = \frac{p_{ij} - p_{i \cdot} p_{\cdot j}}{\sqrt{p_{i \cdot} p_{\cdot j}}}$ ,  $p_{ij}$  – elements of  $\mathbf{P}$  matrix,  $\mathbf{P}$ ,  $p_{\cdot j} = \frac{Q b_{jj}}{n Q^2}$ ,  $i, j \in \{1, 2, \dots, J\}$ .

5. Decomposition of  $\mathbf{A}$  matrix according to singular values:  $\mathbf{A} = \mathbf{U} \mathbf{\Gamma}^2 \mathbf{U}^T$ , where:  $\mathbf{U}$  – matrix of the own values  $\lambda_k$  of  $\mathbf{A}$  matrix,  $\mathbf{\Gamma}^2 = [\gamma_k^2]$  – diagonal matrix including the squares of singular values  $\gamma_k$  of  $\mathbf{A}$  matrix,  $k \in \{1, 2, \dots, K\}$ ,  $K$  – real dimension of projection,

$K = \sum_{q=1}^Q (J_q - 1)$ ,  $J_q$  – number of the category of  $q$  feature.

6. Determination of the matrix that includes the coordinates of the feature category on all the axes of real connections:  $\mathbf{F} = \mathbf{D}_r \mathbf{U} \mathbf{\Gamma}$ ,  $\mathbf{D}_r$  – diagonal matrix of the boundary frequencies of lines.

7. Seeking a lower dimension of space for the presentation of results in such a manner so that a deformation of the output configuration of points could be as small as possible:

a) Criterion for the selection of the dimension of projection space may constitute a participation of the inertia of the dimension established in the total inertia, i.e. in the sum of all the main inertia:

$$\tau_{K^*} = \frac{\sum_{k=1}^{K^*} \lambda_k}{\sum_{k=1}^K \lambda_k} = \frac{\sum_{k=1}^{K^*} \lambda_k}{\lambda}, \quad \text{where } K^* \in \{1, \dots, K\} \text{ is the selected dimension}$$

of projection. It is accepted that the best solution is the selection of  $K^*$ , whose  $\tau_{K^*}$  has the value close to 1, and an increase of the space dimension does not cause any sudden increase of this index.

According to Greenacre, the optimal dimension  $K^*$  of space is:

$$K^* = \max \left\{ k \in \{1, \dots, K\} : \lambda_k > \frac{1}{Q} \right\}$$

Greenacre also provides a method to improve the results of an analysis of features recorded in the Burt matrix by rescaling the coordinates of the individual points according to the formula:  $\tilde{\mathbf{F}} = \mathbf{F} \cdot \Gamma^{-1} \tilde{\Lambda}$ , where:  $\tilde{\Lambda}$  – the diagonal matrix of the first  $K^*$  own values

modified according to the formula:  $\tilde{\lambda}_k = \left(\frac{Q}{Q-1}\right)^2 \left(\sqrt{\lambda_k} - \frac{1}{Q}\right)^2$ ,  $\mathbf{F}^*$  – the matrix of the first  $K^*$  coordinates of categories from  $\mathbf{F}$  matrix.

A classification of the results of the analysis of correspondence with the Ward method was carried out in the study (Joe and Ward, 1963).

In the study, the following variables and their categories were accepted by assigning appropriate denotations to them:

1. use of disaster loans: KR\_KLES (Yes, No),
2. status of arable farm: ST (T - commercial, NT – non-commercial),
3. age of the person who manages the arable farm: WIEK(<=45 – lower than 45 years, >45 – higher than 45 years, 45 years – average in the group examined),
4. education of the person who manages the arable farm: WYK (SW – secondary or higher, PZ – primary or vocational),
5. average acreage from the years 2004-2012: (<=15 – at most 15 ha, >15 – over 15 ha, where 15 ha is the median of the acreage),
6. type of production: R\_PR (M – mixed, Z – animal, R – plant),
7. possession of voluntary insurance: UBEZ (Yes, No).

The first feature was recognized as dependent, and the further ones were considered to be independent.

### 3 Results and Discussion

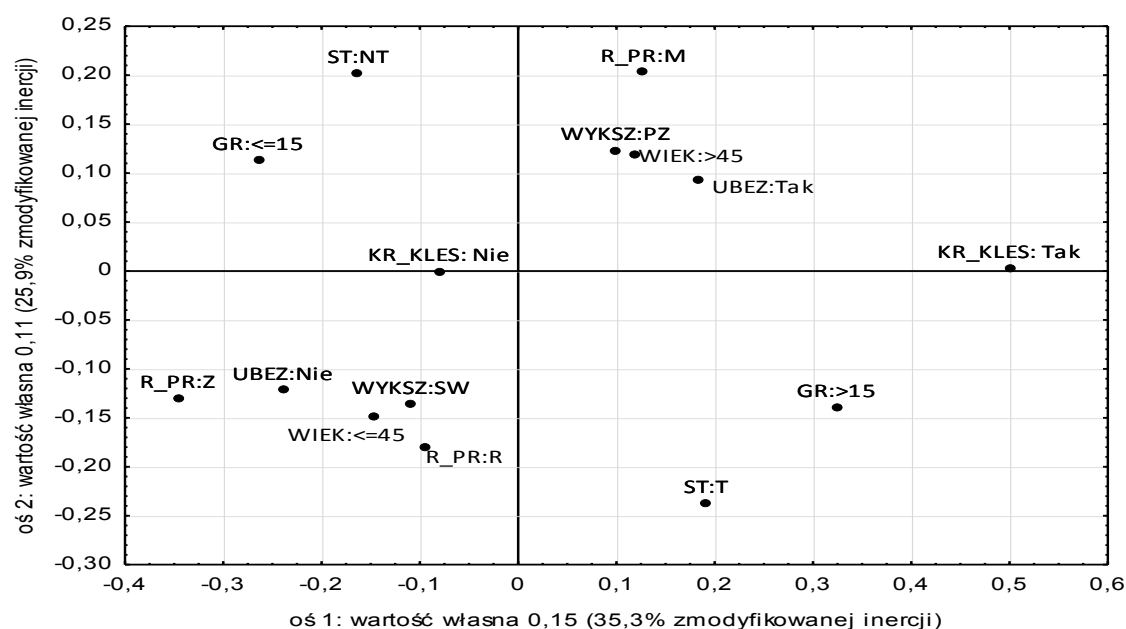
In the case of the research into connections between the use of disaster loans and the categories of the selected features, the Burt matrix was obtained with the dimensions of  $15 \times 15$ . The dimension of the real space of the co-occurrence of answers to the question was 15. The optimal dimension of the projection spaces of the categories of variables, in accordance with the Greenacre criterion, is selected on the grounds of the following condition:  $\lambda_k > 1/Q$ . In the case analyzed, the  $i$  value indicates the  $R^i$  space (cf. Table 1)

The use of the elbow criterion points to the possibility of an analyze of the connections of the categories of features in three or four dimensions ( $R^3$  or  $R^4$ ). In the study,  $R^4$  was selected taking the Greenacre criterion into consideration. After making modifications of the own values, the presentation of the co-occurrence of the categories of features will be presented in  $R^2$ , where the lag explanation degree is over 61% of the inertia modified. A graphical presentation of the results for the analysis of correspondences in the two-dimensional space is presented in Fig. 1.

**Table 1.** Singular values and own values as well as the explanation degree of total lag prior to and after modification

Number of dimensions $K$	Values		Percent	Values				Percentage	
	$\gamma_k$	$\lambda_k$	$\lambda_k/\lambda$	$\tau_k$	$\tilde{\gamma}_k$	$\tilde{\lambda}_k$	$\tilde{\lambda}_k/\tilde{\lambda}$	$\tilde{\tau}_k$	
1	0.478	0.228	19.984	19.984	0.391	0.153	35.294	35.294	
2	0.430	0.185	16.187	36.172	0.335	0.112	25.944	<b>61.238</b>	
3	0.394	0.155	13.598	49.770	0.293	0.086	19.864	81.102	
4	0.388	0.151	<b>13.174</b>	62.944	0.286	0.082	18.898	100.000	
5	0.378	0.143	12.483	75.427	$\tilde{\lambda} = 0.433$				
6	0.332	0.110	9.653	85.079					
7	0.310	0.096	8.414	93.493					
8	0.273	0.074	6.507	100.000					
		$\lambda = 1.1429$							

Source: Author's own calculation

**Fig. 1.** Presentation of the results of the connections of the categories of features in two-dimensional space

Source: Author's own calculation.

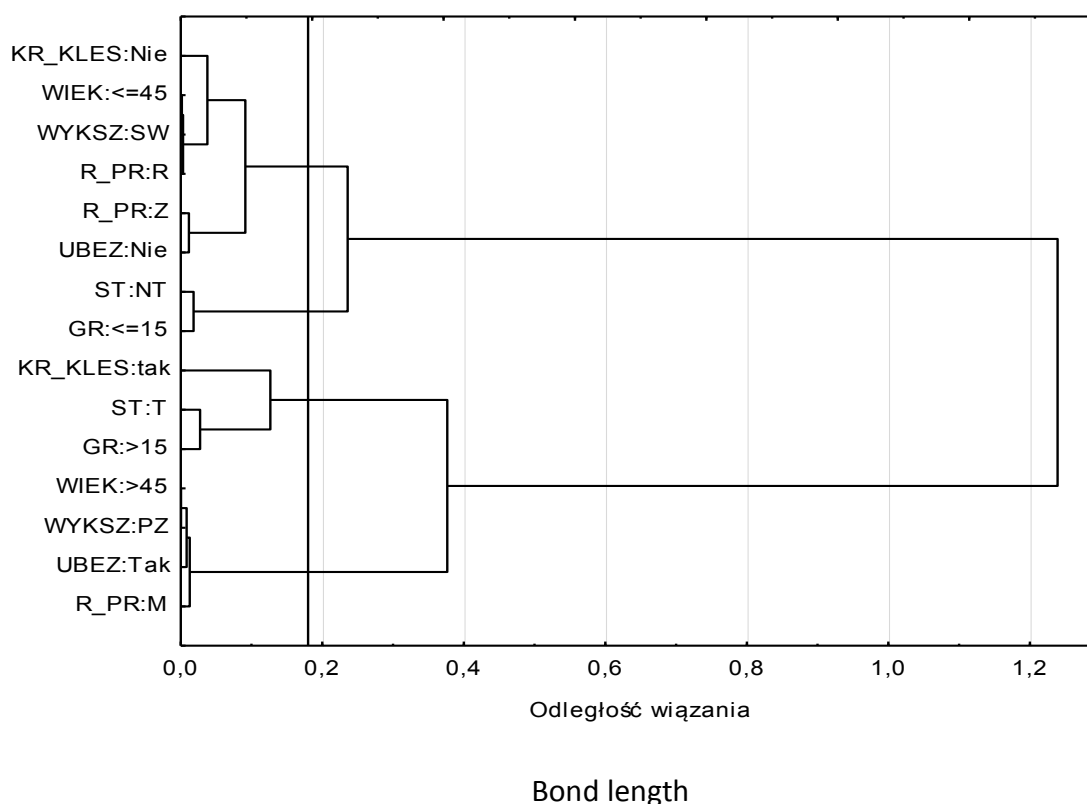
Axis 1: Own value 0.15 (35.30% of the inertia modified)

Axis 2: Own value 0.11 (25.90% of the inertia modified)

It can be found on the grounds of the dendrogram that the following category: use of disaster loans by farmers in the Middle Pomerania region is connected the most with the category that indicates the commercial nature of production in the arable farm and the acreage of over 15ha. The analysis demonstrated that farmers aged below 45 with secondary or higher education and who run farms which specialize in plant or animal production did not use any disaster loans. This group of farmers did not possess any insurance coverage, either. Hence, it can be assumed that these are arable farms that are exposed to a small extent to the occurrence of hazards of a natural character. The analysis also demonstrated that certain categories of features are not connected with the following category: use of disaster loans. These are chiefly the following categories: a non-commercial status of the arable farm

and the average acreage of up to 15 ha. In view of this fact, it can be assumed that those farmers did not use any disaster loans.

**Fig. 2.** Dendrogram of the division of the categories of features with the aid of Ward's method with square Euclidean distance



Source: author's own study

It is evident based on an analysis of the dendrogram that farmers aged over 45 with vocational education at the most, and who manage mixed arable farm, did not take into consideration any possibility to use public support in the form of disaster loans.

## 4 Conclusions

For those arable farms which are afflicted by natural disasters, public support in the form of preferential disaster loans offers an opportunity to restore their original production capacity. Based on the results obtained, it can be found that farmers in the Middle Pomerania region do not use very willingly loans with preferential interests (as little as 11% of the respondents used this form of public support). The analysis demonstrated that it was chiefly farmers from commercial farms who were the beneficiaries of preferential disaster loans.

Farmers from the Middle Pomerania region used more frequently working capital loans connected with the restoration of productivity through the purchase of inventories for production rather than investment loans connected with opening of fixed assets. The minimum level of funding was 37.20% on the average, while the maximum level reached 60.00%. Every third farmer who received funding claimed that the level was insufficient to cover the losses that were the result of the occurrence of natural disasters. Moreover, farmers claimed that the level of disaster loans and the resulting low coverage of the losses

make them use other methods as well to limit the risk in order to protect themselves against the said risk.

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## Break Even Point in Circular Economy of Biofuels

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**Annotation:** Research question is if excess of energy in C:N balance relevant source for CAP restructuring. The objective is to reduce value of agricultural and regional subsidies by increased price of products made out of waste. It was concluded that 30% decrease of agricultural subsidies is possible due to synergy of production of lacking proteins with fuel standardisation. Abandonment of investment subsidies for biogas, which is lacking any synergy due to subsidised price of green energy will also save many hectares for food and feed production. Balancing C:N doesn't solve problem of obesity. Therefore, saved subsidies should be partly used for schools opening better horizons to people with low social status. Subsidies for healthcare of people with high social status who rarely fall in obesity are not used in reality. Further development of technology converting waste into products would save subsidies for waste processing.

**Key words:** Economy, circular, energy, protein, biofuel, oilseed rape

**JEL classification:** Q42, Q57

### 1 Introduction

Waste is often useful raw material, exceeding balance. Price of excessive energy over proteins (C:N) in European food and feed is seen at obesity, investments to processing of renewable fuels and climate warming. Negative excess of energy over proteins can be compensated by trade, by processing of commodities in circular economy and in mixed or organic farms. Mixed and organic farming is marginalised because of high labour intensity and low income of employees oppose to modern market oriented farming. Although fatty acids (C) may principally act in the hypothalamus and function to increase food intake in response to a fast, triglycerids sensing may depend on local hydrolysis by Lipoprotein Lipase (LpL) in the mesolimbic pathway where they decrease the rewarding or motivational properties of food (Cansell and Luquet, 2015). Therefore, obesity of people with limited physical activity can be regulated.

World trade has compensated excess of palatable fatty food and feed in Europe by import of 70-80% of proteins from overseas (Table 2). Later, Europe has decreased dependence on global commodity trade by start of circular economy decreasing imports of lacking protein to 50% by production of proteins for feed from byproduct of biofuels of first generation.

Surprisingly, while biofuels are taxed the other alternative energies are supported. Farmers receive subsidies to produce excess of energy. Traders benefit from import of proteins. Municipalities are supporting investments into waste processing. These contradictory policies benefit stakeholders but, from system point of view are more expensive than above shown example of conversion of waste into resource in circular economy.



Are subsidies of waste processing and agricultural subsidies really cheaper than revenues from sold products compensating C:N unbalance? This research question is answered if objective of this article succeeds to reduce value of agricultural and regional subsidies by increased price of products made out of waste. Objective will be reached by comparison of filling gaps by worldwide commodity trading with investments into technologies for products processed from waste and low yields of organic or high costs of mixed farms.

## 2 Materials and Methods

Not all parts and data used fits together precisely. This study is not comparative neither compile only, but construct conclusions for main objective from relationships. Therefore, methodology proves objectives if following arguments will be true:

Benefits of excessive energy in circles = f(- healing costs of inhabitants with overweight and obesity; + energy of biomass and biofuels; + income of inhabitants due to compensated imports of lacking proteins; + decreased damage due to climate warming; + biodiversity; - climate warming)

Enthalpy (Scheme 1), climate warming (Scheme 2) and health costs (Table 1) were found as secondary issues besides C:N balance making products out of wastes (Table 2 and 3). Filling gaps by worldwide commodity trading with investments into technologies for products processed from waste and low yields of organic or high costs of mixed farms has no common denominator value. Therefore, argument of comfort and investment attractiveness of public and private investments are discussed. Expectations for testing of findings by taxpayers and investors as relevant groups of stakeholders are follows:

1. People are lazy. Therefore, labour intensive technologies will be abandoned and employee status in industry of circular economy preferred.
2. Investors are rich. Therefore, the most expensive stable investments will be preferred over accidental commodity trading opportunities.

Unstructured interview was used for verification of relationship between different supports, for example private, public, investment, product and operations subsidies reducing its value due to increased price of products made out of waste.

Data from technical analysis were converted into currency as common denominator allowing comparison of fuel, health and trade in both Nature and Society if possible. Normative values of saved GHG, costs of biomass waste processing and price of biofuels were used to calculate impact for both Nature and Society. An excise duty was not taken into consideration because this criteria applies only for society. Costs of dependence on palatable food was calculated from costs of medical care diseases caused by obesity.

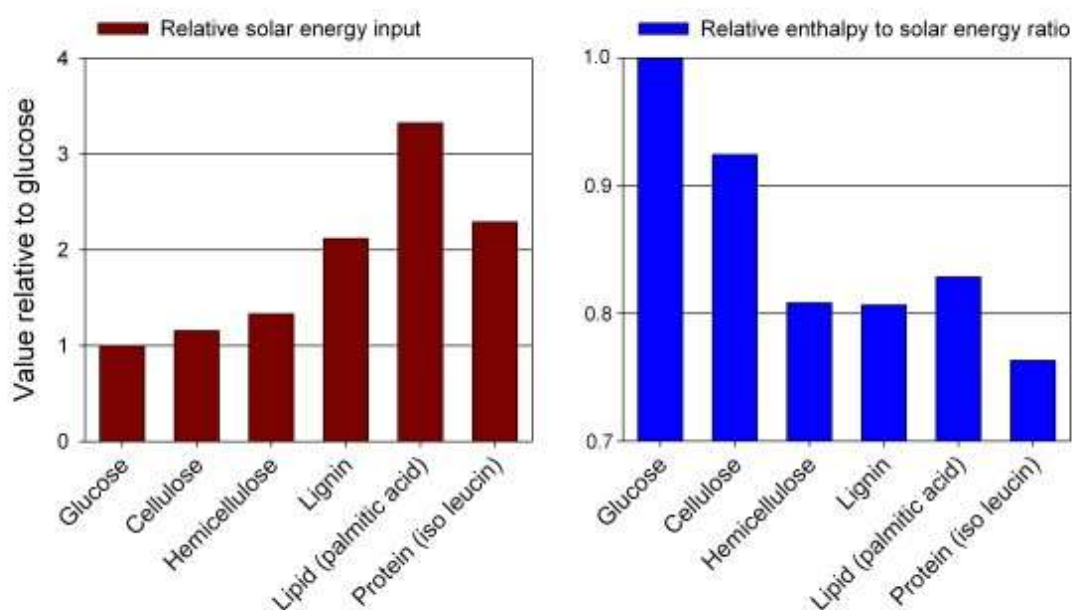
Value of imported proteins from overseas was compared with investment costs for decision to protect or remove trade barriers. Standard practice evaluating technologies, which use the global warming potential (GWP) compare the integrated radiative forcing of emitted gases over a fixed time horizon (Solomon, 2007). Edwards, M.R. and Trancik, J.E. (2014) demonstrate that the GWP misvalues the impact of CH<sub>4</sub>-emitting technologies as mid-century approaches, and we propose a new class of metrics to evaluate technologies based on their time of use. The instantaneous climate impact (ICI) compares gases in an expected radiative forcing stabilization year, and the cumulative climate impact (CCI) compares their time-integrated radiative forcing up to a stabilization year. The impact of natural gas for transportation, with

CH<sub>4</sub> leakage, exceeds that of gasoline within 1–2 decades for a commonly cited 3 W.m<sup>-2</sup> stabilization target. The impact of algae biodiesel overtakes that of corn ethanol within 2–3 decades (Frank, E.D., Han, J., Palou-Rivera, I., Elgowainy, A. and Wang, M. Q. (2012), where algae co-products are used to produce biogas and corn co-products are used for animal feed.

### 3 Results and Discussion

Firstly, increased price of products made out of waste for reduction of subsidies is searched in process of saving solar and use of chemical energy in Nature to its select best performing source. Values of glucose, cellulose, hemicellulose, lignin, lipid and proteins are shown in relation to energy input (left pane) and to enthalpy to solar energy input ratio for glucose (right pane) (Scheme 1). Lipids having sixth position and needing twice more solar energy oppose to glucose when constructed at left pane have third position at right pane of solar energy leaving hemicellulose, lignin and proteins behind. Highly concentrated energy of lipids favours both industrial processing and worldwide trade oppose to organic and mixed farming with local applicability only. Therefore, trade and industrial processing of condensed energy of oils will be compared with less concentrated energy of glucose in following text (Scheme 1).

Scheme 1. Efficacy of Nature

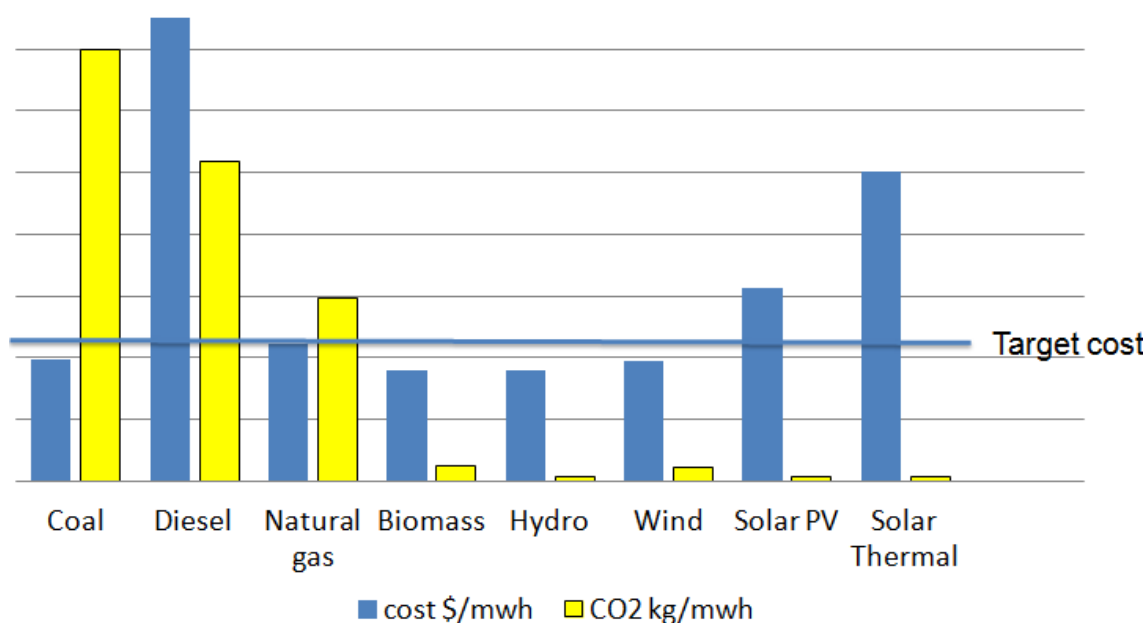


Source: Bentsen and Felby, 2012

Secondly, costs and pollution of generated and used renewable energy were observed to select the cheapest and the least polluting solution. For example, renewable electricity generation reached 64.4 TWh in the U.K. last year, up 20 percent from the 53.7 TWh reported for 2013. Bioenergy increased 24 percent reaching 22.9 TWh. The increase in bioenergy generation is primarily attributed to the second biomass conversion at Drax Power Station. Renewables accounted for a record 19.2 percent of electricity generation, up 4.3 percent from 14.9 percent in 2013. Renewable capacity was 24.2 GW at the close of 2014, up 23 percent

from the 4.5 GW reported in 2013. Best combination of both low cost electricity and low carbon emissions have biomass, hydro and wind energy production facilities (Scheme 2). All other sources of energy cause higher both costs and climate warming (Burnham, A., Han, J., Clark, C. E., Wang, M., Dunn, J. B. and Palou-Rivera, I., 2012).

**Scheme 2.** Electricity Cost and Carbon Dioxide Emissions per kilowatt hour



Source: [http://www.viaspace.com/biomass\\_versus\\_alternatives.php](http://www.viaspace.com/biomass_versus_alternatives.php) from 24.4.2015

Thirdly, only biomass was further processed because its cultivation and harvest pushes people to move, what they are accustomed to. Otherwise, their increased body weight increases health costs. To confirm this expectation the health costs were compared according to body weight. The predicted average adjusted total direct medical costs per year and per user were estimated to be EUR 1029 for healthy weight people, EUR 1093 for overweight people and EUR 1040 for obese people. The predicted indirect costs increase significantly from a healthy weight participant (EUR 2271) to an overweight participant (EUR 2826,  $p < 0.01$ ) as well as to an obese participant (EUR 2830,  $p < 0.05$ ) (Wolfenstetter, 2012). Health costs per one participant of each category of different categories are listed in headlines of columns (Table 1). Age and social status have opposite impact on obesity. Overweight and obesity are significantly different in age categories. Social status of people with normal weight and overweight significantly correlates. But, social status of people with overweight and obesity has opposite polarity, don't correlate significantly and is significantly different. We may conclude that human body has large capacity to use excess of energy for improvement of social status. People with high social status should bare their health costs of overweight. Obesity more damage people with low social status. They should be better treated not by hospitals but schools. Increased costs for medical care for patients with overweight directly EUR 11 and indirectly EUR 59 per year indicate that not everyone is harmed by unbalanced C:N. Therefore, consequences of C:N imbalance on health costs may finish with this justification of school role improving competitiveness of individuals, which brings higher benefits than waste conversion to products, but out of topic of this article.

Healthy weight:  $18.5 \leq \text{BMI} < 25$ ; overweight:  $25 \leq \text{BMI} < 30$ ; obesity:  $\text{BMI} \geq 30$ .

a - Column percentages per gender, age and social inequality score are shown.

b – Row percentages per each characteristic (sex, age group, socioeconomic strata) and weight category are shown.

t – t-test value; r – correlation; p – reliability

**Table 1.** Health impact of excessive energy

< 75 years		Overall	Healthy weight (EUR 2271)		Overweight (EUR 2826)		Obesity (EUR 2830)	
			n = 2581 [n %] <sup>a</sup>	n=988	[n %] <sup>b</sup>	n=1135	[n %] <sup>b</sup>	n=458
Age (years)	35–45	22.1%	330	57.9%	185	32.5%	55	9.6%
	45–55	26.3%	325	47.8%	253	37.2%	102	15.0%
	55–65	27.4%	203	28.7%	369	52.1%	136	19.2%
	65–75	24.1%	130	20.9%	328	52.6%	165	26.5%
			t=-0.430; p=0.696;		t=7.584; p=0,005;			
Social class	Lower	14.8%	94	24.7%	175	45.9%	112	29.4%
	Lower middle	20.3%	176	33.7%	215	41.1%	132	25.2%
	Middle middle	22.0%	231	40.6%	257	45.2%	81	14.2%
	Upper middle	25.0%	291	45.1%	264	40.9%	90	14.0%
	Upper	17.9%	196	42.3%	224	48.4%	43	9.3%
			r=0.973; p=0.005		r=-0,369; p=0.541;			

Source: Wolfenstetter, 2012, adapted

Fourthly, self-sufficiencies below 100% between production and consumption of biomass for food and fuel are showing need for imports (Table 2) to compensate lack of protein. 68% of lacking proteins in EU C:N food and feed balance is showing needed volume with price of N up to level of imported soybeans. Skins of oilseed rape are considered as waste even with protein content due to glucosinolates. But this protein feed from waste becomes a product if its volume is sufficient to run research, standardisation and genetic or industrial improvements. There is not much place for manoeuvres as land is limited resource. 75% of self-sufficiency in N from oilseed rape shows the volume if biofuel is processed.

**Table 2.** EU - 27 balance sheet for protein rich feed materials in 1000 t for 2011/12

	EU production (*)		EU consumption (**)		Self-sufficiency (%)
	Products	Proteins	Products	Proteins	
Soybeans / meal	1275	485	32672	15220	3
Rapeseed and sunflower/meals	27492	5164	21779	6917	75
Pulses	2180	480	1780	392	122
Dried forage	4483	852	4250	808	105
Miscellaneous	3205	738	6056	1291	57
Sub-total	38635	7719	66537	24628	31
Fish meal	324	224	576	397	56
Total	38959	7943	67113	25024	32

Source: PROLEA in FEAC: <http://www.fefac.eu/files/55172.pdf>, 2015

(\*) EU production from EU seeds

(\*\*) Including consumption by the pet food industry and on-farm uses

Miscellaneous: includes groundnuts, linseed, copra, palm kernel and cotton seed meals and corn gluten feed (Table 1).

Fifthly, the needed volume of lacking proteins was compared with potential of lacking land and performance of crops across countries of Europe (Table 3). The best alternatives are oilseed rape covering lacking protein with 0% increase and alfa-alfa with 8% increase of yield or area to decrease imports of soy by 50%. Pulses and alfalfa may compensate lack of proteins in circle of organic farming. Oilseed rape may decrease imports of protein to 50% in conventional agriculture circle. Table 3 shows consequences of assumption that 50% of the imported soya bean protein would be replaced by EU production of each of the mentioned crops when they have reached a yield level competitive to that of soft wheat.

**Table 3.** Yield increases required for the potential value of the protein crops to match that of wheat

Crop	Yield			Oil		Starch		EU
	current (t/ha)	required (t/ha)	increase (%)	produced (M ton)	World oil (%)	produced (M ton)	Area needed (km <sup>2</sup> )	arable land (%)
Soya	2.7	3.4	30	3.9	9.5	0	57.264	5.4
Rape	3.1	3.1	0	13.8	61.9	0	111.846	10.5
Sunflower	2.2	2.9	31	20.3	133.3	0	163.277	15.4
Lupin	1.0	4.2	334	1.9	nd	0	51.934	4.9
Pea	2.7	4.8	76	0	0	15.5	72.683	6.8
Faba bean	2.7	4.5	69	0	0	11.1	63.553	6.0
Alfalfa	40.2	43.6	8	0	0	0	40.294	3.8

Source: de Visser, Schreuder. and Stoddard, 2014

Sixthly, stemming from previous work(s) biobutanol and hydrogenated vegetable oils (HVO) may increase benefits of saturation of lacking proteins while fully replacing ether based additives in modern fuels.

Volume of waste biomass from industrial processing of decreased number of high yielding crops in crop rotation is increasing opportunity to convert this waste to product for sale. Southern sorts for production of vegetable oils and northern model of wood processing into biofuels offer complementary ingredients for standardisation of products for example feed and fuels. Therefore, negative impact of waste from globally specialised crop rotation needn't only to increase turnover and make products competitive by low price and standard quality, but also improve biodiversity in wild Nature. We have proved in our other articles that properties of biobutanol standardise fuels better than bioethanol. Trends reflect strong growth and investments across all market sectors (REN21 Renewable Energy Policy Network for the 21st Century, REN21, 2011). Also reuse of investments of first generation of biofuels while a break event point for investments into second generation biofuels is decreasing is positive. Private investments into first generation of biofuels can be repaid and European public subsidies for waste biomass processing, especially investment subsidies and subsidised price of green energy from biogas facilities, can be decreased if high quality renewable fuel – biobutanol is produced.

High yields and advanced technology of agriculture commodities favours local waste processing, while reducing 80% dependence on World trade with feed proteins to 50%. Private

investments into processing of byproducts are two and half times exceeding capacity of production of commodities like oilseed rape and cereals. These commodities have advantage of natural monopoly for France, Germany, Czech Republic and Poland. Further, not only oilseeds and cereals, but all lignocellulosic materials, starch and simple sugars can be processed by microorganism *Clostridium acetobutylicum* producing biobutanol, ethanol and acetone. Quality of raw biofuels is bad, except of methylesters of oilseed rape. Besides fuel quality improving biobutanol, properties of fuel from biomass can be improved by hydrogenation of animal fats and other waste biomass in fuel blends.

Biogas technology is transporting waste to fields while damaging diversity of wild Nature oppose to all technologies of biofuels. Privately invested biofuel technologies, which are also improving C:N balance in feeds are much better option than public investment support and subsidised green energy of biogas. This difference of private and public support of investments and operations justifies ban of public support for developing market of biogas.

Subsidies for bioeconomy of fuels are recently replaced by regulations, what makes this technology cheaper for taxpayer. The joint selling (including fixing prices together) supporting promotion of increased volume of proteins in food and feed against standard competition rules) under conditions of Article 101(3) of Treaty on Functioning EU regulate market access. Further, the EU Commission has launched a public consultation on new draft guidelines on the application of EU antitrust rules in the agricultural sector in January 2015. The joint promotion on some specific criteria such as protein content in the oilseed sector including technical information for feeding ration, would help to promote EU production in comparison with standard use of soybean for the feed sector (Copa-Cogeca, 2015).

#### 4 Conclusion

The objective to reduce value of agricultural and regional subsidies by increased price of products made out of waste succeeded to decrease this value about 30%. Also long list of observed issues was reduced with following arguments:

1. Synergy of two factors, lacking protein and fuel as new product from waste in circle of global economy is developing faster than local mixed and organic farming (Table 2, 3). Decrease of emissions in carbon equivalent by synergy of lacking N balancing by biofuels was discussed.
2. Privately financed investments to biomass processing technologies may develop even faster if competing biogas technology would lose high public investments (see discussion). Subsidies developing biogas are removing number of hectares from availability for feed and food production at all farms without synergy effect of proteins and competitive price for new product as green energy is subsidised.
3. Ban of subsidies of Common Agriculture Policy for commodities is justified as World price for products with natural monopoly is stable and profitable (see discussion).
4. Circle of mixed and organic farming with enthalpy and entropy compensating each other still deserves some subsidies (Scheme 1).
5. Some public subsidies should be given to schools to teach people with low social status whose vulnerability by obesity was found (Table 1).

6. It was shown that high performing upper class of inhabitants (Table 1) is not harmed by overweight and can cover higher health costs itself without subsidies.

Limitations: These six arguments are still complex from methodological point of view. Methodological simplification of generalised factors of employees' laziness and investors' stability for prognoses of development of circular economy would help. Low fit of data of secondary origin is known, but was compensated by references to publicised data. Especially, data about volumes of subsidies and default climate warming data were not shown in this article as they are known. But, still further research is needed to prove validity of default values of both subsidies and carbon equivalent emissions.

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## The Significance of Domain Names for Agribusiness – Czech and Austrian comparative study

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**Annotation:** The second half of the 20<sup>th</sup> century brought about a new perception of Agribusiness, an emergence and bustling development of information systems and information technologies (“IS-IT”) and a modern stage of European integration. Internet domain names as an IS-IT representative have a significance for the EU business *par excellence*, the Agribusiness. They can perform a myriad of functions and impact Agribusiness. How real is this potential and to what extent and with which intensity is it realized to increase the efficiency of Czech and Austrian Agribusinesses? A study of this IS-IT economic and legal sphere is completed by the investigation and comparison of the employment of domain names registered and used by rather homogenous Czech and Austrian Agribusiness subjects, organic farmers. Three sets of data were researched and explored. Secondary data about domain names and Agribusiness were scrutinized, a search of TLDs databases of Registry Operators, Whois, etc. was performed, and the inconsistencies between these data were addressed by inquiries. The potential functions and importance of domain names for Agribusiness was confirmed and a forensic and target quantitative assessment of Czech and Austrian Agribusiness domain names was conducted along with partial qualitative multi-disciplinary remarks from areas linguistic, economics, etc. Their comparison and evaluation relied on induction and on feedback earned based on direct inquiries of selected subjects. A new perspective regarding the underestimated potential of domain names and Agribusiness is offered. EU, Czech and Austrian policies share the same conceptual tenor, but the contextual and multidisciplinary analysis with a complementary inquiry and ad hoc investigations suggests an information gap, and especially Czech farmer’s reduced awareness about the significance of domain names for Agribusiness allowing speculation. Further study needs to be done to reverse this trend.

**Key words:** Agribusiness, Domain name, Europe 2020, Internet, Website.

**JEL classification:** M15, Q13, Q16, R11

### 1 Introduction

The post-modern global society is significantly virtualized and dematerialized. The Internet dramatically influences the professional, as well as the social and private life of a tremendous number of subjects, including those from the EU. The Internet’s appropriate use is critical for European integration, especially if e-platforms such as Websites are used. The new strategy launched in the EU in 2010 for the new decade (“Europe 2020”) underlines the vital importance of the talent and creativity of Europeans leading to innovations and a high quality agricultural sector (EC, 2010). Times of passive and backwards farmers producing “just in case” overwhelming lakes of milk and mountains of butter are definitely gone, and the modern Common Agricultural Policy (“CAP”) has two strong pillars, production and regional development, and serves many purposes going far beyond the simple generating and providing of food. Anachronistic stereotypes are a poor basis for future policy strategies (Copus, 2014). Objectives and goals of both pillars can be met only if an effective and efficient use of modern instruments is performed by all stakeholders, and especially the disadvantaged ones. Despite all European integration efforts, large disparities still remain across different parts of the EU (Copus et al, 2008) and the Internet function can critically help to reduce these



gaps at modest costs. The post-Lisbon EU needs pro-active Europeans working effectively and efficiently, and the genuine engagement of all stakeholders needs to go even beyond the principle of shared management (Peters and Gregory, 2014). The Internet can be a great vehicle for it, especially via a well-used and visited Website (MacGregor, 2013). There are key 2 options to attract to an e-presentation on a Website – by a volatile search engine optimization (“SEO”) mechanism and by the mechanism of selection of appropriate domain names. The last mentioned is at the heart of this comparative study paper.

Czech and Austrian organic farmers, aka Biofarmers, generally have ready access to the Internet. They are rather a homogenous group, a group which is aware that a Website is a set of related and connected Webpages, that all publicly accessible Website collectives constitute the World Wide Web (Köhler and Arntd, 2011) and that each Website is attached to a domain carrying a domain name (MacGregor, 2012). A Czech or Austrian organic farmer can get access to appropriate servers, register his own domain, label it with an attractive domain name with a tree structure (Sonntag, 2006) and attach to it a system of interlinked hypertext documents, in short, Websites (Cvik and MacGregor, 2014), so as to become visible in the cyber-world and consequently in the real world. Great domain names and Websites increase the interest of the public, and ultimately the competitiveness of farms and farmers (Šmejkalová, 2013). Czech and Austrian Biofarmes are subjects of EU law and policies, and have a choice of whether or not to take advantage of domain names, to boost their agri-activities and further advance the CAP and Europe 2020. They are free to take just a partial advantage of it, or even to completely decline this opportunity. Being an organic farmer does not mean being an Internet expert, indeed an important asymmetry of information exists (MacGregor, 2014c) and since no guidance is provided, farmers are left on their own. Thus, the objective of the paper is to check the perception of Internet domains and domain names by Austrian and Czech Biofarmers, in particular based on a trio of data sets to find whether they take advantage of domains names and common domains aimed toward the support of their Agribusiness, and whether the current status quo matches with official EU strategies.

## 2 Materials and Methods

This paper represents one stage of a large strategic search about the significance of domain names, and thus is a continuation of a set of papers published within the last 12 months (MacGregor, 2014b). It is an attempt to reach practical semi-conclusions related to case studies about the meaning and use of domain names for Agribusiness (Cvik and MacGregor, 2014). There are various metrics and criteria to select the “ideal” domain name (Huber and Hitzelberg, 2010) for posting the “ideal” Website. Basically, three domain name choice strategies are available – generic descriptive term for industry, name of producer, and trademark of producer (Salomon, 2012) and for the organic Agribusiness the first one seems highly relevant. This comparative study relies on an attractiveness predisposition of domain names that strongly suggests the topic *organic farming* or *biofarming*, as the generally perceived advantage over conventional Agribusiness, in the Czech Republic and in Austria, and checks its real status. A triad of sources and approaches and methods was selected of a primary, as well as secondary nature – research, identification and reviews of published data (i), researching pre-selected domain names and their registration status (ii) and assessing their employment and the general appearance of attached Websites (iii). All collected data and information will be evaluated, based on quantitative analysis with an ad hoc qualitative complementing, and will be re-assessed in a comparative manner.

The yielded-up sum of various data will be processed via Meta-Analysis (Schmidt and Hunter, 2014) in order to reconcile them and imply the confirmation or rejection of the key hypothesis. The abundance of both the functions and potential of domain names for business, including agribusiness in Central Europe, is, in the light of published data as well as based on practical observation, obvious. However, to what extent, and to what intensity is this reflected by the praxis?

A forensic and targeted quantitative assessment of pre-selected descriptive Czech and Austrian Agribusiness domain names was conducted, along with partial qualitative multi-disciplinary remarks from the field of linguistics, economics, etc. Their comparison and evaluation relied on induction and on feedback earned, based on direct inquiries of selected subjects. “Ideal” domain names, according to academic findings (Huber and Hitzelberg, 2010), were projected to a rather homogenous sector of the organic Agribusiness, i.e. 20 domain names highly suggesting *organic* and *biofarming* were identified. Based on findings about top level domain appropriateness (MacGregor, 2014b), these domain names were assigned to national top level domains, i.e. TLD .cz and TLD .at. An investigation within WHOIS and the national registry for TLD .cz and TLD .at was performed and cross-examined by a direct access to pertinent Websites. This battery of processes provided static conclusive information about the real use of these domain names within the restricted sample. Academic sources suggest that these prime domain names should be used vigorously by the organic farmers to boost their agribusiness. This is the hypothesis to work on it, explore and confirm or reject it.

### 3 Results and Discussion

The EU agriculture needs to attain higher levels of production of safe and quality food, while preserving the natural resources that agricultural productivity depends upon, and this can be done exclusively in a competitive and viable agricultural sector operating within a properly functioning supply chain, and which contributes to the maintenance of a thriving rural economy (EC, 2013). Neither the EU law, nor national Czech nor national Austrian law, orders organic farmers to register domain names identified by academic and other professional conclusions as ideal for Agribusiness, and to use them in compliance with both pillars of modern CAP. Similarly, no real public boosting or support is provided, and thus Czech and Austrian organic farmers are left on their own. A set of direct inquiries of organic farmers conducted recently obtained an absolutely clear message – “Yes, we have a domain name and Website and they are important for our agribusiness and nobody helped us with their setting and we would like very much to get assistance” (Cvik and MacGregor, 2014). Seeing EU proclamations (EC, 2013) as well as a well-established interrelation between naming and business success (Charette and Hooker, 2015), it seems unbelievable that no guidelines are offered to farmers for registering domain names. The registration and maintenance of domain names is simple, costing between EUR 5 and 50 (MacGregor, 2014b), i.e. an important strategic instrument can be obtained easily and cheaply, provided a right choice is made and is rightly processed. Despite the lack of free external help, the majority of Czech and Austrian organic farmers go for domain names (Asociace, 2013). They either hire a paid expert or, more commonly, they do it by themselves (Cvik and MacGregor, 2014).

Domain names directly suggesting *organic farming* and *biofarming*, and registered within TLD .cz and TLD .at should be definitely “in” and used ideally by the entire community of national organic farmers satisfying standards and expectations linked to *biofarming*, or perhaps by the

top organic farms in the country. The domain names selected for this study slightly deviate due to linguistic reasons. The search regarding their registration status was performed by using official Internet domain name system (“DNS”) resources – global WHOIS, <http://www.whois.com/whois/>, and national registries, i.e. the Czech TLD Registry CZ.Nic <http://www.nic.cz/> and the Austrian TLD Registry AT.Nic <https://www.nic.at/index/>.

Firstly, there was performed the search regarding the pre-selected ideal domain names referring to biofarming within TLD .cz. The resulting yields from WHOIS and CZ.Nic were identical and as indicated in Table 1.

The hypothesis that Czech organic farmers register and use prime domain names suggesting biofarming is, preliminarily based on the tested sample, rejected. Of the 12 pre-selected domain names, only one is truly used for Agribusiness, and at least four are held by individuals for speculative reasons. The only biofarming domain is registered and used exclusively for individual Agribusiness, i.e. for a single organic farm, Biofarm Sasov of Josef Sklenář. Mr. Sklenář beat the crowd, with a priority for over one decade (registration since 2003) and deserves some applause. An extremely low awareness and/or contradiction between academic findings and real life exists in this sphere. To contrast these results, an interview was conducted with a successful organic farmer family Doležalovi operating “bio” Agribusiness on their Křížové pole farm at the Czech-Austrian border, in Vyšší Brod. They confirmed a heavy reliance on their Website at <http://www.farmadolezal.cz/> and indicated that their Agri-tourism line depends directly upon the Website, while their selling product line depends indirectly. Their Website shows customer friendliness and the identity challenge, i.e. dealing with an unwelcome intrusion in their farm integrity (Di Domenico and Miller, 2012).

**Table 1.** “Bio-farm/er” Domain Names with URL within the Czech TLD .cz

Domain name with URL	Registrant /Use
<a href="http://bioczech.cz/">http://bioczech.cz/</a>	Milan Vacek – shopping, not related to organic farming...
<a href="http://bio-czech.cz/">http://bio-czech.cz/</a>	NOT registered
<a href="http://biofarma.cz/">http://biofarma.cz/</a>	Josef Sklenář, Biofarm Sasov, Jihlava – individual Agribusiness
<a href="http://bio-farma.cz/">http://bio-farma.cz/</a>	NOT registered
<a href="http://biofarmar.cz/">http://biofarmar.cz/</a>	WEBMINT s.r.o., Prague – for sale
<a href="http://bio-farmar.cz/">http://bio-farmar.cz/</a>	Jiří Mareš, NEO, Lanškroun – advertising, speculation
<a href="http://ecofarma.cz/">http://ecofarma.cz/</a>	Oldřich Migel - speculation
<a href="http://ekofarma.cz/">http://ekofarma.cz/</a>	Karel Kládívko, Farma Svojiše – not yet Website
<a href="http://organicfarm.cz/">http://organicfarm.cz/</a>	František Fiala – for sale, speculation
<a href="http://organic-farm.cz/">http://organic-farm.cz/</a>	Václav Silovský – speculation, Website not attached
<a href="http://organicfarmar.cz/">http://organicfarmar.cz/</a>	NOT registered
<a href="http://organic-farmar.cz/">http://organic-farmar.cz/</a>	NOT registered
Summary: 17% Agribusiness, 33% not registered, 42% sale/speculation, 8% general e-shop	

**Source: Own processing**

Secondly, the search was performed about the pre-selected domain names referring to organic farming within TLD .at. Results yield from AT.Nic were completed by WHOIS, see Table 2.

The hypothesis that Austrian Biofarmers register and use prime domain names suggesting biofarming, is, based on the limited sample, preliminarily rejected. Of the 12 pre-selected domain names, only three are supporting the Agribusiness, two in a collective manner and thus boosting SMEs innovative sustainable synergy (Hockerts and Wüstenhagen, 2010) and one in an individual manner. Generally, the result is slightly better than in the case

of Czech organic farmers, nevertheless still the praxis seems to be very remote from academic studies.

**Table 2.** “Bio-farm/er” Domain Names with URL within the AustrianTLD .at

Domain name with URL	Registrant /Use
<a href="http://bioaustria.at/">http://bioaustria.at/</a>	<a href="#">Ultes GmbH – Website under construction</a>
<a href="http://bio-austria.at/">http://bio-austria.at/</a>	<a href="#">Bio Austria Verein – collective Agribusiness</a>
<a href="http://biofarm.at/">http://biofarm.at/</a>	<a href="#">Webscan KEG, Klagenfurt – collective Agribusiness Webhosting</a>
<a href="http://bio-farm.at/">http://bio-farm.at/</a>	NOT registered
<a href="http://biofarmer.at/">http://biofarmer.at/</a>	<a href="#">Franz Weiss, Fischamend - not accessible/operational Website</a>
<a href="http://bio-farmer.at/">http://bio-farmer.at/</a>	<a href="#">BIJA, Slovenia – not accessible/operational Website</a>
<a href="http://organicfarm.at/">http://organicfarm.at/</a>	<a href="#">Arne Pastor – individual Agribusiness</a>
<a href="http://organic-farm.at/">http://organic-farm.at/</a>	<a href="#">Klaus Berghold, not Website</a>
<a href="http://organicbauer.at/">http://organicbauer.at/</a>	NOT registered, item <a href="http://organiclandwirt.at/">http://organiclandwirt.at/</a>
<a href="http://organic-bauer.at/">http://organic-bauer.at</a>	NOT registered, item <a href="http://organic-landwirt.at/">http://organic-landwirt.at/</a>
Summary: 17% Agribusiness, 42% not registered, 33% unknown, 8% Webhosting	

**Source: Own processing**

The previously expressed concern regarding the varied level of innovative activity as the consequence of regional heterogeneity (Copus, 2008) and regarding the lack of more centralized action on the EU level (MacGregor, 2014a) might be among the reasons why the hypothesis was not confirmed, i.e. why ideal domain names for organic farmers are not ideally used. Naturally, some further research needs to be done and the entire myriad of reasons must be identified and addressed, in order to reach the necessary correction of this deplorable situation. Nevertheless, it is critical to keep in mind the already established facts – domain names are significant and serve many functions (MacGregor, 2014b), the test for the selection of an ideal domain name is a balancing test (Salomon, 2012) with a strong factor of wording referring to the industry or goods or services, and the public has a reasonable knowledge about domain names and their significance, although an asymmetry of information is omnipresent (MacGregor, 2014c). Regarding organic farmers in the Czech Republic and in Austria, it seems that the information gap is even larger. They clearly proclaimed the importance of domain names and go ahead and register them (Cvik and MacGregor, 2014) rather randomly and intuitively, perhaps relying excessively on the SEO. Such reliance without knowing webmastering techniques in the Agribusiness context is ill-placed (Carmona et al, 2012). The best domain names for organic farmers with the highest potential to meet the abundance of expectations, as selected by secondary data conclusions, are not registered at all or registered by speculators. Other industries do not demonstrate such disparities, and often the top domain names according to academia are as well sold for the highest prices (Huber and Dingeldey, 2004). However, regarding organic farming, we have this bizarre situation, which, in light of Europe 2020, is not acceptable.

Austrian and Czech organic farmers belong to the large majority of the Czech (and Austrian) SMEs which have registered a domain name and have been actively using their own Websites (Asociace, 2013), but based on the selected comparison it seems that they go their intuitive way. Their perception of domain names seems, based on the tested sample, impaired, by Czech farmers even more than by Austrian. Prime domain names strongly suggesting organic farming remain often not registered, or more sadly, registered by Czech speculators. Hence the potential of domain names to boost the efficiency of Agribusiness seems underused. A further research should be done, to cover a larger spectrum of domain names used by farmers, to address the suggested disharmony and insufficiency of their awareness about

the domain name potential for their Agribusiness efficiency, and to help farmers with e-business.

#### 4 Conclusion

The agriculture sector has been, for over fifty years, at the core of the EU's attention, including the most pro-integration duo engine, the European Commission and the Court of Justice (Burley and Mattli, 1993). The post-Lisbon EU wants to get closer to its citizens, and Europe 2020 wants them to be more effective and efficient while recognizing the importance of sustainable development and of innovations (EC, 2010). The Czech and Austrian policies are generally in compliance with these EU strategies, including the recent project of the European Network for Rural Development and National Rural Network with interlinked e-platforms with domain names and Websites (MacGregor, 2014a). The effectiveness is recognized, but the efficiency in the realization is weak, even on the state level, see eagri.cz.

The performed field search involving a restricted sample of Austrian and Czech organic farmers' domain names leads, due to the homogenous feature, to preliminary conclusions. Firstly, Austrian, and more so Czech, farmers miss the attraction capacity of descriptive domain names, which is, along with a SEO mechanism, critical for boosting e-presence and efficiency in general, and leaves these prime names to Czech speculators. Secondly, Austrian farmers benefit by common domains supporting their Agribusiness efficiency, while Czech farmers don't exhibit such a common drive and work for themselves. Recently, the European Commission published a press release about the adoption of 24 rural development programmes to boost EU farming, providing funds to states in order to modernize farms, help young farmers and improve management and infrastructure (EC, 2015), while directly mentioning the Czech Republic (but not Austria). Sadly, smart, sustainable and inclusive growth in Central Europe Agribusiness via practical IS/IT projects was ignored. There is a clear misbalance of information and a reduced awareness by farmers. A more extensive search should be done to study these deficiencies, to find instruments to improve the current status and to help Czech and Austrian farmers increase the efficiency of their Agri-activities by making their e-presence attractive and supporting their qualitative and quantitative growth.

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## Factors influencing costs of milk production in the EU – importance of herd size

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**Annotation:** Text of the paper deals with the problem of milk production, and evaluates the factors that may significantly affect the costs of production. This issue has become very topical, especially in relation to changes in the CMO (abolition of quota system). The authors used mostly the database of European Dairy Farmers (EDF) association, in which the economic results of 19 European countries are summarized over the last few years. The enterprises were sorted by farm size (according to heads in dairy cow herds) and for evaluation of the basic characteristics were used methods of testing of statistical hypotheses. The results show that there may be some differences between large enterprises and family farms. In case of the total cost, there has been clearly demonstrated that the costs of milk production decrease with increasing herd size. Total costs varied significantly in 3 groups: up to 100, from 101 to 350 and herds with more than 350 heads of dairy cows. This roughly corresponds to the cost of feed, which is one of the most important items of direct costs. It is proved that, with larger farms, these costs have risen significantly in the same groups as was recorded in the growth of concentrate intake. Concentrated fodders are far more used on the large farms (around 8 kg per cow and day), suggesting efforts for greater intensification of production. However, it is obvious that especially on small family farms (up to 50 heads) are used rather extensive production methods and it corresponds to both the intake of concentrate (about 5 kg per cow) and lower total milk yield (up to 7.500 kg ECM/cow.year). On the other hand, we can see here a better treatment of cows on these small (family) farms, which can be seen through the indicators as culling rate or total lifelong milk yield.

**Key words:** Costs of milk production, dairy herd size, intensification, milk yield, labour costs.

**JEL classification:** Q12, D24

### 1 Introduction

Milk quota abolition has forced many companies to reconsider the factors that will limit milk production into the future. Factors other than milk quota such as land, labour, capital, stock, etc. are going to become the limiting factors for many in a post-EU milk quota scenarios now. Mach and Rezbova (2009) pointed a visible dependence between the values of land rent (which corresponds with the real land price) and milk production per hectare of grazing area. There could be an estimation that with the rising price of this production factor, the milk production per unit also rises, so that a land user tries to maximise its utilisation. This relationship is best described by a multiplicative function with dependence about 44 %.

If the release of quotas could increase the volatility of milk prices, it is very important for milk producers to, while maintaining quality and keeping milk yield, minimize their production costs (Chrenkova, 2011). This raises the question of economies of scale.

As stated Kumar et al. (2013) in comparison of Indian agricultural co-operatives, a cross comparison between the member and the non-member farmers of the dairy co-operatives



suggested that the scale of farming and level of adoption of improved animals had been significantly higher for member farmers. Similarly, the co-operative member households contributed significantly higher quantity of milk at higher levels of productivity than their non-member counterparts. The co-operative members were found to have better market access for selling milk. Per unit cost of milk production was on the lower side for the members and they realised higher price of milk than the non-member farmers. This also confirmed Mkhabela and Mndeme (2010) using a panel of 37 South African farms for the period 1999 to 2007, where larger farms were able to produce any given level of output at lower costs compared to their smaller counterparts. The best farmers, in terms of average costs of producing a litre of milk, are found between the 100,000 to about 170,000 litres of milk per year output range and these were found to spend less than R1 (rand) per litre. In order to determine the future attitudes and intentions and to identify the key factors influencing farmers who intend to expand, exit, remain static or contract their businesses in the future, O'Donnell et al. (2011) carried out a survey of a large group of Irish commercial dairy farmers. The sample was analysed to determine the effect of key survey variables on the future intentions of dairy farmers. There were higher proportions of farmers intending to expand than farmers intending to exit the dairy sector. Farmers who were intent on expanding had larger total farm areas, larger milk tank capacity per litre of milk quota, more modern milking facilities, more available cow housing and more housing that could be converted at a relatively low cost and were more likely to have a successor. Špička and Smutka (2014) zoomed in the valuation of European regions. In the most of European regions, there is a relatively high significance of small specialised farms including dairy farms. The DEAVRS method (data envelopment analysis with variable returns to scale) reveals efficient and inefficient regions including the scale efficiency. The research reveals that substitution of labour by capital/contract work explains the variability of the farm net value added per AWU (annual work unit) income indicator by more than 30%. The significant economic determinants of production efficiency in specialised dairy farming are farm size, herd size, crop output per hectare, productivity of energy, and capital. Specialised dairy farms in efficient regions have significantly higher farm net value added per AWU than inefficient regions. They also have a slightly higher milk yield, specific livestock costs of feed, bedding, and veterinary services per livestock unit. Wieck and Heckeley (2007) provided evidence on the determinants, cost differentiation, and development of short-term marginal costs of dairy farms in important production regions of the EU. The empirical study was based on the estimation of multi-input multi-output Symmetric Generalized McFadden cost functions using an unbalanced panel data set of the European Farm Accountancy Data Network. They showed that milk output, milk yield, herd size, labour input, and fodder production can be attributed to significant marginal cost differentiation of farms, whereas for crop and animal output, grassland, stock of other animals, and depreciation only minor differentiation could be found. Cocchi et al. (1998) reported on the use of a growth accounting approach to calculate and decompose cost efficiency indices into technical change, regional competitive advantage stemming from spatial effects, and economies of size. Dairy farm data for Connecticut, Maine, Vermont, Michigan, New York and Pennsylvania for the years 1968, 1970, 1977, 1980 and 1988 are utilized in the analysis. The results showed that technological change yielded a 1.8% average annual rate of cost reduction over the period studied. In addition, medium and large farms were, on average, 12% to 20% more efficient than small farms.

## 2 Materials and Methods

Although panels have been used in consumer research for a number of years, the use of a panel of producers or farmers as a source of farm management data started in the 1960's (Conneman, 1969). Basically, a farm panel is a group of farmers questioned and revisited over a period of time to obtain various types of information. Panel studies can be used to identify both net and gross change in the dependent variable. The data produced by these panels are generally suitable for statistical analysis, and are able to expose cause-effect relationships.

Data in this research was obtained from questionnaires from the European Dairy Farmers association (EDF) among dairy farmers (producers) from 19 European countries (only two were not the EU members – Switzerland and Ukraine). This unbalanced panel includes data from 2006 to 2014 and contains 2596 entries in total. The average number of farmers provided data was 288 per year. A substitution of the sample during these years is about 40%. More detailed data on this panel is shown in *table 1*, where is shown the number of respondents in single years and in single group of herd size.

**Table 1.** Numbers of respondents in particular groups

<b>Years</b>								
2006	2007	2008	2009	2010	2011	2012	2013	2014
244	280	267	304	315	331	320	314	221
<b>Dairy herd size</b>								
<=50	51-100	101-200	201-350	351-500	>=501			
357	679	789	374	152	245			

Source: EDF database

Before statistical analysis was first the measured data categorized into groups according to herd size. The goal of statistical analysis was then assess whether the differences between the created groups is statistically significant. For this verification was chosen analysis of variance. Analysis of variance is used to compare the level of reporting measurable character in different populations, which are limited by variations (levels) of a sorting factor. Through the selection of the considered populations we investigate the hypothesis of equality of mean values. There are a few groups of survey results and, based on a statistical test, it is decided whether the group means differ significantly. Difference of mean values can be understood as a character dependence on sorting factor (Hebak et al., 2013).

If we look at the impact of just one factor, we are talking about simple sorting analysis of variance, i.e. the statistical character is influenced by only one factor. In the case of assessing the impact of several factors, there is used multi-factor models of analysis of variance (Seger & Hindls, 1995). Null hypothesis, which is verified, states that all averages in particular populations are identical, i.e.  $H_0: \mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$ . Then alternative hypothesis assumes that there is at least one pair of averages (means), which are not equal each other. Null hypothesis can also be interpreted as the effect of sorting factor was not demonstrated. The entire test procedure is usually written into a table that clearly shows the decomposition of the total variance. The total variance, in the case of simple sorting analysis, is decomposed into two parts, on the variance between classes (it characterizes the effect of factor on the given character) and the residual variance (it characterizes just effect of random causes). The test statistic "F" has the form:

$$F = \frac{\text{variance between classes}}{\text{residual variance}}.$$

Statistics F has, with validity of the null hypothesis, F-distribution with degrees of freedom  $(k - 1)$  and  $(n - k)$ . If the value F exceeds the critical value of F-distribution, the null hypothesis of the conformity of averages is rejected. If the null hypothesis is rejected, it is necessary to decide, which samples are significantly different from each other and which are not. This is done by multiple comparison methods differing conditions of use, the rate of risk control of the first kind error and strength of test. The most commonly performed are paired comparisons, i.e. the comparisons of pairs of mean values. These are also widely represented in statistical programs. Among the best known method of paired comparisons belongs Tukey HSD test. Tukey HSD test is modified for the case of unbalanced sorting. It has been proven that applies these equations (Andel, 2007):

$$P\left\{|y_i - y_j| < sq_{k,n-k,\alpha} \sqrt{\frac{1}{2}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)} \text{ for all } i, j\right\} \geq 1 - \alpha.$$

If there is obtained

$$|y_i - y_j| > sq_{k,n-k,\alpha} \sqrt{\frac{1}{2}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)},$$

the hypothesis of equality  $\mu_i = \mu_j$  can be rejected.

The statistical program "SAS" was used for data processing.

### 3 Results and Discussion

First of all was analysed how herd size affects the total cost of milk production. These costs are referred as a value in Euro (€) per 100 kg of energy corrected milk (ECM). Analysis shows that significant differences in the cost amounts can be observed between categories of dairy cow herd size up to 100 heads, as well as between 101 and 350 heads, and then from 351 heads upward (see *table 2*). The results also shows that the total costs decrease with increasing number of heads in the dairy cow herd (see *table 2 and 3*), suggesting economies of scale. The groups that did not show statistically significant differences are marked with the same colours (red, green, blue) and crosslets.

**Table 2.** Analysis of total costs according to dairy herd size (€/100 kg ECM)

Herd size (heads)	No. of obs.	Mean	Std. dev.	Coeff. of variation (%)
Up to 50	357	49.0762187 <sup>*</sup>	16.8169689	34.2670430
51-100	679	47.2926102 <sup>*</sup>	12.7212101	26.8989384
101-200	789	43.5076971 <sup>**</sup>	10.1933542	23.4288526
201-350	374	43.0865985 <sup>**</sup>	9.6660520	22.4340103
351-500	152	39.8649893 <sup>***</sup>	9.2826427	23.2852004
501 and more	245	39.2016884 <sup>***</sup>	10.6946606	27.2811224

Source: EDF database, own calculations

The coefficients of variation also indicate that the measured data reported in these groups are of a higher variability. The greatest variation occurs in the lowest group (small farms up to 50 heads, 34%) and in the highest group (the largest farms with more than 500 heads, 27%).

As a cause could be brought a big diversity of farms, which are small family farms to large companies.

The most important component, that affects the amount of direct costs, is the cost of feed, where the differences are significantly manifested by splitting of the file into 3 groups (see *table 4*). The lowest feed costs are in the group of the smallest farms (herd size up to 50 heads, € 7.21/100 kg ECM). It appears as a compact group namely from 51 to 200 heads (€ 8.6 to 8.9/100 kg ECM). Then comes a significant leap and in herd size from above 201 heads we can observe an increase in this cost upward the level of € 11/100 kg ECM. As in previous case of total costs, also here can be seen a higher variability. The greatest variation occurs in the lowest group (up to 50 heads, 80%), so although the mean of this group is significantly different from the others, we cannot say that all small farms have lower feed costs (standard deviation is here 5.8 €/100 kg ECM). Feed prices also may play a certain role, because they can vary from small to large farms, as well as between the EU regions.

We can only generally assumed that smaller farms tend to use the extensive process of production utilizing pastures (lowest cost), while larger farms tend to use supplementary feeding with concentrated fodders - they are specialised in milk. A similar trend of the consumption of concentrates (concentrate intake) also demonstrate it in *table 5*. On the other hand, we can see here a better treatment of cows on these small (family) farms, which can be seen through the indicators as culling rate or yield, when these smallest farms achieve low levels of culling rate (around 23% in average) and the highest lifelong milk yield (around 31.5 ths. kg/cow), which means a higher number of lactations.

**Table 3.** Statistical comparison of dairy herd size categories (total costs, €/100kg ECM)

Comparisons significant at the 0.05 level are indicated by ***.					
Herd comparison	size	Difference Between Means	Simultaneous Confidence Limits	95%	
Up to 50 ...	51-100	1.7836	-0.3491	3.9163	red <sup>x</sup>
Up to 50 ...	101-200	5.5685	3.4870	7.6501	***
Up to 50 ...	201-350	5.9896	3.5743	8.4049	***
Up to 50 ...	351-500	9.2112	6.0475	12.3749	***
Up to 50 ...	501 a. m.	9.8745	7.1704	12.5787	***
51-100 ...	101-200	3.7849	2.0763	5.4935	***
51-100 ...	201-350	4.2060	2.1036	6.3085	***
51-100 ...	351-500	7.4276	4.4958	10.3594	***
51-100 ...	501 a. m.	8.0909	5.6621	10.5197	***
101-200 ...	201-350	0.4211	-1.6294	2.4716	green <sup>xx</sup>
101-200 ...	351-500	3.6427	0.7479	6.5375	***
101-200 ...	501 a. m.	4.3060	1.9220	6.6900	***
201-350 ...	351-500	3.2216	0.0782	6.3650	***
201-350 ...	501 a. m.	3.8849	1.2046	6.5653	***
351-500 ...	501 a. m.	0.6633	-2.7071	4.0337	blue <sup>xxx</sup>

Source: EDF database, own calculations

**Table 4.** Differences in feed costs (€/100 kg ECM)

Herd size (heads)	No. of obs.	Mean	Std. dev.	Coeff. of variation (%)
Up to 50	357	7.2109262	5.7935362	80.3438561
51-100	679	8.6444595 <sup>x</sup>	3.9459392	45.6470319
101-200	789	8.9037021 <sup>x</sup>	4.3531352	48.8912948
201-350	374	11.7425004 <sup>xx</sup>	5.7053082	48.5868258
351-500	152	11.4054288 <sup>xx</sup>	4.8752401	42.7449086
501 and more	245	12.7426872 <sup>xx</sup>	5.9052879	46.3425637

Source: EDF database, own calculations

Development of milk yield per dairy cow and year then also indicates some intensification of milk production on larger farms, however the highest performance is achieved in the group of 351 to 500 heads, and then in group 51 -100 heads, and these averages are not statistically different to each other (green colour). A statistically significant difference in all group averages showed the group up to 50 heads (the very lowest milk yield) and a group of 501 or more (the second lowest yield). Reduction of milk yield in the highest size group is quite interesting (see *table 5*), and will be the subject of further research in the future. We can just suppose together with Spicka & Smutka (2014), that the core of large agricultural enterprises is in inefficient regions of the EU and they have a more extensive structure and produce more non-commodity output (public goods).

**Table 5.** Means of selected variables

Herd size (heads)	Milk yield (kg/cow.year)	Concentrate intake (kg/cow.day)	Share of culled cows (% per year)	Lifelong yield of cows (kg/cow)
Up to 50	7374.21	5.3404160	22.9005156	31495.94
51-100	8503.20 <sup>xx</sup>	6.3179881 <sup>x</sup>	29.2896422 <sup>x</sup>	29248.06 <sup>xx</sup>
101-200	8247.34 <sup>x</sup>	6.2552617 <sup>x</sup>	27.9125466 <sup>x</sup>	27177.02 <sup>x</sup>
201-350	8215.80 <sup>x</sup>	7.7580984 <sup>xx</sup>	29.3235182 <sup>x</sup>	26111.35 <sup>x</sup>
351-500	8750.82 <sup>xx</sup>	8.2867343 <sup>xx</sup>	29.9708855 <sup>x</sup>	29580.08 <sup>xx</sup>
501 and more	8160.63	7.9086059 <sup>xx</sup>	32.6315343	27214.15 <sup>xx</sup>

Source: EDF database, own calculations

Attention deserves also an indicator of labour input (see *table 6*). Total labour costs per litre of milk decrease with increasing number of heads in the herd. This can be attributed to greater automation of operations (farms with larger herd size) and also to the fact that these costs are “diluted” by higher milk production. In the groups above 200 heads, labour costs are roughly the same (statistically insignificant difference). It is obvious, that by this quantity roughly the same technologies are used, and these streamline the use of human labour.

**Table 6.** Total labour costs (€/100 kg ECM)

Herd size (heads)	No. of obs.	Mean	Std. dev.	Coeff. of variation (%)
Up to 50	357	13.2241155	7.7895647	58.9042403
51-100	679	10.2576711	4.6763084	45.5884026
101-200	789	7.6811492	2.6825890	34.9243188
201-350	374	6.8191996*	2.3591600	34.5958484
351-500	152	6.4664805*	2.1888093	33.8485410
501 and more	245	6.4070104*	2.4863903	38.8073396

Source: EDF database, own calculations

It corresponds to research done by Maksim et al. (2014), which suggests that high levels of production result: (1) in low cost per unit of output, (2) with an increase in the effective size of the farm business, and (3) with an increased effectiveness of labour and machinery. The high level of production provides a simple and effective method of increasing farm size. Farms with high agricultural productivity and high levels of productivity per head resulting in a large volume of business compared with farms with the same size but with lower production levels. This additional business volume is the result of working more effectively, without increasing the surface of the land or the size of the activities. Du Toit et al. (2010) investigated factors influencing the long-term competitiveness of 11 commercial milk producers from East Griqualand, South Africa, using unbalanced panel data for the period 1990 to 2006. Results of a ridge regression analysis have showed that dairy herd size, the level of farm debt, annual production per cow, technology and policy changed over time, and the ratio of trading income to total milk income influenced the long-term competitiveness of these milk producers. To enhance their competitiveness in a deregulated dairy market, relatively small and profitable milk producers should consider increasing their herd sizes, as the importance of herd size in explaining competitiveness suggests that size economies exist.

#### 4 Conclusion

From the EDF data analysed in the context of investigating the factors that affect the milk production and the costs of production revealed, that, irrespective of the origin country and year of observation, there are economies of scale. In case of the total cost, there has been clearly demonstrated that the costs of milk production decrease with increasing herd size. Total costs varied significantly in 3 groups: up to 100, from 101 to 350 and herds with more than 350 heads of dairy cows. This roughly corresponds to the cost of feed, which is one of the most important items of direct costs. It is proving that, with larger farms, these costs have risen significantly in the same groups as was recorded in the growth of concentrate intake. Concentrated fodders are far more used on the large farms (around 8 kg per cow and day), suggesting efforts for greater intensification of production. However, it is obvious that especially on small family farms (up to 50 heads) are used rather extensive production methods and it corresponds to both the intake of concentrate (about 5 kg per cow) and lower total milk yield (up to 7.500 kg ECM/cow.year). On the other hand, we can see here a better treatment of cows on these small (family) farms, which can be seen through the indicators

as culling rate or total milk yield, when these smallest farms achieve low levels of culling rate (around 23%) and the highest lifelong milk yield (around 31.5 ths. kg ECM/cow), which probably means a higher number of lactations.

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## Relation Between Excise Tax and Beer Consumption in Chosen EU States

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**Annotation:** Excise tax is one of the most important financial restrict instrument in frame of the whole agri food sector and European Union is in many aspects very heterogeneous block. One of these aspects is various beer excise tax in every member state; in the EU is harmonized only minimum level of the excise tax (0.748 EUR per ht/degree Plato).

The aim of the topic, respectively the research question is to confirm or to disprove the general significance of the relation between excise tax level and beer consumption level (per capita) in the European states. The paper is finding answers for four research questions: (i) Does the amount of excise tax influences beer consumption?; (ii) Is there any relation between the share (%) of alcohol consumed in beer and beer consumption?; (iii) Does the minimum age for drinking beer influences beer consumption?; (iv) Does the GDP per capita influences beer consumption?; In the paper are used statistical methods. The data sources are Brewers of Europe, World Health Organization and World Bank. For the analysis are used data from 33 European states.

The excise tax influences beer consumption in every state variously, so it makes sense to keep tax policy in this area on the national level in frame of EU.

**Key words:** excise tax, beer, consumption, wine, spirits,

**JEL classification:** D12

### 1 Introduction

The beer consumption is in many European countries very important phenomenon, especially in central European countries (Germany, Austria, Czech Republic) and countries on the British Islands (United Kingdom and Ireland). Without beer the social life mainly in the above mentioned countries can be poorer. On the other hand beer is alcoholic drink, so the influence of its consumption can be in some cases very negative. High consumption can make many problems – alcoholism, car driving under alcohol influence etc. So the states usually want to regulate its consumption and they use various instruments for it. The states have minimum age for drinking alcohol except some states situated outside of Europe (Benin, Burkina Faso, Cameroon, Ghana, Guinea-Bissau, Mali, Sao Tome and Principe, Sierra Leone, Togo, Bolivia, Syria, Bangladesh, Timor – Leste, Cambodia and China). Above mentioned states have extremely low consumption of alcohol. A little bit funny restriction is in Antigua and Barbuda where the minimum age is 10 years.

In the Europe the minimum age for drinking alcohol is 18 years except Austria (16), Belgium (16 for wine and beer, 18 for spirits), Cyprus (17), Denmark (16 for off-premise sales for wine and beer), Finland (20 for off-premise sales for spirits), Germany (16 for wine and beer, 18 for spirits), Iceland (20), Luxembourg (16), Malta (17), Netherlands (16 for wine and beer, 18 for spirits), Norway (20 for spirits), Portugal (16), San Marino (16), Spain (16), Sweden



(20 for off-premise sales for wine and spirits) and Switzerland (16 for wine and beer, 18 for spirits).

One of the instruments how to regulate beer consumption can be excise tax. In the European Union all the states must have minimum level of this tax for spirits and beer. Only for wine there is no minimum level.

All the products on sale should have been grown, reared, caught, brewed, pickled, baked, smoked or processed by the stallholder (Bavorová, 2014). To change or to manage excise taxes is very sensitive, the governments must be very careful during managing this instrument, because the excise taxes have very high multiplication influence into the whole agrifood sector and sector of service. If the governments increase excise taxes, the influence of this step is higher, because it has influence on the other taxes collection. We can give an example in Czech case. From the beginning of 2010 there was an increase in excise duty which resulted in a price increase for beer from all companies (Maier, 2012). And it decreased not only excise taxes collection; it decreased total beer industry taxes collection. The governments also use very often in brewing industry reduced excise taxes rate for smaller producers. Regional branding is applied also by the European Union, especially in the field of agriculture (Antoušková, 2014).

The European beer market is very favorable for the consumers. From the beginning of 2010 there was an increase in excise duty which resulted in a price increase for beer from all companies (Soukup, Brčák and Svoboda, 2014).

Thirty years of economic research has established that consumer choices about drinking are responsive to prices in the expected way (Chaloupka et al, 2002; Cook, 2007). Since alcohol taxes reduce sales and per capita consumption of ethanol, it is entirely plausible that they reduce alcohol abuse and related consequences for public health and safety (Cook and Durrance, 2013). But some researches are not agreed with it. Price is not the sole factor influencing beer sales, as evidenced by the relatively new craft beers which sell on the basis of taste and quality, generally at higher prices than the traditional beers (Ascher, 2012). Factors affecting beer choice and consumption from a consumer preference perspective can be divided in two different categories: beer attributes and factors related to the purchase process (Aquilani et al, 2015)

In this connection, the conclusions of Manning, Blumberg and Molton's study can be noted, that very heavy drinkers were found to be less responsive to changes in price than any other drinking group. The implication of this finding is that while higher alcohol taxes may reduce consumption by light and moderate drinkers, it will have little impact on very heavy drinkers, many of whom impose considerable external costs on society. In a more recent study [Manning, Blumberg and Molton (1995), Freeman (2000)], after controlling for income, found that alcohol taxes only modestly impacted the consumption of beer, with short-run and long-run elasticities around 0.01 and 0.1.

A tax change focused on one part of the alcoholic beverage market is not as effective as a tax change including all beverage types (Delcher et al, 2012).

### 1.1 Research questions

The aim of the research is to check how the restrictions in the beer (alcohol) sector influence the consumption per capita. On this base it is possible to define four research questions:

- i. Does the amount of excise tax influences beer consumption (l/capita)?
- ii. Is there any relation between the share (%) of alcohol consumed in beer and beer consumption (l/capita)?
- iii. Does the minimum age for drinking beer influences beer consumption (l/capita)?
- iv. Does the GDP per capita influences beer consumption (l/capita)?

## 2 Materials and Methods

It is very difficult to find credible data for beer consumption per capita, so for this contribution are used data from WHO (World Health Organization). But the data are in form of pure alcohol consumed in beer, wine, spirits etc. For the contribution the data are not modified.

For the modeling were used cross section data for the year 2010 for every member states EU-28 plus Iceland, Norway, Serbia, Swaziland and Turkey, so there are available 33 observations.

For the case of this contribution is used one hectoliter of beer with 12 degrees Plato or 5 % of alcohol. (According to the beer excise tax value)

The values of GDP/capita are from the database of World Bank.

For all the particular model was used econometrical program Gretl.

The methods used in the contribution:

Basic linear regression,

Elasticities,

Document studying.

## 3 Results and Discussion

The beer excise tax can be counted by two ways. The first way is counting from the amount of used malt and it depends on Plato degree. The minimum level of the tax in this case is 0.748 EUR per hL / degree Plato of finished product. This system is usually used in beer traditional countries like in Germany or Czech Republic. Second tax system depends on percentage of alcohol. The minimum level of the tax in this case is 1.87 EUR per hL / degree of alcohol of finished product.

The beer excise tax policy in Europe is very heterogeneous as we can see from the Table 1. From the beer excise tax view the most restrictive state is Iceland. The tax for one hectoliter of beer with 5 % of alcohol is 170.28 EUR. From the EU members the highest excise tax is in Finland – 143.52 EUR. The lower extreme is in case of Romania and Romania is also the only one state which follows the minimum level of the tax, the beer excise tax for one hectoliter is 8.976 EUR. It means that in Iceland the beer excise tax is 19 times higher than is the minimum level, in Finland it is 16 times higher.

In United Kingdom was very specific situation, every year the excise duty increased by inflation plus 2 % more, so it is a reason why the excise tax is so high.

Table 1. Basic data, 33 observations

	Beer (%)	Tax (EUR/hl)	Beer (l/capita)	Wine (l/capita)	Spirits (and others, l/capita)	GDP/Capita (USD)	Age
Austria	50	24.000	5.2	3.7	1.4	51800.9	16
Belgium	49	20.526	5.4	4.0	1.8	44358.3	16
Bulgaria	39	9.204	4.4	1.9	5.0	6580.8	18
Croatia	40	26.410	4.9	5.5	2.0	13500.9	18
Cyprus	41	22.940	3.8	2.2	3.2	27889	17
Czech Republic	54	15.432	7.0	2.6	3.4	19764	18
Denmark	38	41.040	4.3	5.5	1.6	57647.9	16
Estonia	41	27.360	4.2	1.1	4.9	14629.6	18
Finland	46	143.520	5.7	2.1	4.6	46202.4	18
France	19	13.200	2.3	6.8	3.1	40706.1	18
Germany	54	9.444	6.4	3.3	2.1	41723.4	16
Greece	28	31.200	2.9	4.8	2.6	26861.5	18
Hungary	36	23,952	4.8	4.0	4.5	12958.5	18
Iceland	62	170.280	4.4	1.5	1.3	41696	20
Ireland	48	75.408	5.7	3.1	3.1	47900.8	18
Italy	23	28.200	1.5	4.4	0.7	35875.7	18
Latvia	47	14.736	5.8	1.4	5.2	11446.5	18
Lithuania	46	11.808	7.1	1.2	7.1	11852.2	18
Luxembourg	36	9.520	4.3	5.1	2.5	102857	16
Malta	39	18.000	2.7	2.3	2.0	19695.3	17
Netherlands	47	32.640	4.7	3.6	1.7	50338.3	16
Norway	44	52.230	3.4	2.7	1.6	86096.1	20
Poland	55	21.360	6.9	1.1	4.5	12484.1	18
Portugal	31	18.430	4.0	7.1	1.8	22538.7	16
Romania	50	8.976	7.2	4.2	3.0	8139.1	18
Slovakia	30	17.218	3.9	2.3	6.8	16509.9	18
Slovenia	44	52.800	5.1	4.3	1.0	23417.6	18
Spain	50	9.960	5.6	2.2	3.4	30736	16
Serbia	51	18.460	6.4	3.0	3.2	5399.3	18
Sweden	37	86.976	3.4	4.3	1.5	52076.3	18
Switzerland	32	24.480	3.4	5.2	2.0	74276.7	16
Turkey	63	108.040	1.3	0.2	0.6	10135.7	18
United Kingdom	37	108.960	4.3	3.9	3.4	38363.4	18

Source: WHO, European Commission and Own calculations

First model is focused on beer consumption per capita dependency on excise taxes (Table 2.).

The influence is not statistically significant or rather it is statistically significant on very bad significance level. So the result is that there must be some other variable than excise tax which

influences beer consumption. It doesn't make any sense in this case to focus on the other statistical values.

**Table 2.** Beer consumption on beer excise tax, 33 observations

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	4.90878	0.372235	13.1873	<0.00001	***
e. tax	-0.00747874	0.0066455	-1.1254	0.26906	
Mean dependent var	4.614909	S.D. dependent var		1.530216	
Sum squared resid	71.98885	S.E. of regression		1.523884	
R-squared	0.039251	Adjusted R-squared		0.008259	
F(1, 31)	1.266490	P-value(F)		0.269064	
Log-likelihood	-59.69503	Akaike criterion		123.3901	
Schwarz criterion	126.3831	Hannan-Quinn		124.3971	

**Source: Own calculations**

If the highest share of consumed pure alcohol is from the beer, we can say, that the country is a "relatively beer country". The "most relatively beer country" is Turkey (63 %), Iceland (62 %) and Poland (55 %). The reason of so high value in Turkey can be tourism and the Islamic religion. The really typical beer states like Germany and Czech Republic have the share 54 %. Very interesting share is possible to see in case of Spain, where exactly ½ of pure ethanol is consumed by beer. The lowest share in case of beer is in France (19 %); but in France is the highest share of wine (56 %).

In the Table 3 are the results of dependency of beer consumption per capita on alcohol beer share.

**Table 3.** Beer consumption on alcohol beer share, 33 observations

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	26.395	4.95271	5.3294	<0.00001	***
alcohol beer share	3.51933	1.02019	3.4497	0.00164	***
Mean dependent var	42.63636	S.D. dependent var		10.22503	
Sum squared resid	2417.580	S.E. of regression		8.830993	
R-squared	0.277393	Adjusted R-squared		0.254083	
F(1, 31)	11.90023	P-value(F)		0.001639	
Log-likelihood	-117.6762	Akaike criterion		239.3524	
Schwarz criterion	242.3454	Hannan-Quinn		240.3595	

**Source: Own calculations**

The dependency seems to be perfect, there is very high statistical significance and also all the other statistical parameters are very good. Only the R<sup>2</sup> is pretty low.

The elasticity is 0.73 %; if the alcohol beer share increases by 1 % (not by 1 percentage point), so the beer consumption (pure alcohol) increases by 0.73 %.

Now it is possible to make synergic model from all two previous models, because the second model represents consumer's habits or rather the synergic model can eliminate consumer's habits influence.

**Table 4.** Beer consumption on beer excise tax and alcohol beer share, 33 observations

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	1.05022	0.912279	1.1512	0.25874	
e. tax	-0.0151608	0.00551052	-2.7513	0.00997	***
alcohol beer share	0.0975792	0.0218463	4.4666	0.00010	***
Mean dependent var	4.614909	S.D. dependent var		1.530216	
Sum squared resid	43.23588	S.E. of regression		1.200498	
R-squared	0.422982	Adjusted R-squared		0.384515	
F(2, 30)	10.99574	P-value(F)		0.000262	
Log-likelihood	-51.28266	Akaike criterion		108.5653	
Schwarz criterion	113.0549	Hannan-Quinn		110.0759	

Source: Own calculations

It seems that the third model has excellent results. The tax elasticity is -0.13 and alcohol beer share elasticity is 0.9. The deeper analysis is the chapter Conclusion.

**Table 5.** Beer consumption on GDP/capita, 33 observations

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	5.12785	0.462466	11.0881	<0.00001	***
GDP/capita	-1.52984e-05	1.13448e-05	-1.3485	0.18727	
Mean dependent var	4.614909	S.D. dependent var		1.530216	
Sum squared resid	70.77808	S.E. of regression		1.511014	
R-squared	0.055410	Adjusted R-squared		0.024939	
F(1, 31)	1.818460	P-value(F)		0.187267	
Log-likelihood	-59.41516	Akaike criterion		122.8303	
Schwarz criterion	125.8233	Hannan-Quinn		123.8374	

Source: Own calculations

The statistical significance of minimum age beer drinking is extremely low; if for the variable "age" is used unit "year", the p-value is 0.7184 and if the "age" is dummy variable like 0-1 vector, so the p-value is 0.803. 0 means minimum beer drinking age lower than 18, 1 means 18 and higher. (In the paper are not the results)

For the influence of GDP/capita and its influence of beer consumption can be made two opposite assumption. Better economic situation (GDP/capita) can increase total beer consumption (people can buy more products) or better economic situation can increase only high quality beer and other high quality alcohol products.

The regression is again not statistically significant, so it means that the economic development does not have significant influence on beer consumption.

This can be different for a wine consumption.

**Table 6.** Wine consumption on GDP/capita, 33 observations

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	2.48841	0.486782	5.1120	0.00002	***
GDP/capita	2.59481e-05	1.19413e-05	2.1730	0.03754	**
Mean dependent var	3.358424	S.D. dependent var		1.680411	
Sum squared resid	78.41674	S.E. of regression		1.590463	
R-squared	0.132184	Adjusted R-squared		0.104189	
F(1, 31)	4.721839	P-value(F)		0.037544	
Log-likelihood	-61.10622	Akaike criterion		126.2124	
Schwarz criterion	129.2054	Hannan-Quinn		127.2195	

**Source: Own calculations**

In the case of wine the dependency is significant (0.05 significance level). So it means that wine is product with high quality and good economic situation makes higher demand of this product.

The same dependency is possible to try for spirits. The results are in Table 7.

**Table 7.** Spirits consumption on GDP/capita, 33 observations

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	3.89209	0.463757	8.3925	<0.00001	***
GDP/capita	-2.90259e-05	1.13764e-05	-2.5514	0.01588	**
Mean dependent var	2.918879	S.D. dependent var		1.640499	
Sum squared resid	71.17389	S.E. of regression		1.515233	
R-squared	0.173546	Adjusted R-squared		0.146886	
F(1, 31)	6.509646	P-value(F)		0.015882	
Log-likelihood	-59.50718	Akaike criterion		123.0144	
Schwarz criterion	126.0074	Hannan-Quinn		124.0214	

**Source: Own calculations**

In case of spirits the results are opposite than in case of wine. Dependency is statistically significant, but it is possible to check negative dependency. It means that better economic situation decreases spirits demand and the people are more focus on wine.

## 4 Conclusion

The main aim of this paper is to check if the beer excise tax influences beer consumption, more rather what are the other determinants which influence beer consumption in almost all European states (totally 33 states).

*Influence of excise tax (1<sup>st</sup> research question)* –The beer excise tax separately doesn't influence the beer consumption per capita.

*Influence of share (%) of alcohol consumed in beer (2<sup>nd</sup> research question)* – Relative share of alcohol consumed in beer influences the beer consumption per capita.

Both explanatory variables are better to put into one model, because it eliminates consumers habits. This finding is very important for the EU institutions that it important not to harmonize the beer excise tax on the EU level but it is important to keep beer excise tax policy

on the authority of every single EU member state. The excise tax elasticity is -0.13 and it is similar to the results of Manning, Blumberg and Molton (1995) and Freeman (2000).

*Influence of minimum drinking age for beer (3<sup>rd</sup> research question)* – The minimum drinking age for beer doesn't influence the beer consumption per capita, so from only the statistical view this instrument is not important. Neither low age makes bad habits in frame of beer consumption, nor high age changes beer to "forbidden fruit" for the consumers.

*Influence of GDP/capita (4<sup>th</sup> research question)* – The GDP per capita doesn't influence beer consumption per capita. Much more interesting are the results for wine and spirits consumptions. In case of wine the dependency is positive with the elasticity 0.26 %. In case of spirits the dependency is negative and the elasticity is -0.33 %.

For the public authorities in this research contribution are two important findings. At first the managing of beer excise tax should be kept on the national level because of the consumers habits. Secondly there is one additional reason for economic development, according to the rising GDP/capita the wine consumption increases and consumption of spirits increases with higher elasticity (sensitivity).

The results of this research may serve for national and EU authorities to run better the excise tax policy and economic development.

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## Performance of Czech Dairy Farms

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**Annotation:** The Czech dairy sector passed through dramatic changes after the accession of the Czech Republic to the European Union. The development after the year 2004 can be characterized by a reduction in the number of cows, a growth in milk yield, capital market imperfections, a high dependency of the local farm price on world market price development and the strong dependency of farm performance on policy measurement, namely quotas and subsidies. The aim of the paper is to evaluate the profitability and efficiency of Czech dairy farms on a regional bases and with respect to the policy measurement changes. The evaluation will be addressed using two main methods, namely stochastic frontier estimation and Spearman correlation coefficient computation. The calculations and estimation are based on unbalanced panel data of Czech dairy farms-local entities drawn from the Registr32 database and the State Agricultural Intervention Fund database. The data set covers the period from 2004 to 2013. The results show that producers in all analysed regions extensively exploited their production possibilities. However, the profitability tendency was not the same in the analysed regions. The worst situation was in the Královéhradecký region where the decrease of profitability was caused by the decrease of output and by the loss of market power. Whereas the profitability increased the most in the Moravskoslezský region and it was especially due to technical change.

**Keywords:** Profitability, efficiency, dairy, policy, subsidies, quotas, region

**JEL classification:** Q12, Q18

### 1 Introduction

The Czech Republic entered the European Union (EU) in 2004 which opened the free market with new opportunities and challenges. It meant also the introduction of the Common Agricultural Policy (CAP) and its market regulation and interventions. New milk quotas and price regulation were introduced (e.g. national reference quantity and a minimum milk price). The quotas influenced milk production and also the herd count. National reference quantity grew the whole time. In spite of quotas annual growth, the number of cows decreased significantly. The lowest number of cows were in 2009 (the lowest number since 1993). Milk production on Czech dairy farms decreased annually most significantly in the first part of the tracked period (the biggest decrease since entering the EU was in 2010). After 2010 it steadily increased until the end of the period.

The aim of the paper is to evaluate the profitability and efficiency of Czech dairy farms in a regional context and with respect to the policy measurement changes. The paper addresses the following research questions: How did policy measurement contributes to the profitability and efficiency of dairy farms? Are there the regional differences in profitability and efficiency of dairy farms and their development?

The achievement of the research objectives extended the knowledge of the Czech dairy sector economy and competitiveness of dairy farms. The performance of Czech dairy farms has only been analysed in a few studies (e.g. Bošková, 2014; Špička, 2013) and these studies typically measured the performance physically by total factor productivity and technical efficiency.

Kumbhakar and Lien (2009) pointed out that maximization of productivity growth might not correspond to the profit maximization that is the goal of most producers. They suggested measuring performance in terms of profit and decomposed profitability into components such as output growth, output and input price changes, technical change, returns to scale, mark-up and technical efficiency change.

## 2 Materials and methods

The analysis of the performance of Czech dairy farms is based on Sipiläinen et al. (2013) extension of Kumbhakar and Lien (2009) approach to profitability decomposition, see equation (1).

$$\frac{1}{C} \frac{d\pi}{dt} = \dot{Y}_P \left( \frac{R}{C} - 1 \right) + \frac{\dot{P}R}{C} - \dot{W} + TC + [(1 - RTS^{-1})\dot{Y}_C] + (\dot{Y}_P - \dot{Y}_C) + \dot{T}E, \quad (1)$$

where  $\pi$  is profit,  $R$  is the total revenue,  $C$  is the total cost,  $\dot{Y}_P$  is the rate of change in output weighted by output revenue shares,  $\dot{Y}_C$  is the rate of change in output weighted by estimated output cost elasticities,  $\dot{P}$  is the rate of change in output price,  $\dot{W}$  is the input price change,  $TC$  is technical change,  $RTS$  is returns-to-scale,  $\dot{T}E$  is technical efficiency change and  $t$  is time.

From equation 1, it is evident that the profitability change can be decomposed to seven components: (i) the output growth component  $\dot{Y}_P (R/C - 1)$ , (ii) the output price change component  $\dot{P} (R/C)$ , (iii) the input price change component  $\dot{W}$ , (iv) the technical change component  $TC$ , (v) the scale component  $(1 - RTS^{-1})\dot{Y}_C$ , (vi) the mark-up component  $\dot{Y}_P - \dot{Y}_C$  and the technical efficiency change  $\dot{T}E$ .

The components (i)-(iii) can be computed directly from the observed data according to the following equations based on Sipiläinen et al. (2013) in modification for one output of the production:

$$\dot{Y}_P \left( \frac{R}{C} - 1 \right) = \frac{(Y_{m,t} - Y_{m,t-1})}{\frac{1}{2}(Y_{m,t} + Y_{m,t-1})} \left( \frac{R}{C} - 1 \right), \quad (2)$$

$$\frac{R}{C} = \frac{\frac{1}{2}(TS_{m,t} + TS_{m,t-1}) + \frac{1}{2}(\bar{Y}_{m,t} + \bar{Y}_{m,t-1})}{\sum_j \frac{1}{2}(W_{j,t} + W_{j,t-1}) \frac{1}{2}(X_{j,t} + X_{j,t-1})}, \quad (3)$$

Where:

$$\frac{\dot{P}R}{C} = \frac{(P_{m,t} - P_{m,t-1})}{\frac{1}{2}(P_{m,t} + P_{m,t-1})} \frac{R}{C}, \quad (4)$$

$$\dot{W} = \sum_j \frac{\frac{1}{2}(W_{j,t} + W_{j,t-1}) \frac{1}{2}(X_{j,t} + X_{j,t-1})}{\sum_j \frac{1}{2}(W_{j,t} + W_{j,t-1}) \frac{1}{2}(X_{j,t} + X_{j,t-1})} \frac{(W_{j,t} - W_{j,t-1})}{\frac{1}{2}(W_{j,t} + W_{j,t-1})} \quad (5)$$

where:  $P_m$  is the price of output  $m$ ,  $Y_m$  is quantity of output  $m$ ,  $\bar{Y}_m$  is monetary value of output  $m$ ,  $W_j$  is the price of input  $j$  ( $j=1, \dots, J$ ) and  $X_j$  is quantity of input  $j$  ( $j=1, \dots, J$ ).

As Sipiläinen et al. (2013) noted, employing averages of the consecutive periods  $t-1$  and  $t$  ensure that the analysis is time consistent for 'static' variables.

A computation of the rest of components (iv)-(vii) is based on the estimation of cost function. The cost function estimation needs information about input prices. However, this information is limited and the variability of input price is low for such estimation, we employ the duality theorem and estimate an input distance function (IDF). Using the homogeneity property we can estimate the following stochastic translog IDF with  $M$  outputs and  $J$  inputs based on panel data:

$$-\ln X_{1i,t} = (\alpha_0) + \sum_{m=1}^M \beta_m \ln Y_{mi,t} + \frac{1}{2} \sum_{m=1}^M \sum_{n=1}^N \beta_{mn} \ln Y_{mi,t} \ln Y_{ni,t} + \sum_{m=1}^M \sum_{j=2}^J \delta_{mj} \ln Y_{mi,t} \ln \tilde{X}_{ji,t} + \sum_{j=2}^J \beta_j \ln \tilde{X}_{ji,t} + \frac{1}{2} \sum_{j=2}^J \sum_{k=2}^K \beta_{jk} \ln \tilde{X}_{ji,t} \ln \tilde{X}_{ki,t} + \alpha_t t + \frac{1}{2} \alpha_{tt} t^2 + \sum_{m=1}^M \alpha_{mt} \ln Y_{mi,t} + \sum_{j=2}^J \beta_{jt} \ln \tilde{X}_{ji,t} + v_{i,t} - u_{i,t}, \quad (6)$$

Where:  $\ln \tilde{X}_{jit} = \ln X_{jit} - \ln X_{1i,t}$ ,  $\alpha$ ,  $\beta$ ,  $\delta$  are parameters to be estimated. The symmetry restrictions imply that  $\beta_{jk} = \beta_{kj}$  and  $\beta_{mn} = \beta_{nm}$ .  $v_{i,t} \sim iidN(0, \sigma_v^2)$  is a stochastic error term and  $u_{i,t} \sim N^+(\mu, \sigma_{u_{i,t}}^2)$  is a time varying inefficiency.

We also normalised all variables in logarithm by their sample mean which makes it possible to interpret the estimated first-order parameters as elasticities at the sample mean. Equation 6 was estimated in the form of True Fixed Effect Model (TFEM) to farm heterogeneity captured, using the maximum simulated likelihood method in the econometric software LIMDEP 9.0.

Following Kumbhakar and Lien (2009) the TC component, that takes into the account the averages of the consecutive periods  $t-1$  and  $t$ , can be computed from IDF as in equation 7:

$$TC = -\frac{\partial \ln X_1}{\partial t} = \alpha_t + \alpha_{tt} t + \sum_{m=1}^M \alpha_{mt} \ln Y_{mi,t} + \sum_{j=2}^J \beta_{jt} \ln \tilde{X}_{ji,t}. \quad (7)$$

The scale component is computed using the following equations 8 - 10:

$$RTS = \frac{1}{\sum_m \partial \ln X_1 / \partial \ln Y_m} \quad (8)$$

$$\frac{\partial \ln X_1}{\partial \ln Y_{mi,t}} = -\left( \beta_m + \sum_{n=1}^N \beta_{mn} \ln Y_{ni,t} + \delta_{mj} \sum_{j=2}^J \ln \tilde{X}_{ji,t} + \alpha_{mt} t \right) \quad (9)$$

$$\dot{Y}_C = RTS \sum_m \frac{\partial \ln X_1}{\partial \ln Y_{mi,t}} \frac{(Y_{m,t} - Y_{m,t-1})}{\frac{1}{2}(Y_{m,t} + Y_{m,t-1})} \quad (10)$$

Equation 10 is also used to compute the mark-up component. Finally, the technical efficiency change is computed using equation 11:

$$\dot{T}E_{i,t} = \frac{TE_{i,t} - TE_{i,t-1}}{\frac{1}{2}(TE_{i,t} + TE_{i,t-1})}, \quad (11)$$

Where the technical efficiency is estimated using the Jondrow et al. (1982) approach.

Moreover, we analysed the impact of subsidies and milk quota on the profitability components. The impact was analysed with Spearman's rank correlation coefficients computed with rate of change of subsidies and milk quota (computed similar to change of technical efficiency, see equation 11). Following the Minviel and Latruffe (2014) findings, that each type of subsidy has to be treated separately in empirical analysis, we divided total

farm subsidies into three main groups: Single Area Payments (SAPS), Less Favoured Areas (LFA) payment and the others.

The analysis uses unbalanced panel data of Czech dairy farms-local entities drawn from the Registr32 database and the State Agricultural Intervention Fund database. The data set covers the period from 2004 to 2013 and consists of 470 cases. We used following outputs and inputs in this study to estimate the IFD: total output ( $y_1$ ), support payments ( $y_2$ ), labour measured in AWU ( $x_1$ ), total utilized land in hectares ( $x_2$ ), capital ( $x_3$ ) and material and energy ( $x_4$ ). The inclusion of support payments is based on the Kumbhakar and Lien (2009) approach which deals with the goal to include all farms' incomes into the profitability function. Basic characteristics are in Table 1. Outputs as well as inputs (except labour and land) are deflated by price indices (aggregated agricultural output and input indices (2010 = 100) – source Czech Statistical Office database). The output price for milk and input prices for labour and land are taken from the Czech Statistical Office database.

**Table 1.** Characteristics of sample

	Mean	Std. Deviation	Minimum	Maximum
Output (CZK)	188,344.44	282,870.98	2,299.81	1,562,615.53
Land (ha)	648.61	743.08	78.98	4,520.46
Work (Person)	97.12	195.19	1.00	845.00
Material and energy (CZK)	158,215.75	197,269.73	5,241.86	1,120,704.93
Capital (CZK)	3,632.19	5,222.34	2.00	28,177.00
Total subsidies (CZK)	6,224,717.66	7,969,929.91	1.00	50,906,896.94
SAPS (CZK/ha)	2,133,293.64	2,980,798.84	1.00	27,160,639.28
LFA (CZK)	1,319,915.57	1,864,740.85	1.00	14,397,884.00
Others subsidies (CZK)	1,542,532.98	2,580,865.61	-13094.47	23,508,318.62

Source: own calculations

### 3 Results and discussions

Table 2 provides the estimated parameters of the IDF. All first-order parameters are significant even at 1% significance level. As far as the theoretical consistency is concerned, the estimated model implies that the estimation should inherit the properties of an input distance function. The input distance function must fulfil the following conditions: symmetry, monotonicity, positive linear homogeneity, non-decreasing and convex in outputs, and decreasing in inputs. These requirements imply:  $\beta_{xj} > 0$  and  $\beta_{ym} < 0$  for  $j=2,\dots,5$  and  $m=1,\dots,3$ . Table 2 shows that these conditions are met.

Since all variables are normalized in logarithm by their sample mean, the first-order parameters can be interpreted as elasticity of the IDF with respect to output and as shadow value share with respect to inputs on the sample mean. As can be seen from the table in Table 2, the input share of capital is the lowest (0.0447), the input share of land is the highest (0.4619), and elasticity of the output is about 0.2526 and the elasticity of the support payment is 0.0256. That is, the share of capital in the total cost is only 5%; however, the share of land is about 46%. This reflects the absence of innovations in milk production connected with capital market imperfections, especially at the beginning of the analysed time period. This result was also confirmed by Čechura et al. (2014). The parameter lambda is highly significant and greater than one. The variation in  $u_{it}$  is more pronounced than the variation in the random component  $v_{it}$ . This indicates that most of the deviation from the border of the input requirement set is due to technical inefficiencies rather than random shocks.

Table 2. Parameters estimate

Variable	Coeff.	SE	P [ z >Z*]	Variable	Coeff.	SE	P [ z >Z*]
Time	0.0148***	0.0031	0.0000	X22	0.1601***	0.0553	0.0038
Y1	-0.2526***	0.0275	0.0000	X33	0.0190**	0.0079	0.0156
Y2	-0.0256***	0.0128	0.0453	X44	0.0979**	0.0481	0.0417
X2	0.4619***	0.0337	0.0000	X23	-0.0417**	0.0209	0.0459
X3	0.0447***	0.0130	0.0006	X24	-0.1316***	0.0510	0.0100
X4	0.2033***	0.0375	0.0000	X34	0.02879	0.0186	0.1210
TT	-0.0084***	0.0022	0.0001	Y1X2	0.0383	0.0277	0.1662
Y1T	-0.0090***	0.0023	0.0001	Y1X3	0.0109	0.0103	0.2906
Y2T	-0.0019***	0.0007	0.0121	Y1X4	-0.0283	0.0223	0.2059
Y11	-0.0739***	0.0304	0.0149	Y2X2	-0.0268***	0.0062	0.0000
Y22	-0.0002	0.0030	0.9408	Y2X3	0.0052*	0.0028	0.0645
Y12	-0.0188***	0.0039	0.0000	Y2X4	0.0210***	0.0071	0.0032
X2T	0.0004***	0.0001	0.0000	Sigma	0.2110***	0.0004	0.0000
X3T	0.0185	0.0020	0.3421	Lambda	7.0035**	4.5771	0.0474
X4T	-0.0001***	0.0001	0.0009				
X5T	0.0017	0.0014	0.1980				

Source: own calculations

Note: \*\*\*, \*\*, \* denotes significance at the 1%, 5%, and 10% levels respectively

The average technical efficiency of dairy farms is 94.18%. The distribution of technical efficiency is narrow: the standard deviation is 0.02, the minimum value is 92.86% and the maximum value is 99.53%. That is, the milk producers extensively exploited their production possibilities. These results are compatible with the results of Čechura et al. (2014), who used the Fixed Management Model (FMM) to analyse the technical efficiency of Czech and Slovak farms which produce milk.

Table 3. Regional comparison of technical efficiency of dairy farms

	Mean	Std. Deviation	Minimum	Maximum
Jihočeský (ID 1)	0.939	0.019	0.931	0.988
Jihomoravský (ID2)	0.948	0.022	0.951	0.981
Karlovarský (ID 3)	0.941	0.021	0.950	0.988
Královehradecký (ID 4)	0.935	0.019	0.939	0.987
Liberecký (ID 5)	0.944	0.021	0.930	0.990
Moravskoslezský (ID 6)	0.940	0.020	0.932	0.989
Pardubický (ID 7)	0.943	0.022	0.930	0.988
Plzeňský (ID 8)	0.941	0.018	0.931	0.986
Středočeský (ID 9)	0.935	0.020	0.929	0.995
Ústecký (ID 10)	0.939	0.018	0.930	0.979
Vysočina (ID 11)	0.940	0.021	0.929	0.986
Zlínský (ID 12)	0.945	0.019	0.930	0.987

Source: own calculations

When we compare technical efficiencies we can conclude that there are no big differences in their average in the regions of the Czech Republic (see Table 3) – the mean of technical efficiency is between 93.5% and 94.7%. The highest mean of technical efficiency is in the Jihomoravský region (94.79%), however the highest maximum of technical efficiency is in the Středočeský region (99.52%). The standard deviation of each region does not suggest big differences inside the regions (only around 2%).

The trend of average technical efficiency is different in each region (2004 – 2013). It has the highest annual growth in Jihočeský, Jihomoravský and the Pardubický region, on the contrary the average drops annually in Karlovarský region. Other regions have irregular tendency.

Table 4 presents the mean value of profitability components. As can be seen, the profitability of milk producers increased by 2.7% per annum on average. The technical change and the output price change pushed this profitability change. That is, milk farms employed investments in order to shift their production frontier. The positive contribution of technical change could be due to modernization and innovation supported by investment subsidies (see Špička and Machek, 2015). The investment subsidies are involved in “other subsidies” in our analysis. Table 4 shows the significant positive correlation between other subsidies change and technical change. Moreover, the increase of SAPS and LFA was connected with the increased technical change. This result opposes the Sipiläinen and Kumbhakar (2010) foundation that agricultural subsidies negatively affected technical change and should be put to future research.

On average the output price change component contributed positively to profitability change (1.4% per annum). The development of domestic milk price reflects the world price development and can be described by strong fluctuation, especially in time period 2006-2009 when the primary rapid increase in 2007 was followed by two years of decreasing milk price. After that the milk price mainly increased, the year 2012 being the exception. The average relative growth rate of milk price was 2% during the analysed period. This tendency of output price was correlated with policy measurements, especially with SAPS and quota, see the significant Spearman’s rank coefficients in Table 3. The simultaneous increase of SAPS and output price strengthen the profitability of milk producers. The introduction of milk quota is on the other hand connected with the output price decrease due to supply increase.

The positive contribution to the profitability increase was also pronounced in the case of mark-up component. A non-zero mark-up component implies that some market imperfections exist on the milk market. Moreover, this imperfection is significantly connected with the LFA and the other subsidies change and also with quota change. This shows that agricultural policy instruments can lead to market distortions (as mentioned also Brooks et al. (2008)).

Conversely the scale component contributed negatively to the profitability change. This result implies that milk farms did not operate on an effective scale, similar to milk farms in Norway (see Kumbhakar and Lien, 2009). The significant negative correlation can be found among scale component and the LFA, the other subsidies and the quota changes. The significant negative correlation was also observed between SAPS and technical efficiency change. Similar results were obtained by Rizov et al. (2013). Finally, the profitability change as a whole was positively correlated with SAPS and LFA subsidies which are an additional income for milk producer and significantly contributed to their profitability. Similar result was obtained by Chrastinová and Burianová (2009) for Slovak farmers.

**Table 4.** Mean value of profitability change components (in percent) and Spearman's rank correlation coefficients

	Mean	SAPS change	LFA subsidy change	Other s. change	Quota change
Output growth	-0.040	-0.017	<b>0.173</b>	<b>0.180</b>	<b>0.150</b>
Output price change	1.375	<b>0.222</b>	0.041	-0.076	<b>-0.166</b>
Input price change	-0.107	0.038	<b>0.107</b>	0.092	<b>0.147</b>
Technical change	1.872	<b>0.201</b>	<b>0.329</b>	<b>0.297</b>	<b>0.475</b>
Scale	-0.858	-0.049	<b>-0.326</b>	<b>-0.353</b>	<b>-0.270</b>
Mark-up	0.256	0.037	<b>0.292</b>	<b>0.305</b>	<b>0.269</b>
Technical efficiency change	-0.055	<b>-0.109</b>	0.023	-0.070	-0.029
Profitability change	2.658	<b>0.189</b>	<b>0.139</b>	0.088	0.009

Source: own calculations

Note: Bolded coefficients are statistically significant with  $\alpha = 0.05$ .

Table 5 presents the mean of components of profitability of dairy farms from a regional point of view. The output growth is negative in most of the regions (the greatest negative change is in the Karlovarský region (-7.4%) and the highest positive growth in the Středočeský region (2.6%). The output price change is mostly positive, only the Jihomoravský region has negative change. The highest positive price change is in the Jihočeský region (3.28%). The input price change is not significant and it is also positive in most of the regions except the Moravskoslezský, Pardubický and Plzeňský region. The technical change component only grows positively and can be found between 0.06% (the Královehradecký region) and 2.54% (the Jihomoravský region). The mean of scale component in each region is mostly negative, only four regions reach positive change of this component (Královehradecký, Středočeský, Jihomoravský, Karlovarský). It means that only those regions are moving towards the optimization of production. The rest of the regions do not produce with optimal returns to scale. The results of mark-up components quidiffer, half of the regions reached positive change of the component (the component was from (-2.74%) to 4.91%). Technical efficiency is steady (according to Table 3 and Table 5). The change is only from (-0.68%) to 0.20% and is negative in the half of regions. Finally, profitability change is between (-5.50%) in the Královehradecký region and 5.67% in the Moravskoslezský region.

**Table 5.** Calculated profitability change components (mean of each region in percent)

	Output growth	Output price change	Input price change	Technical change	Scale	Mark-up	Technical efficiency change	Profitability change
Jihočeský (ID 1)	-0.68	3.28	0.12	1.69	-3.41	2.93	-0.37	3.74
Jihomoravský (ID2)	-0.32	-0.72	0.86	2.54	1.70	-2.74	-0.43	-0.47
Karlovarský (ID 3)	-7.43	3.04	0.92	0.60	5.54	0.57	-0.34	1.05
Královehradecký (ID 4)	-6.29	1.92	0.27	0.06	0.91	-1.60	-0.68	-5.50
Liberecký (ID 5)	-0.58	0.61	0.11	1.04	-1.29	-1.97	-0.16	-2.04
Moravskoslezský (ID 6)	0.96	1.40	-0.67	2.04	-1.43	1.70	0.02	5.67
Pardubický (ID 7)	-0.18	2.04	-0.36	1.68	-0.16	-1.14	0.19	3.22
Plzeňský (ID 8)	0.00	1.92	-0.66	1.02	-1.09	0.61	0.20	3.77
Středočeský (ID 9)	2.56	0.13	0.83	1.04	1.41	0.00	0.00	4.39
Ústecký (ID 10)	-1.74	1.70	0.24	1.16	-1.77	3.06	0.00	2.61
Vysočina (ID 11)	-2.45	2.10	0.34	1.43	-2.69	4.91	0.00	3.41
Zlínský (ID 12)	-0.44	1.61	0.16	1.99	-0.20	-0.04	-0.10	2.71

Source: own calculations

## 4 Conclusion

The level of technical efficiency shows that milk producers in all analysed regions extensively exploited their production possibilities. However, the change of technical efficiency negatively affected the profitability of milk farms. The positive development of profitability, obtained in the analysed time period, was especially due to the technical change and the output price change. The mark-up component also had a positive contribution to the profitability change. On the other hand, the increase of profitability was slowed down by scale component.

The profitability development was not the same in the analysed regions. Although the mean profitability change was positive, the profitability decreased in three of the analysed regions. The worst situation was in the Královéhradecký region where the decrease of profitability was caused by the decrease in output and by the loss of market power. On the other hand the profitability increased the most in the Moravskoslezský region and it was especially due to technical change.

The development of milk producers' profitability was influenced by the agricultural policy and its measures. The increase in volume of received subsidies as well as the introduction of milk quota meant that milk farmers employed investments in order to shift their production frontier. Conversely the majority of the agricultural policy instrument under observation led to market distortion and decreased the motivation of farmers to move to optimal scale. The repeal of the milk quota was connected with an increase in milk production. We can suppose that the abolition of the milk quota in April 2015 will be followed by a further increase in milk production, leading to greater supply in the commodity market connected with a decrease in the price of milk.

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# Establishing food security for Bangladesh's rural poor through sustainable collective farming practices

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**Annotation:** Food security is a particularly notorious concept in Bangladesh, a country with severe overpopulation issue and forecasted population expansion by another 40 million within the next 35 years. Aware of the gravity of the situation and country's uncertain future, the paper makes an attempt at assessing the potential of collective farming in establishing food security for Bangladesh's rural poor by contrasting individual and collective farming practices. It does that by producing a set of four scenarios using Rangpur division data as a base and a hypothetical village model to generate the results, revealing potential boosts in rice production ranging from 32.38% in case of land aggregation and 300% cropping intensity, a further 41.55% if selected improvements are introduced, and an additional 31.18% should high-yielding varieties be grown under optimal growing conditions, for a total increase of 145.81%, compared to current production levels. Financial side of collective farming and possible constraints are addressed as well using specific examples such as minimum farm holding size needed to justify the ownership of selected pieces of equipment and the cost-benefit analysis of substituting some of the more labor-intensive activities with appropriate mechanized equipment, while at the same time highlighting the importance of government support in establishing and maintaining collective farming initiative.

**Key words:** collective farming, food security, sustainable agriculture, rural poor, Bangladesh, rice production

**JEL classification:** Q01, Q15, Q18, J11

## 1 Introduction

Food security is a condition in which all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life (Mallick et al., 2012). Bangladesh, as one of the most densely populated countries in the world, with over 150 million inhabitants (TWB, 2015), is particularly vulnerable to issues related to food security. As country's population is expected to rise to almost 200 million by 2050 (UN, 2012), the need for sustainable intensification of food production becomes even more pressing.

Collective farming, as one of the less often used options, could be the way to reaching this goal. Developing countries such as Bangladesh could realize these benefits with relatively moderate investments in subsidies for equipment, fertilizers, and seeds, as well as training of participating farmers and extension officers. Moreover, country's \$187 billion economy (CIA, 2015) is a particularly good candidate as it is reliant on its agrarian sector which provides employment for as much as 45% of the total labor force. However, as rural population continues to migrate to more urbanized areas and move out of agriculture, current labor-intensive practices would have to evolve as well.

Such agricultural transformation, perhaps in the form of collective farming, would most likely benefit rice producers first, which shouldn't come as a surprise as this carbohydrate-rich crop

provides as much as two-thirds of the total calorie supply and about one-half of the total protein intake of an average person in Bangladesh (IRRI, 2015). As such, it is used together with potato (second most widely grown crop), mustard, and lentil (cash crops and important protein sources), to demonstrate the potential of collective farming by contrasting individual and collective farming scenarios.

Introducing farming households to collective farming, however, may be slowed down as over half of the rural households in Bangladesh are landless and forced to live on and cultivate flood-prone land, facing natural calamities and increasingly present effects of climate change year round (TWB, 2015). In case of Rangpur division (one of the country's most impoverished regions), as much as 51.61% of households are landless while the poorest 80% own a mere 15.67% of the total land, suggesting that collective farming may be in fact limited to households with a certain amount of land (NIPRT, 2013).

Other limitations such as availability of resources, access to credit, and knowledge gap, although still significant, are less restraining and easier to overcome. Collective farming addresses these drawbacks and empowers farming communities in their negotiations with local government and commercial sector, allowing them to achieve better prices for their crops and more favorable deals when purchasing inputs (Braverman et al., 1991).

Cooperative farms from Kyrgyz Republic, for example, were able to achieve several times greater total annual income from crop production compared to individual farms, and significantly higher total factor productivity. Romanian cooperative farms, on the other hand, had higher individual crop yields for wheat, maize, and sunflower than individual farms, higher labor productivity, and higher land productivity (up to a certain farm size). Further to the west, German cooperative farms had the most efficient organizational form in terms of overall technical efficiency during transition (maximum output for given input of land, labor, and capital), while Nicaraguan cooperative farms enjoyed better standard of living, although income was not significantly higher (Agarwal, 2010).

Such examples give hope that collective farming could facilitate the shift from primary staple crops, namely rice, to other cereal crops, from cereals to non-cereal crops, and from crops to non-crop agriculture (livestock, fisheries, and forestry) (NFPCSP, 2012), improve food security for the majority of 47 million people who live below the national poverty (TWB, 2015) and reduce the number of rural families migrating to and overcrowding urban areas. The objective of the paper, therefore, is to assess the potential of collective farming in establishing food security for Bangladesh's rural poor by contrasting individual and collective farming practices through four interconnected scenarios, while taking into account financial side of the concept and the role of the government.

## 2 Materials and Methods

Collective farming is defined as a form of agricultural production in which the holdings of several farmers are run as a joint enterprise (Brown, 1993). It is the back bone of today's collective farming communities in Israel known as *kibbutzim*, which were traditionally created through voluntary collectivization and governed as democratic entities, as opposed to Soviet collectivization which resulted in millions of uprooted people during collectivization mismanagement (Kokaisl, 2013). Evaluating such a concept within the context of Bangladesh, however, requires appropriate model to be developed using country-specific demographic and agricultural data.

Bangladesh demographic and health survey is thus used to single out Rangpur division as particularly impoverished, with substantial rice yield gaps (Sattar, 2015) and the highest proportion of population in the lowest wealth quintile (30%) (NIPRT, 2013), making it ideal for assessing collective farming practices. Appropriate geographical unit with sufficient scalability and comparability qualities essential for extending collective farming nationwide is then selected, allowing division's demographics to be replicated and scaled down. In case of Bangladesh, this geographical unit is a village, hosting on average 232 households, according to 1991 Census (Islam and Jamal, 2012).

Data is scaled down by dividing the average number of households within a village (232) by survey's sample of 1,765 rural households for which land ownership information is available. The resulting quotient of 0.1314 is then used to scale back the number of household members reported in the sample (7,840) and the total amount of land (1,369.26 acres) to 1,030 and 179.97, respectively. This approach produces a village model with 232 households, 1,030 household members, and a combined land area of 179.97 acres (1 acre = 4,046.86 m<sup>2</sup>).

The newly constructed model assumes that collective farming is implemented by all farmers with at least 0.01 acres of land (112 households), although in reality this lower limit may be significantly higher (0.5 acres, for instance). Equally important is the second assumption, stating that all participating households are working together and sharing the fruits of their labor based on incurred costs and contributed inputs. Third and final assumption refers to government assistance in form of subsidies sufficient enough to incentivize larger households (e.g. 2.5 acres and more) to work with the smaller ones and assume the risks of production.

Considering that subsidies to agricultural sector in Bangladesh have substantially increased over the years, makes the last assumption somewhat more plausible (Habiba et al., 2015). In FY 2013, for example, Bangladesh government supplied tractors, power tillers, harvesters, and other agricultural equipment at 25% subsidized prices to 35 districts throughout the country, reduced the non-urea-fertilizer prices by about 70-79% for almost 15 million card users, and distributed nearly 60% of Boro rice seeds, demonstrating ruling party's commitment to agricultural development (ADB, 2013).

Distribution model needed for the second assumption, on the other hand, uses market value of each of the harvested crops, incurred costs (labor, equipment, fuel, seeds, fertilizers, pest control, and miscellaneous), and production surplus (market value less incurred costs), to determine individual shares for each of the participating households. It does that by dividing individually contributed inputs with corresponding collective contributions and using the obtained quotient to calculate the share.

Once model is created and assumptions defined, results are generated and conveniently presented using four scenarios, contrasting individual and collective farming practices on the examples of rice, potato, mustard, and lentil. Moreover, a graph containing results from all four scenarios is included as well, highlighting rice yield gaps and areas of improvement contributing to higher yields.

First scenario thus shows how much an average village can produce when farmers work individually using current agricultural practices, assuming one of the most common triple cropping patterns is used (potato-Boro-Aman) (Hoque, 2001). This scenario shows agricultural reality of rural households, revealing that as much as 14.32% of land is single cropped, 64.39% double cropped, and as little as 21.19% triple cropped. This implies

a cropping intensity of 207.09% (two crops grown within a year), and a total cropped area of 372.71 acres, 81.84% of which is used to grow the aforementioned three crops (BBS, 2014).

Second scenario uses the same triple cropping pattern but the cropping intensity of 300%, which means that all available land is now triple cropped and each crop grown on the entire 179.97 acres of collectively owned land. In this case, the total cropped area increases by 44.87% to 539.94 acres and no free land remains. This scenario shows how much an average village can produce when farmers work as a group, on aggregated land, and using 300% cropping intensity.

Third scenario gives an overview of village production in case selected additional improvements, other than land aggregation and 300% cropping intensity, are implemented. It is an extension of the second one, although it doesn't offer estimates for potato, mustard, and lentil. Selected improvements are organized into three distinct groups, as shown in Table 1.

**Table 1.** Additional improvements related to collective farming

Area of improvement	% of potential improvement
Planting practices: plant spacing (IRRI, 2015)	32.5%
Pest control: weeds, animal pests, pathogens and viruses (Oerke, 2006)	37.4%
Post-harvest practices: harvesting, drying, milling, storing (Mejia, 2003)	13.2%
Total	83.1%

*Note 1:* Selected improvement percentages are applicable to rice only.

Source: IRRI, 2015; Oerke, 2006; Mejia, 2003

Fourth and final scenario uses assumptions of the second one once again, except in this case selected high-yielding varieties of Boro (BINA dhan-14), Aman (BINA dhan-7), potato (BARI alu-7), mustard (BINA sharisha-4), and lentil (BINA musur-4) are used. These short-term varieties, chosen for their short duration and suitability for growth within Rangpur division, require good management practices in order to produce high yields. Consequently, the scenario shows how much an average village can produce using high-yielding varieties under optimal growing conditions typical for BINA (Bangladesh Institute of Nuclear Agriculture) and BARI (Bangladesh Agricultural Research Institute) research centers.

Presented figures are obtained by multiplying land area by the corresponding yields, with third scenario being an exception as improvements are simply added to Table 2 totals. Accordingly, first and second scenario calculations are done using yields achievable under current agricultural practices (kg/acre): 1,559 for Boro, 1,024 for Aman, 7,082 for potato, 404 for mustard, and 341 for lentil (BBS, 2014), while the fourth scenario relies on high-yielding varieties and consequently higher yields (kg/acre): 2,772 for Boro, 2,023 for Aman, 10,117 for potato, 769 for mustard, and 728 for lentil (BINA, BARI, 2015). Moreover, monetary values provided are calculate using 2012 exchange rate (1 USD = 79.60 BDT) and monthly average wholesale prices from 2012 (1 kg of Boro rice = 14.02 BDT, 1 kg of Aman rice = 14.04 BDT, 1 kg of mustard = 56.44 BDT, and 1 kg of lentil = 69.00 BTR) (BBS, 2014).

### 3 Results and Discussion

Findings derived using presented methodology support initial assumption that sustainable collective farming could lead to increased production and higher efficiency of production process. Under current agricultural practices and cropping intensity of 207%, an average

village could produce 189 metric tonnes (MT) (\$33,224) of Boro rice, 162 MT (\$28,655) of Aman, and 179 MT (\$42,339) of potato. As alternative to potato, about 10 MT (\$7,241) of mustard or 9 MT (\$7,489) of lentil could be grown instead. Table 2 provides an overview of village production for this and three remaining scenarios.

**Table 2.** Village production under four different scenarios (in kg)

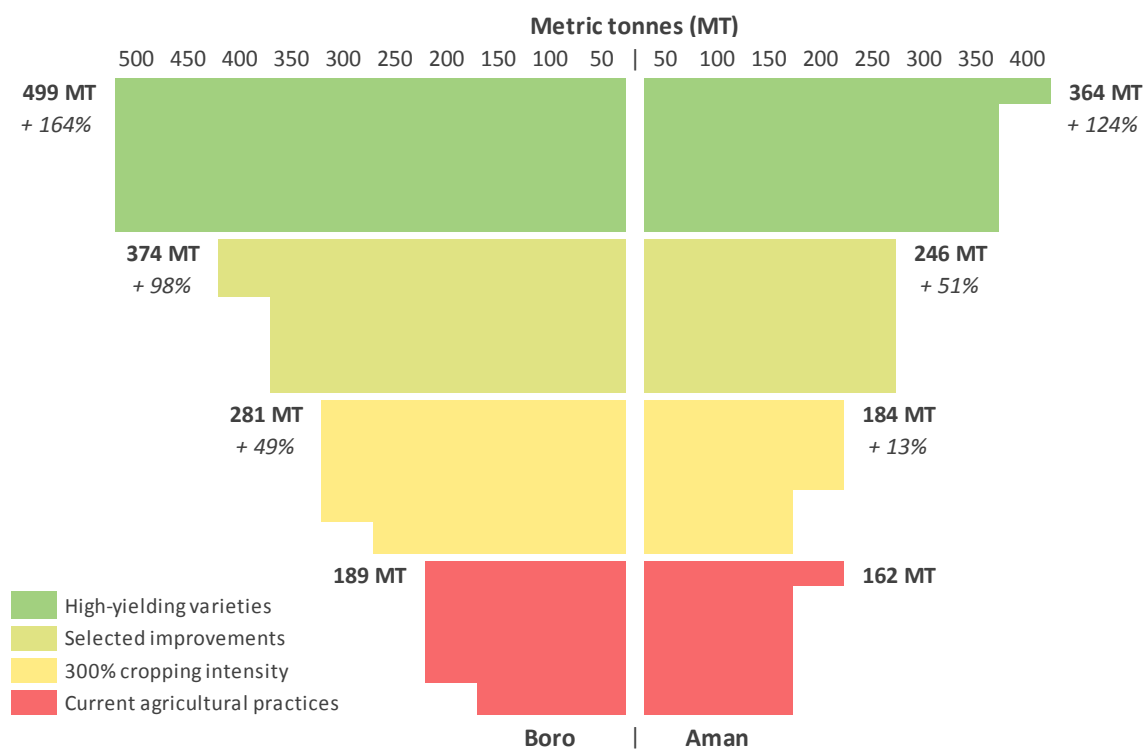
Scenario	Boro	Aman	Potato	Mustard	Lentil
Current agricultural practices	188,641	162,466	179,180	10,213	8,640
300% cropping intensity	280,531	184,262	1,274,604	72,650	61,459
Selected improvements	374,298	245,851	-	-	-
High-yielding varieties	498,907	364,165	1,820,829	138,382	131,100

*Note 1:* Reported results are for directly seeded rice, while in the case of transplanting production is reduced in proportion with the percentage of land used for seedling nurseries.

**Source:** BBS, 2014

Increasing the cropping intensity to 300% through land aggregation, in the second scenario, means that all available land is triple cropped, in which case an average village is able to produce 281 MT (\$49,407) of Boro rice, 184 MT (\$32,499) of Aman, and 1,275 MT (\$301,181) of potato. As in the first scenario, approximately 73 MT (\$51,510) of mustard or 61 MT (\$53,272) of lentil could be grown in place of potato. Triple cropping leads to an increase in production by 49% and 13% for Boro and Aman rice, respectively, with the most notable expansion accomplished in potato, mustard, and lentil production (611.35%).

**Graph 1.** Village production under four different scenarios for Boro and Aman rice



**Source:** BBS, 2014

Introducing selected improvements, such as appropriate seeding practices, pest control, and post-harvest practices, could result in additional 41.55% increase in rice production.

Under such scenario, Boro and Aman production raises to 397 MT (\$69,936), and 261 MT (\$46,002), respectively. These results, however, are obtained assuming half of the potential improvement percentages are realized through collective farming by substituting labour-intensive activities with motorized equipment (rice transplanters, power weeders, reapers, threshers, dryers and milling machines) and applying appropriate pest control.

Fourth and final scenario shows the extent of village production potential in case short-term and high-yielding varieties of Boro, Aman, potato, mustard, and lentil are adopted. Achieving such levels, as discussed earlier, requires good management practices typical for BINA and BARI research centers, ultimately boosting rice production by 145.81%, potato by 916.20%, mustard by 1,254.96%, and lentil by 1,417.36%, compared to currently production levels.

Such results show that even the most basic land aggregation could lead to a remarkable 32.38% increase in rice, and an astonishing 611.35% increase in potato, mustard, and lentil production, effectively establishing food security for the 112 participating households by providing each of their members with approximately 1,600 kcal per day. This leaves the farmers with 321 MT (\$163,241) of rice to sell and make profit from, assuming 86 MT of milled or 144 MT of unmilled rice is self-consumed (541 household members x 159.7 kg of milled or 266.17 kg of unmilled rice per year) (Nayar, 2014), with this surplus rising to 514 MT (\$231,068) if selected improvements are introduced.

Although reported figures may seem enthusiastic, production costs including additional labor, equipment, fuel, and other inputs crucial for achieving desired yields, have to be considered as well. These costs, however, are not only hard to estimate but may also vary from year to year, depending on weather, market prices, availability of credit, and other factors, which is why an alternative approach is used to provide rationale for collective farming, as shown in Table 3.

**Table 3.** Minimum farm holding size justifying the ownership of selected equipment

Activity	Equipment	Minimum farm holding (in acres)	% of households fulfilling the criterion
Land preparation	Tractor	20.49	0.23%
Irrigation	Shallow tube well	4.94	6.67%
Fertilization	Seed-fertilizer distributor	2.77	14.87%
Harvesting	Reaper	7.12	3.51%
Threshing	Power thresher	18.09	0.23%

*Note:* Presented results are specific to Boro rice production.

**Source:** Rahman, 2009

As expected, the example reveals the inability of huge majority of households within Rangpur division to afford the much needed equipment, thus remaining confined to an ever-repeating cycle of low yields and low incomes. In contrast, an almost 180 acres of collectively used land, not only meets the minimum requirements for owning various pieces of equipment, but could also lead to an increase in equipment utilization rates and overall productivity.

Another way of justifying collective farming is through a brief cost-benefit analysis, by contrasting motorized equipment with manual labor. Table 4 does exactly that using transplanting, weeding, and harvesting phases of rice growing and the corresponding equipment. The table shows drastic cost reductions, from 38.53% in case of harvesting

to as high as 91.08% for weeding. Similar results can be achieved for other operations like land preparation, irrigation, fertilization, threshing, drying, milling, and transportation, proving that owning a proper piece of equipment can be a game changer for rural farmers.

**Table 4.** Cost-benefit analysis for selected pieces of equipment (in USD)

Cost structure	Transplanting	Weeding	Harvesting
Amortized equipment	275.50	190.00	99.70
Repair costs	145.00	100.00	26.25
Fuel costs	97.44	688.80	275.52
Labour costs	75.88	151.76	75.88
Total for equipment based production	593.82	1,130.56	477.40
Amortized value of used equipment	-	-	20
Labour costs	2,395.08	12,675.48	756.61
Total for labour based production	2,395.08	12,675.48	776.61

Source: Nguyen, 2006

Acquiring such equipment, however, requires access to funds. Although individual farmers may be limited to micro loans (Moyo, 2010), as a group they stand good chances for acquiring credit from a commercial bank (Deininger, 1993). After all, even if none of the mentioned equipment is pre-owned and has to be purchased, the needed amount wouldn't go beyond \$7,500 or roughly \$65 per participating household (two transplanters, two weeders, and four reapers). Moreover, even after adding the rest of the needed equipment to the collection (ten power tillers, three threshers, one dryer, and three milling machines), that figure still wouldn't reach \$24,500 or about \$220 per household.

Such affordability of motorized equipment effectively discards financial issues as potential barrier to implementing collective farming. This is especially true once the average monthly income of rural households of \$136.91 is considered (BBS, 2010), even though very little or none of it is saved. Instead, what is left to address after land is aggregated, equipment procured, and crops grown, is the market realization of 514 MT (\$231,068) of rice and one of the three additional crops, and the potential rise in unemployment due to a swift labor substitution (potentially solvable through government-organized and privately sponsored large-scale food-for-work programs first used in 1975) (Osmani, 1983).

Fortunately, farmers won't have to go far to sell as 130 MT (\$45,713) of rice can be readily absorbed by the non-participating households within the village itself (489 non-participating household members x 266.17 kg of unmilled rice per year), while the remaining 384 MT (\$134,781) can be sold to a larger buyer or neighboring communities. Unlike rice, mustard, and lentil, potato could be a challenge to market as it requires special storage conditions due to heat and moisture typical for Bangladesh during harvest time. In this case, farmers could either grow sufficient amounts to meet their own needs and grow mustard or lentil on the remaining land, or could make arrangements beforehand with larger buyers to sell the surplus shortly after harvest.

With products marketed and incomes secured, participating households could then start thinking about growing more cash crops and less rice, establishing a cycle of higher incomes



and higher productivity, leading to food security, better diet through crop diversification, intensification of non-crop agriculture, and a more sustainable future.

#### 4 Conclusion

As of now, future of collective farming in Bangladesh is dependent on government assistance and guidance, requiring numerous assessments and detailed analysis. The promising 32.38% increase in rice production due to land aggregation, an additional 41.55% due to substitution of labor-intensive practices with motorized equipment and use of pest control, and a possible further expansion by 31.18% through adoption of high-yielding varieties and use of optimal growing conditions, makes collective farming a prime candidate for establishing food security in Bangladesh.

Once results for remaining three crops are considered, together with easier access to credit, exchange of knowledge, and simplicity of market realization, it becomes clear that collective farming outshines any other known attempt at improving food security. The good news is that the much needed research is already on the way, with field tests and interviews scheduled for the fourth quarter of 2015. Should they prove satisfactory, the next phase would involve a real life simulation in one of the villages within Rangpur division, bringing sustainable future closer and making it noticeably brighter for Bangladesh's rural poor.

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# Structural and economic performance of the meat processing industry in the Central Europe

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**Annotation:** The food industry is one of the world's most important industries with significant impacts on the world economy. Branch "Processing and preserving of meat and production of meat products", NACE Rev. 2 (Code C101) is the key branch of the food industry in the Czech Republic. The problem of this branch in the Czech Republic is its low competitiveness. This is the main reason why this branch is analyzed in the paper. The aim of the paper is to evaluate the development of key structural and economic indicators of the meat processing industry in all Central European countries. Moreover, Germany and Austria, as the main trade partners of the Czech Republic, are also compared with the Central European region. The purpose of the paper is to define the position of the Czech meat processing industry towards its main trade partners. The paper is based on the comparative analysis of structural indicators (number of enterprises, number of persons employed per enterprise), economic features (investment, production value, gross value added) and personnel costs analysis. The evaluation covers the time period 2008 – 2012. The main data source for the analysis is the database of the Eurostat structural business statistics. For a better comparability and relevance of the result, most indicators in branch "Processing and preserving of meat and production of meat products" are calculated per person employed. The indicators are evaluated over time though horizontal analysis and indexes. The results of the comparison show some differences between countries. Except Germany and Austria, the Czech Republic has the highest labor productivity; Slovakia and Poland have the lowest. More in-depth results of the structural and economic analysis in this branch are described and discussed in this article.

**Key words:** meat processing industry, performance, Central Europe, gross value added, costs, production

**JEL classification:** M21, L66

## 1 Introduction

The meat processing industry is one of the key branches in the food processing industry. The performance is important point of view when discussing the competitiveness of each branch (Řezbová and Škubna, 2013), the meat processing industry is not an exception. The structural and economic performance of the meat processing industry has been published only in a few articles mainly focused on national level (Kim, 2009; Mijic et al, 2014). Comparative analyses in the Central Europe have been carried out mainly in the field of agricultural performance (Gorton and Davidova, 2004; Bašek and Kraus, 2011) and agricultural foreign trade (Svatoš and Smutka, 2012; Svatoš et al, 2013). Only a few articles have paid attention to the comparative analysis of the food industry (Čechura and Malá, 2014) or foreign trade in food products and beverages (Mezera and Pohlová, 2014) in the Central Europe. The problem of the Czech meat processing industry is its low competitiveness towards main trade partners. This is the main reason why this branch is analyzed in the paper.

The aim of the paper is to evaluate the development of the key structural and economic indicators of the meat processing industry in the Central Europe (Czech Republic, Poland, Hungary, and Slovakia). Moreover, Germany and Austria, as our trade partners, are also

compared with the Central European region. The purpose of the paper is to analyze and describe the trends of Czech meat processing industry in the Central Europe.

## 2 Materials and Methods

The article aims at data of food industry enterprises, namely enterprises included in the branch NACE Rev. 2 (Code C101) "Processing and preserving of meat and production of meat products" in time period 2008 - 2012. The main data source for the analysis is Eurostat - Structural business statistics for this branch. The paper focuses on the analysis and comparison of the Czech (CZ), Polish (PL), German (DE), Hungarian (HU), Slovak (SK) and Austrian (AT) meat processing enterprises. The data from Eurostat were downloaded on May 7<sup>th</sup>, 2015. The year 2013 was not completely covered by Eurostat to this date.

The article is divided into three research areas. First one includes analysis and comparison of the structural indicators (number of enterprises, number of persons employed per enterprise), second one describes economic features (investment, production value, gross value added) and the last part evaluates and compares the personnel cost (average personnel costs).

For a better comparability and relevance of the result (because of the diversity range of this part of industry), most indicators in the branch "Processing of meat and meat products" are calculated per person employed. The indicators are assessed over time though horizontal analysis (calculation of changes compared with previous year, mean absolute changes) and indexes (relative changes, in percentage). For purpose of this article, the tables contain absolute and relative average changes in period 2008 – 2012.

Brief methodical description of the indicators is described below. However, detailed definitions of each indicator are described in the Commission Regulation 1503/2006 and Commission Regulation 250/2009.

Authors used following indicators.

- Number of enterprises - a count of the number of enterprises active during at least a part of the reference period.
- Number of persons employed - the total number of persons who work in the observation unit (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it (e.g. sales representatives, delivery personnel, repair and maintenance teams). It excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises, as well as those on compulsory military service.
- Personnel costs - the total remuneration, in cash or in kind, payable by an employer to an employee (regular and temporary employees as well as home workers) in return for work done by the latter during the reference period. Personnel costs also include taxes and employees' social security contributions retained by the unit as well as the employer's compulsory and voluntary social contributions.
- Gross investment in tangible goods - investment during the reference period in all tangible goods. Included are new and existing tangible capital goods, whether bought from third parties or produced for own use (i.e. Capitalized production of tangible

capital goods), having a useful life of more than one year including non-produced tangible goods such as land. Investments in intangible and financial assets are excluded.

- Production value - the amount actually produced by the unit, based on sales, including changes in stocks and the resale of goods and services. The production value is defined as turnover or revenue from sales of goods and rendering of services, plus or minus the changes in stocks of finished products, work in progress and goods and services purchased for resale, minus the purchases of goods and services for resale (only for the goods and services sold during the reporting period and excluding the costs of storage and transport of the goods purchased for resale), plus capitalized production, plus other (operating and extraordinary) income (excluding subsidies). Income and expenditure classified as financial or as revenue in the form of interests and dividends in company accounts is excluded from production value.
- Gross Value Added (GVA) is defined as output value at basic prices less intermediate consumption valued at purchasers' prices. GVA is calculated before consumption of fixed capital. GVA is conceptually close to GDP (Gross domestic product), but unlike GDP available in a breakdown by branch of economic activity.

### 3 Results and Discussion

Table 1 contains information about development of number of enterprises in the meat processing industry.

**Table 1.** Number of enterprises

Country	2008	2009	2010	2011	2012	Avg. abs. change (2008-12)	Avg. relative change (%)
CZ	1 062	1 113	1440	1 691	1 718	164	13.30
PL	3 283	2 921	2 857	2 692	2 787	-124	-3.87
DE	11 044	7 521	11 950	11 295	11 120	19	4.99
HU	592	575	600	616	611	5	0.83
AT	1 092	1 058	1 030	986	949	-36	-3.45
SK	372	389	337	331	303	-17	-4.76

Source: Eurostat, own processing

The Czech Republic achieved the highest annual growth in number of enterprises of the meat processing industry, by 164 companies, respectively by 13.3 % per year. The number of meat processors has been continuously increasing during the whole period 2008 – 2012. In Germany and Hungary, the number of meat processing enterprises also increased but with a slight drop in last years. On the contrary, Poland, Austria and Slovakia experienced a decrease of number of the meat processing enterprises. The question is whether the size of companies and concentration of industry has changed. The size is expressed by production value per one enterprise and by number of persons employed per enterprise.

The Czech Republic is the only one country with decreasing production value per enterprise (by 12.52 % on average). It means that the production capacity of the Czech meat processors has been fragmenting in time. Alternatively, Germany has experienced growing concentration since 2010. Poland and Austria concentrates the production capacities during the whole

period 2008 – 2012. Poland decreased the number of enterprises by 3.87 % and increased the production value per enterprise by 10.05 % on average. Austria decreased the number of enterprises by 3.45 % and increased the production value per enterprise by 9.01 % annually. Slovakia also increased concentration since the production value per enterprise rose by 6.8 % annually whilst the number of enterprises dropped by 4.76 % annually. Hungary has had quite stable structure of meat processing industry with slight growth of concentration since 2011.

Analogous findings results from number of persons employed per enterprise (table 2).

**Table 2.** Number of persons employed per enterprise

	2008	2009	2010	2011	2012	Avg. abs. change (2008-12)	Avg. relative change (%)
CZ	23.6	22.3	16.8	14.2	14.1	-2.38	-11.59
PL	37.6	41.5	43.0	44.0	42.9	1.33	3.45
DE	17.5	22.0	17.0	17.9	17.8	0.08	1.93
HU	51.0	48.5	46.0	44.6	45.3	-1.43	-2.88
AT	15.3	16.2	16.8	17.1	18.4	0.77	4.74
SK	23.2	18.2	21.5	23.1	23.6	0.09	1.52

Source: Eurostat, own processing

The Czech Republic decreased the number of persons employed per enterprise from 23.6 (2008) to 14.1 (2012) whilst it increases the number of enterprises. It should imply that large number of small meat processors has been established in the period 2008 – 2012. Poland and Hungary had the highest number of persons employed per enterprise (over 40). Poland increased the number of persons employed per enterprise by 3.45 % on average; Hungary cut the number of persons employed per enterprise by 2.88 % on average despite quite stable number of enterprises. It indicates pressures on cost cutting and increasing labor productivity. So, the production value per enterprise and number of persons employed per enterprise show that the Czech Republic is unique with its structural development.

The key economic indicators of the labor productivity are production value (table 3) and gross value added per person employed (table 4). If there is opposite trend between the two indicators, the intermediate consumption is the main source of difference.

**Table 3.** Production value (per person employed in EUR)

Country	2008	2009	2010	2011	2012	Avg. abs. change (2008-12)	Avg. relative change (%)
CZ	102 735	95 564	100 696	103 308	104 186	363	0.46
PL	88 628	78 139	83 909	97 798	111 565	5 734	6.54
DE	206 565	235 237	210 249	222 324	248 506	10 485	5.19
HU	77 684	75 427	77 398	85 299	88 012	2 582	3.27
AT	195 168	197 840	193 838	218 969	226 404	7 809	3.93
SK	71 694	73 280	77 439	81 940	87 118	3 856	5.01

Source: Eurostat, own processing

All countries have increased the production value per person employed since 2010. The year 2009 was strongly affected by economic crisis. The Czech Republic had the lowest average growth of labor productivity per year (0.46 %). Moreover, the Czech production volume is not

among the states with the lowest overall production value. The Czech Republic belongs to the countries with highest decline in number of person employed, which can further increase the value of the labor productivity. Nevertheless, the Czech Republic should concentrate more on increasing production value rather than cutting number of person employed. On the contrary, the highest increase was generated in Poland (6.54 % per year), in Germany (5.19 % per year) and in the Slovakia (5.01 % per year). It should be an impact of different development of concentration in the meat processing industry between the Czech Republic and other countries.

Table 4 contains gross value added per person employed which is considered as apparent indicator of labor productivity.

**Table 4.** Gross value added (per person employed in EUR)

Country	2008	2009	2010	2011	2012	Avg. abs. change (2008-12)	Avg. relative change (%)
CR	13.4	14.8	14.4	14.1	13.0	-0.10	-0.53
PL	11.3	9.4	11.6	11.5	15.2	0.98	9.48
DE	31.6	37.3	32.5	30.9	30.1	-0.38	-0.59
HU	11.5	13.5	14.2	13.8	12.3	0.20	2.22
A	42.2	41.6	41.7	43.9	42.4	0.05	0.17
SK	8.7	10.8	16.1	14.0	9.3	0.15	6.65

Source: Eurostat, own processing

Gross value added per person employed has been growing in Poland, Slovakia and in Hungary. When comparing with production value per person employed in the table 3, Poland achieved a progress in cost management. So, the gross average growth of gross value added per person employed was higher than a growth of production value per person employed. Slovakia was also successful in cost management but it had the lowest absolute labour productivity of all selected countries in 2012. Alternatively, Hungary has increased the production value since 2010 but the gross value added per person employed decreased which indicates some problems in management of input-output efficiency.

The Czech Republic and Germany experienced a slight drop in gross value added per person employed in time. Since the Czech Republic increased the production value per person employed and decreased the gross value added per person employed (from 14.9 in 2009 to 13.0 in 2012), there are doubts about efficient management of intermediate consumption. The same finding is true for Germany. However, Germany has one of the highest labour productivity, together with Austria.

Following part is devoted to personnel cost analysis (table 5) because the gross value added should cover particularly staff expenses (wages) in order to generate positive operational profit.



**Table 5.** Average personnel costs (per employee in thousand EUR)

Country	2008	2009	2010	2011	2012	Avg. abs. change (2008-12)	Avg. relative change (%)
CZ	10.8	10.3	11.1	11.3	11.7	0.23	2.12
PL	8.8	7.4	8.2	8.6	9.0	0.05	1.11
DE	23.2	23.7	23.5	23.1	24.6	0.35	1.53
HU	9.5	9.1	9.4	9.9	9.4	-0.02	-0.16
AT	30.0	30.5	30.0	32.2	32.7	0.68	2.23
SK	8.9	9.1	10.0	9.7	10.3	0.35	3.83

Source: Eurostat, own processing

All countries were able to cover personnel costs by the gross value added, except for Slovakia in 2008 and 2012. Personnel costs increased in all countries of Central Europe, excluding Hungary, where there was a slight decrease in these cost by 20 EUR per annum. The highest and rising personnel cost are in Germany and Austria (annual increase by 350 EUR, respectively 680 EUR). Rising wages in this branch can attract more workers, which can indicate an increasing number of persons employed in these countries. In the Czech Republic, current low level of wages in the meat processing industry and physical strenuousness in the branch are not sufficiently motivating factors for attracting young people.

The economic growth in the meat processing industry is affected by investment activity. Table 6 shows gross investments in tangible goods per one person employed.

**Table 6.** Gross investments in tangible assets (per person employed in EUR)

Country	2008	2009	2010	2011	2012	Avg. relative change (%)
CZ	2 995	2 811	3 244	3 612	2 660	-1.43
PL	3 331	2 120	2 915	3 157	3 129	2.14
DE	3 579	4 390	3 486	4 228	4 014	4.57
HU	1 754	1 885	2 309	3 167	2 732	13.34
AT	6 778	5 909	6 089	5 944	7 458	3.33
SK	3 579	4 919	2 802	2 823	2 316	-5.70

Source: Eurostat, own processing

Investments in machinery and equipment take the largest part (over 50 %) of investments in tangible goods in all evaluated countries. Second most important part is represented by investments in construction and upgrading of buildings and investment in tangible goods. The Czech Republic and Slovakia experienced relative average drop of investments in tangible assets. The downward trend is not long-term. The gross investments vary year by year. On the contrary, there was a relative increase of gross investments in Poland, Hungary, Germany and Austria. A decrease of investments in the Czech Republic is a bad sign for the future competitiveness of the meat processing industry.

## 4 Conclusion

The aim of the paper was to evaluate the development of the key structural and economic performance of the meat processing industry in the Central Europe (Czech Republic, Poland, Hungary, and Slovakia). Moreover, Germany and Austria, as our trade partners, are also compared with the Central European region.

The descriptive analysis of Eurostat data shows significant differences between the Czech Republic and the rest of selected countries. First, the meat processing industry in the Czech Republic has been strongly fragmenting unlike other Central European countries. Especially Poland, Austria and Germany concentrate their production capacities. Concentration has its pros and cons. One result of the concentration is inexpensive and readily available meat distributed in that amount required by big retail chains. Alternatively, such is inhumane to the animals and may have created new health risks. Moreover, people are not able to follow an origin of the meat. The important thing from the economic viewpoint is that concentration supports economic efficiency because of economies of scale and experience curve effects. Although the production value per one person employed in the Czech Republic has increased since 2010, the gross value added per person employed has decreased. It indicates some problems with cost management like in Germany. On the other hand, Poland has the most dynamic growth of labor productivity, good cost management and strong concentration efforts. Furthermore, the Czech Republic, together with Slovakia, experienced an average relative drop of gross investments per person employed unlike other selected countries.

Overall, the results indicate not very optimistic outlook for the Czech meat processing industry when comparing with our main competitors. Alternatively, the public support of small and medium meat processors together with changing consumer preferences towards local products should enhance the local markets of regional products and employment in the rural areas.

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## Is African swine fever an economic threat to the EU?

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**Annotation:** African swine fever (ASF) is one of the most dangerous animal epidemics that requires notification. It has already entered the EU member states of Lithuania and Poland via the Ukraine and Belarus, with proven occurrences found in both domestic and wild pig populations. The probability of an introduction into other European countries is high and could have catastrophic economic consequences, one reason being that there is currently no vaccination available. The goal of this project is to determine – for a country that produces and exports pork, such as Germany – which parts of the pork supply chain would experience losses as a consequence of an ASF outbreak and to estimate the economic losses such an outbreak would cause. Three types of scenarios and five cost categories were considered in this study. By using these types of costs in combination with a relational database system, it is possible to research various scenarios and to calculate the financial impact under a number of different conditions. The analyses show that a single outbreak of ASF in a German region with a high animal density would result in a total loss of over €670.8 million. With a second outbreak, the total loss would rise to approx. €893 million. These high losses are primarily the result of the expected drop in price for pork on the domestic market, the reduction of intra-EU deliveries and the reduction of exports to third countries.

**Key words:** African Swine Fever, European Union, Animal-Disease-Decision-Support-System, Economic Impact, Scenario Analysis, Relational Database System

**JEL classification:** I19, Q19

### 1 Introduction

Animal diseases can develop into widespread health threats that can result in great financial losses affecting not only farmers, but also upstream and downstream industries in the value chain. African swine fever (ASF) is one of the most dangerous animal epidemics. The situation is especially threatening since ASF has begun spreading. ASF was officially registered in Russia in 2007 – its first occurrence in a country bordering the EU. Since then, the affected region has expanded toward Western Europe. ASF has been introduced into Lithuania and Poland via the Ukraine and Belarus (Blome and Beer, 2013; BMEL, 2014). Moreover, there have already been 100 confirmed cases of ASF among domestic and wild pigs in the EU. In the case of domestic pigs, this has occurred not only on small farms, but also in a large operation in Lithuania with approx. 20,000 animals (FLI, 2014). Fighting this epidemic presents a great challenge, especially among wild pig populations especially because there currently exists no vaccine for ASF (SUS, 2014). It is highly probable that the disease will find its way into other European countries, which could have a catastrophic economic impact. Especially susceptible are countries like Germany, the Netherlands, Denmark, France and Spain because pork production is an important branch of the economy in these countries (AMI, 2014).

Due to the confirmed ASF cases there, export of pork from Eastern Europe has already been greatly restricted. In February 2014, for example, Russia halted almost all pork imports from the EU (LWW-L, 2014). Besides its effects on export trade, the outbreak of an animal disease also results in financial losses nationally. Considered one of the most dangerous

animal diseases, ASF requires notification worldwide. Because the disease is so infectious (although it is not a zoonosis agent), any ASF outbreak requires immediate culling of the entire herd (BMEL, 2014; OIE, 2014). Overall ASF and CSF (classical swine fever) are the two epidemics that have the greatest financial effect on pork production worldwide (Hirsch, 2010; Moennig, 2000). In 2006, during the last CSF outbreak among domestic pigs in Germany (North Rhine-Westphalia), 15,000 animals were culled from infected herds, as were over 106,000 healthy animals in the movement restriction zones. Jaeger (2006) estimated the direct costs for damages incurred to be roughly €40 – €80 million. According to Meuwissen et al. (1999), the last CSF outbreak in the Netherlands (1997/1998) resulted in a loss of €2.3 billion and over 11 million swines were culled.

This study seeks to determine in which parts of the value chain and to what degree economic losses would be incurred in the case of an outbreak of ASF in Germany, one of the largest pork producers in Europe. With the help of five cost categories and the relational databank system TEUS, variations of parameters can generate two types of scenarios and evaluate the total economic effect of a swine fever outbreak using several different assumptions.

## 2 Materials and Methods

### 2.1 The Animal-Disease-Decision-Support System

For the following calculations we used the animal-disease-decision-support system called TEUS (in German: *Tierseuchen-Entscheidungs-Unterstützungs-System*), a relational database management system with SQLBase designed with Gupta Team Developer 6.2. With this system, it is possible to research various scenarios to calculate the financial impact under various conditions (size of the restriction areas, regional animal density, number and geographic locations of subsequent swine fever outbreaks, etc.). TEUS is based on two basic assumptions. First, it assumes circular restriction areas established after the outbreak of a disease. Second, it is assumed that an outbreak of a disease can be assigned to one of two possible scenario-types: Either it is a singular outbreak (scenario-type 1), or there are two outbreaks characterized by temporal and geographical distance between the first and the second outbreak (scenario-type 2). In the second case it is possible to differentiate between (a) overlapping restriction areas and (b) completely distinct restriction areas. The latter means that there are additional economic consequences due, for instance, to the need to establish a second disease control strategy and infrastructure.

The architecture of a relational database system is known as the entity-relationship (ER) model, and it connects the above-mentioned points, listing the entities (cost categories, parameters, algorithms, etc.) and the relationships between the entities. The specifications for this ER model were defined by a pilot study (Näther et al., 2013). With the help of this ER model, the respective input masks and the necessary functionalities were programmed to save the calculated results, acquire a printable report and be able to export the results to a CSV file as a basis for further calculations. Therefore, TEUS is a unique instrument that enables one to build a decision-making arena (by variation of parameters) step by step and to economically assess the available options within a short period of time in the case of an outbreak of ASF.

## 2.2 The Cost Categories

The study considers five relevant cost categories (CC) to calculate the total damage of an ASF outbreak. The five cost categories are sub-divided into 20 types of costs (Table 1). These types of costs were validated through an extensive literature review and expert interviews. On the basis of these cost categories and with the help of special algorithms implemented into TEUS, it is possible to calculate values for a set of alternative scenarios as variations of cost-relevant parameters.

**Table 1.** The five cost categories

Cost Categories (CC)	Types of Costs
CC 1: Costs of governmental control	1.1 Compensation through Animal Disease Fund
	1.2 Government aid for part-financing
	1.3 Other assistance
	1.4 Labour costs
	1.5 Cost of material
CC 2: Costs of farms directly affected (infected/culled)	2.1 Value of culled animals (not compensated)
	2.2 Loss of production because of vacancy
	2.3 Additional cleansing & disinfection measures
	2.4 Disposal of stocked fodder
	2.5 Additional deterioration because of stagnation
	2.6 Reduced performance in case of restocking
CC 3: Costs of farms indirectly affected (not culled, but in the restriction zone)	3.1 Costs of sub-optimal weights
	3.2 Loss of production because of marketing barriers
	3.3 Increased loss of swine
	3.4 Extraordinary veterinary expenses
CC 4: Other costs in agribusiness	4.1 Sales decline in the feed industry
	4.2 Price drop for swine
	4.3 Reduced domestic consumption of pork
CC 5: Effects on foreign trade	5.1 Reduction of intra-community shipments
	5.2 Breaking off of export markets

Source: Based on Näther et al. (2013)

## 2.3 Cost-relevant parameters

In order to isolate the virus during an ASF outbreak, movement restriction zones are set up around the infected herd (absolute protection zone at least  $r \geq 3$  km, and surveillance zone at least  $r \geq 10$  km) (European Commission, 2001). In light of the experience of countries that have been confronted with an ASF outbreak, the existing uncertainties and the lack of vaccines, experts believe that the restriction zones should be larger than the law dictates (protection zone at least  $r \geq 4$  km and surveillance zone at least  $r \geq 15$  km) (Mr A Groeneveld 2014, pers. comm., 10 June; Mr C Staubach 2014, pers. comm., 16 Dec). Accordingly, there are differing bans on introducing animals after an ASF outbreak in the restriction zones: in the protection zone at least 40 days and in the surveillance zone at least 30 days. Within these restriction areas, at the very least, culling is conducted among the infected herd. However, in practice, animals are also culled within a radius of 1 km from the infected herd because the virus may already have spread due to factors such as weather, other animals, and movements of people and machines (Hop et al, 2015). Then, all pig herds within the restriction zones are registered, inspected and subjected to strict hygiene guidelines (European Commission, 2001). These measures also will be assumed in this study.

An outbreak immediately results in an export ban by foreign countries (CC 5.2) as well as a reduction in intra-community transportation in order to prevent the introduction of the virus into other areas (Mr A Groeneveld 2012, pers. comm., 12 Mar). When the infection can no longer be locally contained (scenario-type 2b), the EU can pass legislation prohibiting the affected countries from exporting products to other EU member states (Saatkamp, Berentsen and Horst, 2000). It can, therefore, be assumed that any further outbreak exerts a great influence on exports. These decisions result in a considerable excess domestic supply which in turn leads to falling prices for pork (CC 4.2). Consumer behavior (CC 4.3) can also be influenced by information in the press about the outbreak, as seen in the BSE crisis of 2001 (Dierks, 2004). These changes are depicted in Table 2. The cost categories that are unaffected by these two situations are not listed.

**Table 2.** Changes in cost for cost categories 4 and 5 in the various types of scenarios

Scenario-Type	Outbreaks	Types of costs	Reduction percentage	Length of time	Losses per day
1		4.2	50%	56 days	€ 2,646,000
1	1	4.3	13%	20 days	€ 2,558,029
1		5.1	40%	40 days	€ 3,752,219
1		5.2	60%	180 days	€ 1,964,453
2a		2	4.2	55%	80 days
2a	(with overlapping restriction zones)	4.3	20%	20 days	€ 3,935,423
2a		5.1	45%	45 days	€ 4,221,247
2a		5.2	62%	190 days	€ 2,029,935
2b		2	4.2	55%	80 days
2b	(no longer locally contained)	4.3	20%	25 days	€ 3,935,429
2b		5.1	50%	50 days	€ 4,690,274
2b		5.2	65%	200 days	€ 2,128,158

Source: authors' calculations

Parameters such as regional animal density, the number and geographic location of outbreaks, combative strategy, and time and distance between outbreaks can also vary in quantity and, through use of applied algorithms, yield the decision-making space (sum total of all evaluated scenarios) of a disease outbreak.

### 3 Results and Discussion

#### 3.1 Single ASF Outbreak (Scenario-Type 1)

In order to determine the ramifications of an ASF outbreak, not only changes in parameters (restriction areas, transportation embargos/supply prohibitions, length of time of diminished consume and effect on foreign trade, etc.) but also in types of costs (falling pork prices, rate of reduced consumption, measure of effect on foreign trade, etc.) must be considered. Table 3 depicts the results for a single ASF outbreak for three different animal population densities (AD) (low = 400 animals/km<sup>2</sup>, medium = 800 animals/km<sup>2</sup>, high = 1,200 animals/km<sup>2</sup>), including the percentage of increase relative to the lowest density.

According to TEUS, a single outbreak of ASF in a German region with low AD would result in a total loss of over €667.4 million, with medium AD of over €669.1 million and with high AD of over €670.8 million. The results show that the costs of the first four cost categories are linearly dependent on animal density, albeit to varying degrees. Cost category 3 shows

the greatest increase. Cost category 5 is independent of animal density, but accounts for almost 70% of the total costs.

**Table 3.** Costs of a single ASF outbreak with varying animal densities

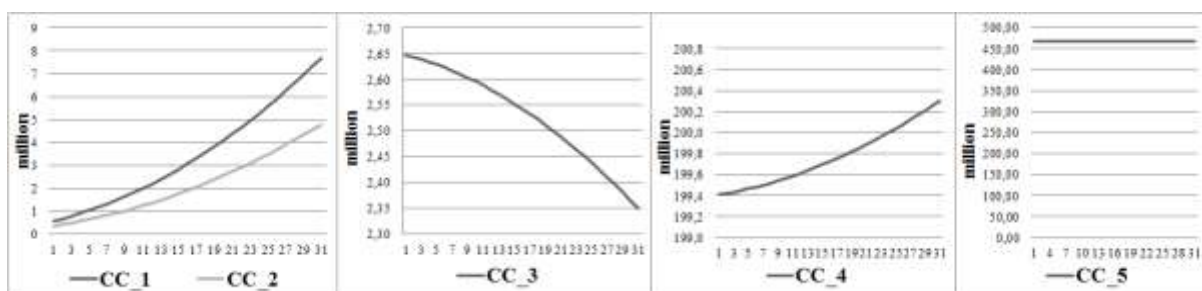
Cost Categories	Low AD	Medium AD	High AD	
	(€)	(€)	% incr. AD 400	(€) % incr. AD 400
CC 1: Costs of governmental control	331,574.25	568,770.94	71.54%	805,967.64
CC 2: Costs of farms directly affected	206,545.15	354,300.35	71.54%	502,055.54
CC 3: Costs of farms indirectly affected	1,323,780.25	2,647,560.53	100.00%	3,971,340.77
CC 4: Other costs in agribusiness	199,378,236.43	199,408,028.99	0.01%	199,437,821.54
CC 5: Effects on foreign trade	466,168,279.80	466,168,279.80	0.00%	466,168,279.80
<b>Σ CC 1 - 5:</b>	<b>667,408,415.88</b>	<b>669,146,940.61</b>	<b>0.26%</b>	<b>670,885,465.29</b>

AD = Animal density (animals/km<sup>2</sup>)

Source: authors' calculations

Regarding the development of cost (sensitivity analysis) in relationship to the size of the culling zone inside the protection zone (1–4 km), one notes that cost categories 1, 2 and 4 increase to the square of the enlarging area of the culling zone. Thus, the radius will increase 31 times in 100 m steps (abscissa) until arriving at an area of 4 km radius and the end of the protection zone. Figure 1 illustrates this quadratic gain of the ever-increasing area of depopulation. This also means that the greater the zone of culling, the greater the loss of income for the feed suppliers (CC 4.1). For CC 3, the income decreases quadratically depending on the area affected. This can be explained by the decline in number of the indirectly affected operations in the protection zone due to the enlargement of the culling zone. CC 5 remains constant because it is not related to the size of the culling zone. It was previously noted in a study on the economic evaluation of strategies to combat animal epidemics (Näther et al., 2013) that a plan needs to be determined and applied as soon as possible in order to keep economic losses to a minimum.

**Fig. 1.** Cost development with enlargement of culling zone



Source: authors' calculations

### 3.2 Multiple ASF Outbreaks (Scenario-Type 2)

To study multiple outbreaks of infection, this investigation includes a new cost category considering the decrease of intra-community trade and export embargos by non-affected third countries (cf. Table 2). In the following calculations, it is assumed that in case of a multiple outbreak (without limitation of generality: two outbreaks), the second outbreak



location with medium animal density occurs exactly 6 km away from the first and is therefore within its restriction zone. The time between the outbreaks is assumed to be either 10 or 30 days. The results show that the cost categories 1, 2, 4 and 5 remain constant with the change of time (CC 1: €1,043,164; CC 2: €649,810; CC 4: €311,687,624 and CC 5: €534,238,296). In CC 4 one notes that the costs (CC 4.3: price reduction per kg slaughter weight €0.55) for almost 75% of the total losses were incurred in the cost category CC 4. CC 3 (costs to indirectly affected farms) rises with the increasing duration. The change from 10 to 30 days results in a daily loss of approx. €205,000. The main reason for this is that the second outbreak and the overlapping of the restriction zones subject many animals to a longer transportation ban and, therefore, costs are incurred through the suboptimal weight of finishers (CC 3.1), increased loss of production (CC 3.2), loss of swine (CC 3.3) and extraordinary veterinary costs (CC 3.4). With a second outbreak after 10 or 30 days the total loss would rise to approx. €893 and €898 million, respectively.

The next calculation focussed on the distance between the outbreaks among regions of medium animal density. It was assumed that the second outbreak occurred 10 days after the first, but varied the distance from 2 to 30 km away from the originally infected herd (at a greater distance, the observation areas no longer overlap). The distance is increased 15 times in 2 km intervals until a radius of 30 km is reached. Because the outbreaks have overlapping restriction zones, this is an example of the scenario-type 2a. The cost categories 1, 2, 4 and 5 are identical with those in the previous calculation; only category 3 rises. The increase in distance from 2 to 30 km results in a daily loss of €31,830 and a total loss at 30 km distance of €894 million. Nigsch (2009) also studied the economic losses related to CSF in Austria and determined that the duration and geographic spread of an outbreak must be minimized in order to keep total damages as low as possible.

When a local containment can no longer be assumed (scenario-type 2b), the calculations still find the results for CC 1 und 2 to be identical to those of the preceding cases. Due to the separation between the restriction zones and the unchanged time between the outbreaks, CC 3 reveals that there is no rise in costs, which remain at €5,295,121. In accordance with the changes seen in Table 2, CC 4 lies at €331,364,774 (+6.3% for scenario-type 2a) and CC 5 at €660,145,392 (+23.6% for scenario-type 2a), and the total losses of scenario-type 2b rise to approx. €998 million. In this calculation, CC 4 and CC 5 together comprise 99.3% of the total loss. In their study on CSF, Näther et al. (2013) showed that these two categories accounted for a 94-99% share of total costs. Other authors (Hop et al., in print; Saatkamp, Berentsen and Horst, 2000) have also come to the conclusion that the indirect costs of animal disease outbreaks far surpass the direct costs.

#### 4 Conclusion

Despite observing due diligence regarding biosafety standards, epidemics of any kind can break out among animals at any time and any place. This is facilitated partly by liberal market policies, which also put countries in jeopardy of being infected with disease agents from far abroad. There is no way to be completely protected from this risk. A good example is the outbreak of a highly pathogenic avian influenza (HPAI) at the beginning of 2015 in Germany, the Netherlands and Great Britain. It is unclear how the virus was able to take hold on farms that were geographically far apart and had differing housing systems. To date no relationship has been found among the affected farms (FLI, 2015). Similarly, an expansion

of ASF or other animal diseases cannot completely be ruled out. European countries that are major pork producers are especially vulnerable to disease outbreaks.

It must also be kept in mind that the probability of a farm of being indirectly affected and, therefore, needing to heed protective restrictions, such as transportation bans inside a 15 km observation zone, is roughly 235 times greater than the probability of being directly affected by a disease outbreak ( $r = 1$  km). The results of this study show that indirectly affected farms (CC 3) are strongly dependent on the duration and location of a second outbreak.

Furthermore, additional costs in agribusiness (CC 4), particularly the loss due to falling pork prices (CC 4.2), and effect on foreign trade (CC 5), are of increasing political interest as authorities seek to reduce the total damages of future outbreaks.

Thus, it is imperative that steps be taken to deal with possible future disease events from both an epidemiological and an economic standpoint. Because the economic effects of animal diseases have been more or less ignored until now, this study can provide information to fill this research gap. In light of the total damages this study foresees for Germany, European countries and their pig farmers would do well to consider various scenarios of an ASF outbreak and prepare and protect themselves accordingly. Future research is especially needed to identify which countries are most susceptible to which types of costs and expand the future scenarios of other European countries accordingly. TEUS could then be used to determine and illustrate their economic impact.

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## Consumer preferences and attitudes of the young generation to the business concept of Fair Trade in the Czech Republic

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**Annotation:** The business concept of Fair Trade is a trading method that does not emphasise commonly compared price parameters of products. Its aim is to support the chance of manufacturers from third world countries to obtain a fair proportion of the profit and sources for a dignified life. The idea of Fair Trade includes a wide range of social and labour regulations, environmental standards and certification systems, which are based on the principles of voluntariness, ethical consumption and solidarity. The subject of this article is based on the study of literary sources, analysis of selected statistical indicators and our own primary research to discuss consumer preferences and attitudes of young people from the age of 15 to 35 to the monitored area. The data were obtained by quantitative research using a questionnaire survey among respondents (n = 614) from the age of 15 to 35. This age range was chosen on the basis of existing international research results. Basic statistical methods will be used to determine the results. The contribution of this paper is the presentation of current research results in the field of Fair Trade, which is, in the current competitive environment, very important for consumers, organisations and the whole society.

**Key words:** Fair Trade, consumer preferences, research, Czech Republic

**JEL classification:** F13, F18

### 1 Introduction

The concept of Fair Trade is based on the principle of social and economic solidarity between poorer and richer parts of the world. It provides consumers with the opportunity to influence, at least partially, the distribution of power in the world trade through their individual choice of purchasing (Kim, Lee and Park, 2010). In this context, the issue of ethical consumption, which is focused on monitoring the impacts of consumption in social and environmental areas, is in the forefront of interest (Uusitalo and Oksanen, 2004).

Fair Trade is a business partnership based on the dialogue, transparency and respect, striving for a greater equality in the international trade. It contributes to a sustainable development by offering better trading conditions and securing the rights of marginalized producers and workers - especially in the countries of the globalized South (Ballet and Carimentrand, 2011, Walton, 2010, Gould, 2003). The Fair Trade works on the basis of fundamental principles which in a social sphere include mainly the assumption of the existence of democratic bodies, the right for the trade unions, prohibition of child work, good working conditions and a good salary.

In the economic sphere, it is particularly the rule of a minimum purchasing price that would not be dependent on a current price level of a particular commodity, and serves primarily as a guarantee of the fundamental securities for producers (Littrell, Dickson, 1999). Fair Trade ethical principles do not concern only the market and trade, but also production processes (Hira and Ferrie, 2006).

Renard (2003) states that Fair Trade is a product of social interaction and civic coordination, therefore, the support and promotion of this idea by public authorities within individual states is necessary for recognizing its legitimacy. Reynolds (2012) also states that the Fair Trade initiative brings together a wide range of social and labour regulations, environmental standards and certification systems which are built on the principle of voluntariness and the support of ethical consumption. Products of Fair Trade do not always carry a label of bio. It is primarily due to additional costs for the certification process, which cannot usually be spent by small growers (Kuldová, 2012). Andorfer and Liebe (2011) emphasise that the individual consumption of Fair Trade products must be seen in a wider context of the overall ethical consumption. This view is also advocated by Manchiraju and Sadachar (2014). They highlight buyers' behaviour in the area of ethical consumption from the point of view of fashion attractiveness of this issue.

The aim of this article is based on the study of literature sources, analysis of selected statistical indicators and our own primary research to discuss consumer preferences (the age group from 15 to 35 years in the Czech Republic) and attitudes to the business concept of Fair Trade. This category was chosen with regard to the compatibility with existing results of international surveys.

## 2 Materials and Methods

Theoretical bases of the article were compiled through the analysis of secondary sources (examining documents, i.e. books and scientific articles) and the synthesis of knowledge. Current statistical data were taken from the official Internet information sources. Primary data were obtained through quantitative research by means of a questionnaire survey. The sample of respondents was obtained by a deliberate choice. Respondents were chosen with regard to their age, based on research recommendations by Pedregal and Ozcaglar-Toulouse (2011).

The questionnaire survey was carried out among 614 respondents from the age of 15 to 35. The proportion of women accounted for more than 52% (320) and the proportion of men accounted for almost 48% (294) of the total number of respondents. In terms of the age, the age group from 15 to 19 years was represented by 173 (28.18%) respondents. The largest number of respondents belonged to the category from the age of 20 to 25 whose share in the overall structure of the respondents amounted to 38.76% (238). The respondents in the age from 26 to 35 years accounted for 33.06% (203).

An educational structure of the respondents has in this case only an additional informative value due to the nature of the sample of the population. This is a survey of consumer preferences among young people between the ages of 15 to 35. Many of them are studying and therefore, their educational cycle has not been fully completed yet. Approximately a fifth of respondents (122) have university education and nearly a half of respondents (296) have secondary education with the GCSE. Graduates of secondary education without the GCSE accounted for 10% (60) of the total number of the respondents, the respondents with a basic education accounted for 17% (104). In terms of the social status, a half of the respondents

(306) study, 220 respondents (35.83%) are employed, 45 respondents (7.33%) run their own businesses. The proportion of the unemployed accounted for less than 3.5% (21 respondents), women on maternity leave represented approximately 3% (17) of all respondents.

As a part of descriptive statistics, absolute and relative frequencies were used. Furthermore, contingency tables were used. The contingency table is used for transparent visualization of mutual relations of two statistical variables. The type of the contingency table is determined by the number of rows  $r$  and the number of columns  $s$ , it means  $r \times s$  (Hindls et al, 2007). Obviously,  $\chi^2$  is a measurement of the overall dissimilarity of  $n_{ij}$  and  $m_{ij}$ . The bigger the difference between observed and expected values, the higher the test statistic  $\chi^2$ .

$$m_{ij} = \frac{n_i \cdot n_j}{n} \quad (1)$$

$$\chi^2 = \sum \frac{(\text{frequency observed} - \text{frequency expected})^2}{\text{frequency expected}} \quad (2)$$

$$\chi^2 = \sum_{i=1}^r \sum_{j=1}^s (n_{ij} - m_{ij})^2 / m_{ij} \quad (3)$$

$i$  and  $j$  are indexes of rows and columns,  $n_{ij}$  are observed marginal frequencies,  $n_i$  and  $n_j$  are marginal totals,  $n$  is a grand total of observations,  $m_{ij}$  are expected frequencies. The  $\chi^2$  calculated value is compared to the  $\chi^2$  critical value of a chi-square distribution with  $(r-1)(s-1)$  degrees of freedom at the level of significance of 0.05. The hypothesis is rejected if  $\chi^2$  is bigger than the table value. This test is valid asymptotically, and thus it can only be applied if there is a sufficient number of observations. All expected values ought to be higher than one (Hendl, 2009); at the same time, the table should not contain more than 20% theoretical incidence rates (frequencies) of less than 5. Where zero values occur in any of the fields, we proceed to analyse a derived table, created by merging a small number of categories (Hendl, 2009). Cramér's  $V$  was used to determine the degree of association between the variables. During the data analysis, the following null hypotheses were tested:

- $H_{01}$ : The use of a given source of information about Fair Trade does not depend on the gender.
- $H_{02}$ : The use of a given source of information about Fair Trade does not depend on the age group.

For calculation, Statistica programme was used. In this paper the following abbreviations are used: FT - Fair Trade, GCSE - General Certificate of Secondary Education, IESA - Institute for evaluation and social analyses.

### 3 Results and Discussion

According to the Institute for evaluation and social analyses, the term of Fair Trade was known by 52% of the interviewed citizens of the Czech Republic in 2014 (IESA, 2012), this figure is comparable with the world research. Taylor and Boasson (2014) conducted a random survey in households in the USA. They focused on identifying the behaviour of consumers in Fair

Trade, i. e. whether people were aware of this issue and what their buying habits were. Approximately 58% of respondents heard of Fair Trade and more than a quarter bought Fair Trade products intentionally. The survey, presented in this article, shows that of the total ( $n = 614$ ) of the respondents, the concept of Fair Trade was known by almost 70% of the respondents (429). This can be explained by a specific character of the monitored population. The findings are consistent with the results of research by Pedregal and Ozcaglar-Toulouse (2011) which show that people over 25, people with higher education and those living in big cities are particularly interested in Fair Trade products.

Taylor and Boasson (2014) also state that people with liberal political outlook, women and young people who attained higher levels of education, were willing to accept higher price products. Segurette (2004) speaks about so called consumers of a political approach, who are well informed about environmental protection and conditions of producers in developing countries. These consumers mostly have higher education and a higher income as well. IESA research also shows that 34% of respondents, who are interested in buying Fair Trade products, are mainly people with the GCSE and especially for university graduates (IESA, 2012). Low awareness and quality issues regarding Fair Trade raise the skepticism among consumers, while the amount and credibility of information about Fair Trade and also the sale of these products encourage the purchase (Pelsmacker and Janssens, 2007). Based on the results of IESA research from 2011 and 2012, it can be said that the interest of the Czech population in Fair Trade issues is growing (in 2011-2012, the awareness of Fair Trade rose by 13%) (FT Czech Republic and Slovakia, 2014).

High interest in Fair Trade was also demonstrated in the results of the survey presented here. 67% of the respondents said they wanted to learn more about Fair Trade. 30% of the respondents (185), did not encounter the FT concept and 33% (202) said they were not interested in information from this area. The key reason for Fair Trade shops rejection is an insufficient access to information, and low income as well (Pedregal a Ozcaglar-Toulouse, 2011). For 268 of the respondents (43.7%), a higher price of Fair Trade products is the most important factor that negatively affects buying preferences.

The part of the research was identifying how respondents receive information about Fair Trade and the possible use of information resources in connection with the gender and age of respondents. Dependence was assessed using contingency tables. As respondents could choose responses in any combination, each option was examined separately. For the examination of the dependence on the gender, 2x2 contingency tables were compiled. For the examination of the dependence on the age group, 2x3 contingency tables were compiled. Observed p-values for individual sources of information are listed below in Tables 1 and 2. Responses from 429 respondents, who reported the knowledge of the business concept of Fair Trade, were evaluated. This group consisted of 177 men and 252 women. 92 respondents were between the ages of 15 to 19, 190 respondents were from the age of 20 to 25, and 147 were from the age of 26 to 35. In Tables 1 and 2, the frequencies of positive responses are shown. The independence of the age and gender of the respondents was also verified by a contingency table 2 x 3. The statistic value of 0.52 is far below the critical value of 5.99.

**Table 1.** Relation between sources of information and respondent's gender

Sources of information	Frequencies – woman	Frequencies – man	$\chi^2$
Internet	158	112	0.01
School	88	49	2.51
Friends,colleagues,family	73	46	0.46
Shop	53	25	3.35
Cafés, restaurants	46	24	1.68
Press	30	27	1.01
Television	29	23	0.22
Promoaction	10	20	0.84
Job	12	8	0.01
Others	9	8	0.25
Radio	2	6	3.83

Source: Own processing

Table 1 shows that the method of obtaining information is independent of the gender. The test statistic  $\chi^2$  for 2x2 contingency tables 2x2 did not exceed the critical value of 3.84 in any of examined cases ( $\chi^2$  with 1 degree of freedom at the significance level of 0.05). One of the values (using the radio), which is apparently on the border of a possible dependence, does not have a relevant information capability due to a small number of responses. To summarise, the hypothesis H01 cannot be rejected and it can be stated that the use of given sources of information about Fair Trade does not depend on the gender in a given sample.

**Table 2.** Relation between sources of information and respondent's age

Sources of information	15 to 19 years	20 to 25 years	26 to 35 years	$\chi^2$
Internet	56	115	99	1.87
School	36	81	20	34.91
Friends,colleagues,family	29	43	47	4.44
Shop	13	41	24	2.83
Cafés, restaurants	12	33	25	0.93
Press	11	19	27	5.22
Television	10	25	17	0.37
Promoaction	6	16	8	1.17
Job	4	6	10	2.50
Others	0	8	9	5.63
Radio	1	5	2	1.12

Source: Own processing

Table 2 shows that the use of sources of information, with one exception, does not depend on the age of respondents. The critical value of 5.99 ( $\chi^2$  with 2 degrees of freedom at the 0.05 significance level) was exceeded only by dependence between the age and the use of information from the school. This can be interpreted in two ways. Firstly, as a trivial observation that after the age of 25, people do not usually go to school, but also as the evidence that the school is indeed an important source of information whose failure is not (at least in the examined group of the respondents) replaced by using other sources.



To summarize, the use of a given source of information about Fair Trade, except for the information from the school, does not depend on the age group.

In the Czech Republic, the best-sold product is coffee whose percentage proportion of the overall structure of Fair Trade goods is constantly increasing. The highest year on year increase by 23% can be traced in the years of 2010 – 2011. Other types of Fair Trade goods sold in the Czech Republic are cocoa, chocolate, candies and processed food, then to a lesser extent also cane sugar, sweeteners, beverages, cereals, rice, seeds and nuts (Fair Trade Czech Republic and Slovakia, 2014). Buying preferences, which can be traced in the Czech Republic, were also demonstrated in the results of the carried-out research. Nearly 56% (343 respondents) of the total number of the respondents stated that they mostly buy coffee. 32.6% of the respondents buy tea. The third best sold product is cocoa and cocoa beverages (30.9% - 190 respondents). It is followed by chocolate (30.1% - 185 respondents). The total supply of Fair Trade is made up mostly by the assortment of a durable character. Some products which are common in the Fair Trade offer in Western European countries, are sold only in minimal amounts in the Czech Republic.

Buying preferences of consumers in the Czech Republic, according to research IESA (2012), are mainly given by the price of Fair Trade products. Only one third of the respondents is willing to accept a higher price for a product whose packaging bears the Fair Trade brand. Almost half of the respondents (43.7%) expressed that a higher price of Fair Trade products negatively affects their purchasing decisions. This is a slightly different position in comparison with the findings from Western countries. Pelsmacker and Janssens (2007) state that shaping consumer's attitudes to buying Fair Trade products, interest in the products, their likeability and price affordability are very important factors. Nicholls and Lee (2006) also add the FT brand image, which can increase interest in buying FT products.

Bondy and Talwar (2011) focus their research on the economic recession impacts on buying habits of consumers on the market with Fair Trade products. They state that a group of regular consumers of these goods remained loyal and there were no significant statistical changes. Those who bought these products only occasionally showed a standard consumer behaviour, i. e. focus on the price. These results were confirmed in the United States and Canada, but not in Great Britain. This condition can probably be justified by the approach to the issue of Fair Trade in Great Britain, where a great emphasis in this area is put on the political participation of the state, official institutions and civic movements, which results in a higher degree of awareness of the general public (Clarke et al., 2007).

#### **4 Conclusion**

The business concept of Fair Trade is a relatively new phenomenon whose importance has been constantly increasing in recent years. The principles of solidarity and social responsibility are currently affecting all individuals in countries with developed economies because their consumer behaviour can influence a global social climate. The attitude of the younger generation in this context is a very important factor in the future development of both the business concept of Fair Trade and the whole society. The results showed that the attitude of the younger population between the ages of 15-35 to the business concept of Fair Trade is quite positive. The most common source of information was the Internet. This is understandable because of the age of the respondents.

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# Assessment of Young People's Expectations of Agritourism in the Czech Republic

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**Annotation:** The aim of the paper is to assess the awareness of agritourism amongst young people and their expectations as potential customers. The practical benefit of the paper is to form recommendations for the providers of services in agritourism based on the findings. Research questions focus on the preferred type of accommodation in rural settings, expected services, importance of particular services, accommodation of pets. The findings are based on the results gained from a questionnaire. The questionnaire was distributed by email to students of different fields of study at CULS. The survey was carried out in a period of 6 months, ending on 30.4.2015. The results confirm awareness of agritourism as a form of general tourism amongst young people and their interest to spend their holidays in this type of setting.

**Key words:** agritourism, local food, accommodation, animals, students.

**JEL classification:** F18, Q12

## 1 Introduction

Farm tourism (also referred to as agritourism), is a subset of rural tourism. Catalino and Lizardo (2004) defines agritourism as a set of rural activities, including participating in farming activities; exploring local culture; enjoying the landscape and agro-biodiversity; observing organic and conventional agricultural practices; sampling fruits and vegetables, consumption of local products, etc. Rural tourism and agrotourism is considered a stabilizing factor for the future of the countryside in the context of economic and social development, due to the possible improvement of infrastructure, revitalization, development of small and medium-sized enterprises, improving income for the village and also improves the living standard of the population. Visitors want to spend their vacation on special places, which are connected with nature and values. The countryside represents these values and also its own way of life, traditions, connection to nature, implementation of physical activity, etc. (By: Svoradova, Palkechova, and Viragh, 2013). As Balinska (2015) notes, the growing agritourism service market is a result of the changes taking place in consumer attitudes and tourist supply which have an impact on the demand. The growing pace of life (especially in big cities) results in the increasing number of tourists primarily looking for peace, quiet and contact with nature.

The basic conditions to allow the development of agritourism include: (Kasperek, 2007) authentic natural or richly structured cultural landscape without large-scale monocultures, cultural, historical or natural attractions, good transport links to the population centres, a certain level of existing infrastructure, e.g. transport, accommodation and catering facilities, stable political conditions and acceptance among local people in favour of tourism..

The characteristic feature of guest farms is their unique character, especially in comparison to chain hotels. Also, residents of big cities have developed an increasing interest in organic

food. The countryside, farms and agritourism farmhouses are often associated with natural food and healthy lifestyle. (Balinska, 2015). Kasperek (2007) notes, that the wealth of crop plants and livestock breeds is also a valuable part of the cultural heritage. Diversity is particularly interesting to tourists when it appears in its socio-cultural context, i.e. products are not simply on sale, but the visitors' experience is enriched by seeing old production processes, traditional crafts or special festivities in action.

Leco, Hernandez and Campón (2013) examined the attitude of tourists towards the practice of agritourism in Spain. The main activities, in which the tourist would like to participate include horticulture, wine and olive, handling of a cattle and sheep, slaughtering, preparing products and collection of wild fruits. Sidali and Schulze (2010) examined the consumers' preferences for farm tourism in Germany, where five groups were identified as potential guests: organic and wellness seekers, general supporters, pure organic seekers, Wild West supporters and rural idyll and wellness supporters. This study confirms, that the provision of high-value catering, especially organic and regionally produced food, positively influence the preferences of the consumers and one main implication is that a sound promotional campaign of farm tourism could be to invest in traditional, ecologically produced food. Balinska (2015) notes, that in the last several years, residents of big cities have developed an increasing interest in organic food. The countryside, farms and agritourism farmhouses are often associated with natural food and a healthy lifestyle. Preferences of students (Balinska, 2015) include learning about the village and region, low prices, group-bonding retreats and active holidays, where the preference of the active holiday is prevailing. For most students active form of spending leisure time could be the factor influencing their choices of a farm stay as a holiday destination. On the other hand, organic food was low in preferences amongst students (1,8%).

Baker and Cameron (2013) note, that as a consequence of globalisation, the marketing of places has grown in importance on all levels of destination - countries, regions and individual. The role of strategic planning is emphasized in the destination marketing and the role of image presentation and search for own identity.

In the tourist sector, communication is decisive in determining consumption choices, and the Web plays an important role. Considering that the Internet can bring potential benefits and reach new customers, it is important that websites are complete and attractive. (Platania, 2014). Unfortunately, not all farms run their own websites. Tourists choosing rural destinations want to make an informed decision whether to stay on a working farm where agriculture is being practiced or venues which are farms by name only. (Balinska, 2015).

In the past decade there has been a rapid development of information and communication technologies, so the choice of marketing tools in destination marketing should be also adapted accordingly. Attention must be paid mainly to the Internet by creating user-friendly interactive presentations. In the field of communication technologies, emphasis should be placed on the use of the latest applications for mobile communication devices (Soteriades, 2012).

In 2010, the Czech Republic had a total of 22,864 agricultural subjects, of which 3422 dealt with non-agricultural activity. Tourism, accommodation and other leisure activities were operated by 610 agricultural entities (CSO, 2011). From the total number of organic farms 3928 in 2013, 5% (177) were operating non-agricultural activities. The highest proportion (31%) were reported in agri-tourism, which was operated by a total of 60 companies (MA,

2015). Most farms offering agritourism is located in the South Czech and Karlovy Vary regions (Hrabák, 2014).

The aim of this article is based on the study of literature sources, analysis of selected statistical indicators and our own primary research to discuss consumer preferences and attitudes to the concept of agritourism.

## 2 Materials and Methods

The theoretical basis of this paper was compiled using an analysis of secondary sources, which were collected from scientific articles, professional literature and official web portals. Primary data were obtained through own research.

Young people in this article are represented by full-time university students. The questionnaire used closed question with yes, no and not sure/do not know type of answers. For the expression of their preferences, the students had a scale of 1-3, where 1 – I am interested/it is important, 2 – Less important and 3 – Not important.

The survey was conducted in electronic form during the summer term of the school year 2014/15 among the students of the Czech University of Life Sciences in Prague (CULS). The sample was intentional. A total of 3,700 students were addressed by email, of which 2,700 (72.97%) were students of the Faculty of Economics and Management (FEM), 800 (21.62%) students of the Faculty of Agrobiolgy, Food and Natural Resources (FAFNR), 70 (1, 89%) of the Faculty of Engineering (FE) and 180 (4.86%) students from the Faculty of Environmental Sciences (FES) and Faculty of Forestry and Wood Sciences (FFWS). The return was 11.86% (n = 439), which corresponds with the average responses to questionnaires in published surveys.

With regard to the overall proportion of respondents from different faculties, the percentage of responses to a questionnaire survey is the following: FEM – 10,15 %, FAFNR – 18,13 %, FES and FFWS – 8,33 % and FE – 7,14%. These ratios indicate that most students who completed the questionnaire were from FAFNR, which corresponds with the profile of their study and area of interest. The second most responding group were students of FEM. This suggests that the issue of agritourism is also relevant to the economically oriented degree courses of CULS.

The basic identification signs of the monitored sample of respondents may be defined as the following.

- The gender of the respondents is represented by female respondents cca 80 % (352) and by male respondents cca 20% (87). This gender distribution corresponds with the overall gender structure of students at CULS, where the majority of students are female.
- In terms of age, the largest group (63,33%) was between 20-23 years old (278), followed by the group of over 24 years old students (36,45%). Only one respondent was of age under 20.
- From the overall number of respondents (n=439), 274 (62,41%) attends FEM, 145 (33,03%) attends FAFNR, 15 (3,42%) students are from FFWS and FFWS and 5 (1,14%) attends FE.

- The respondents' place of origin in terms of habitants is the following: 34,44 % (138) of students are from big cities (capitals of regions or Prague (more than 90 000 habitants), 31,21% (137) are from small villages (up to 2000 habitants), other respondents are from villages or small cities between 5000-20 000 of habitants (15,95%), bigger cities between 20 000 – 90 000 of habitants (10,93%), regular villages with habitants between 2000-5000 (10,25%).
- In terms of the types of secondary schools, which the respondents graduated from, the structure is the following: nearly 44% (190 students) completed a secondary school with focus on economics and 34,1 % (109) graduated from high school (gymnázium). Nearly 10% graduated from secondary schools with focus on agriculture and 13% stated other types of secondary school.
- Most respondents 135 (30.75%) live in Prague, and 128 respondents (29,16%) live in the Středočeský county, followed by the Jihočeský, Ústecký, Královéhradecký, Plzeňský and Vysočina county, where the respondents are represented evenly by 5 – 6%. Other counties of the Czech republic were represented in scale of 0,5 – 3%.

The paper is processed using the methods and tools of descriptive and inferential statistics. A contingency table is used to test the mutual degree of association of (usually) a pair of variables that can only take a small final number of values. The tested criterion is the sum of normalized differences of the marginal frequencies and their translated values, which in the case of independency will have an asymptotic distribution of  $\chi^2$ . The calculated value is then compared to the critical value  $\chi^2(\alpha)$  with  $(r-1)(s-1)$  degrees of freedom, where  $\alpha$  = required probability level of the test,  $r$  = number of rows of the table,  $s$  = number of columns of the table. The potential correlation (or absence thereof) is tested by way of contingency tables, with an  $\chi^2$  test at the 0.05 level (Hendl, 2009). To measure the strength of correlation, Cramér's  $V$  is used. At the data analysis, the following null hypotheses were tested:

- H01 The intention to spend a holiday on a farm is not dependent on the size of the place of origin.
- H02: The intention to spend a holiday on a farm is not dependent on the faculty which the respondents are attending.

Data were processed and subsequently evaluated by software Statistica.

### 3 Results and Discussion

The survey showed that awareness of the term agritourism amongst young people is high, 77,68 % (341) students answered positively. The statistical evaluation showed that the awareness of the term "agritourism" is not dependent on age, attended faculty or the size of the place of origin in the surveyed sample. 84,8 % (290) of respondents has never been on a holiday on a farm. 45,56 % (200) of respondents answered that they would like to have this experience, but 29,61 % (130) answered no and 24,83% (109) answered that they were not sure. One of the reasons for answering no could be existing allergies for plants and animals (21,4 % of respondents).

The results of the survey as to the preferences of young people can be divided into three categories: preferences on the services provided by the farm, the place of the farm and the type of accomodation. Regarding the services provided by the farm, the survey shows

a strong preference of tasting local products (77%) and the possibility to monitor the process of production these products (71,8%). Other preferences regarding services include the ability to gain information for their study field and diploma theses (30,8%), handling of animals (48,7%), horseriding (48,1%), participating in harvests or fruit and vegetable collection (35,5%), and accommodation of own pets (38,3%). On contrary to our results, Balinská (2015) states in her findings that the expectation that it will be a classic working farm where students can learn plant and animal cultivation is the least expected feature. Interestingly, providing wifi connection is very important only for 17,1% of respondents and not important at all for 37,8 %.

Preferences of students as to the actual place of their stay indicate the importance of local markets (57,2%), cycle paths (49%), nearby ponds or rivers (56%), local festivals or other local events (50,6%), nearby historical monuments (48,3%) transport to the farm (48,7%) and the proximity of a shop (45,8%). The preference of transport convenience according to Balinska (2015) is 3,6%, which is in contrast to our findings.

Preferences of students regarding accomodation and catering include a country-style room (61,73%), a room with the possibility of self-catering (35,08%), bed and breakfast (25,97%) and apartman (24,37%). Other options of accomodation were less favoured, such as tent (16,17%), mobilhome (12,3%) or hostel-type of accomodation with bunk beds (4,56%). Results on the services regarding accomodation indicate a strong preference for an en-suite room (answered as very important by 59,9% of respondents for own shower and 66,5% for own toilet) and a strong preference for the use of refrigator (47,2% of respondents answered as very important).

Statistical evaluation showed that there is a relationship between the intention to spend holidays on farm and the size of the place of origin (see Table 1) and the attended faculty (see Table 2).

**Table 1.** Relationship between the size of the place of origin and the intention to spend holidays on s farm

Population of the place of origin	Yes	No	Not sure
Up to 2000 habitants	59	48	30
2000 - 5000	25	13	7
5000 - 20000	31	23	16
20000 - 90000	14	14	20
More than 90.000 (capitals of the regions and Prague)	71	31	36
Total	200	129	109

Source: Own survey, 2015

The statistical evaluation shows, that the statistical results are by 16,8 higher, than the critical value of  $\chi^2$ , which is 15,5 at degrees of freedom 8 and at the significant level of 0,05. The null hypothesis H01 can be rejected. There is confirmed relationship between the variables, but Cramer's V (0,14) indicates that there is a weak correlation. A more detailed analysis of data shows that differences are apparent due the students of the smallest and the largest place of origin. Residents of small municipalities answered "no" about 20% more than would correspond to their share in the sample, while the share of negative answers from the city habitants were 24% below average. An interesting anomaly is the number of undecided respondents from medium-sized cities, which is 67% above average.



**Table 2.** Relationship between the attended faculty and the intention to spend holidays on the farm

Attended faculty at CULS	Yes	No	Not sure
Faculty of Economics and Management	94	98	82
Faculty of Agrobiology, Food and Natural Resources	98	26	21
Other	7	6	6
Total	199	130	109

Source: Own survey, 2015

The number of respondents attending other faculties than FAFNR and FEM are merged to one group, due to their statistically low value. The statistical value is 43,1 higher, than the critical value of  $\chi^2$ , which is 9,5 at degrees of freedom 4 and at the significant level of 0,05. The null hypothesis H02 can be rejected. Cramer's  $V$  ( $V=0,22$ ) indicates, that the correlation between the variables is in the middle range.

Data in the survey shows that students attending FAFNR are significantly more interested in holidays on the farm – it is about 49% more than would correspond to their representation in the sample. This group is also relatively less undecided (- 40% versus their share of the reference sample).

#### 4 Conclusion

The survey showed that awareness of the term agritourism amongst young people is high and is not dependent on age, attended faculty or the size of the place of origin in the surveyed sample of students. Balinská (2015) states, that present interest of young people in recreation in the countryside in the form of rural tourism is rather low. In our survey 45,56 % of respondents would like to spend their holiday on a farm and 24,83% were not sure.

Statistical evaluation of the relationship between the size of the place of origin and the intention to spend holidays on a farm indicates that respondents from smaller municipalities are not as interested in staying on farms as respondents from big cities. The reason for this could be the already existing familiarity with similar surroundings in their place of origins. This corresponds with the findings of Balinska (2015), where one of the reasons of not staying on a guest farm is a respondent being a rural resident. Statistical evaluation of the relationship between the attended faculty and the intention to spend holidays on a farm showed that students attending FAFNR are the most interested, which can be related to their field of study and the topic of their diploma theses.

The most expected services provided by farms include tasting local products and the possibility to monitor the process of production of these products. This corresponds with the findings of Leco, Hernandez and Campón (2013), although their research was not provided solely on young people and with the general observation of Kasperek (2007). Local products are not necessarily a synonym for organic food, but it is expected. Organic food is high on the preferences generally according to Sidali and Schulze (2010), but shows a low preferences according to Balinska (2015) amongst students. Accommodation of own pets or animals (like horses) is also expected. Amongst the respondents, 69,5 % own pets and 36 % would like to take them when considering a holiday on a farm.

By analysing the results, farms should highlight the unique selling points of the place such as ponds and rivers, local festivals, or the proximity of local shops and transport, as these are preferred by young people. Students prefer accommodation in country-style rooms. This finding corresponds with the findings of Balinska, 2015, where expectations concerning farm stays included a strong preference on a atmospheric house. Expectations of students as to the accommodation also include en-suite rooms and stated access to the kitchen and fridge.

The future research will focus on more detailed analysis of the existing responses, statistical evaluation of other relationships between variables (such as gender preferences on accommodation), obtaining more extensive responses from other universities with no agricultural foundation and from the providers of services in agritourism and their willingness to adapt and the web-presentation of their image.

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## Should we differentiate systems of own revenues in rural and urban local self-governments' budgets? Example from Lower Silesian voivodeship.

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**Annotation:** The main purpose of this article is a presentation, analysis and comparison of own revenues (ORvn) system in all rural (78) and urban(32) of local self-governments (LSG) from Lower Silesian voivodeship in changing economic conditions during 2006-2014 period. The aim of this article is also to attempt to show how a present system of LSG ORvn in these two types of local self-governments have responded to crisis. LSG budgets need relatively stable revenues to sustain their responsibilities so LSG revenues should be also fairly resistant to crisis and should not overreact to economic fluctuations.

The analysis of accessible financial budget data proved that the most vital revenues in the case of investigated types of municipalities are shares from PIT, CIT, real estate tax, tax on transportation vehicles, agricultural and forest taxes and revenues from LSG property. The estimates come from financial reports from The Regional Chamber of Audit.

To compare the meaning and importance of these revenues a comparative analysis has been carried out. Maximum, minimum and medians estimates, but also the first and the third quartiles separately for all urban and all rural LSG in 2006-2014 have been taken into consideration. There are presented among others: a share of ORvn in total revenues (TRvn) in the consequent years, changes in TRvn in urban and rural LSG, differences between growth rate of own-median and total-median LSG revenues and other main revenues share in ORvn of LSG.

Shares of LSG ORvn in TRvn were changing more in urban LSG than in rural ones. The average growth of it was slower than the average growth of TRvn 2008–2010 mostly in urban LSG. The main reason of it was a big share in TRvn of PIT and CIT shares. This suggests that income taxes are not a stable and efficient source of ORvn during a crisis time. Introduction or acquisition of new ORvn is problematic because: (i) there is a relatively low acceptance of sharing other than direct taxes between central and local government, (ii) there is no space for new sources of revenue for local government, (iii) tax base of different types of LSG is also different between each type.

**Key words:** local government, own revenues, rural municipalities

**JEL classification:** H71, H72, H74

### 1 Introduction

In many countries, as well federal as unitary ones, we can observe the trend toward local self-government (LSG) revenue diversification. It concerns not only intergovernmental grants and tax sharing, but also their own revenues sources (Olejniczak, 2012). One of the main goals of differing revenue sources of local government is to get additional protection over the course of economic fluctuations (Gałęcka, 2013) or cycle (Shunk, Porca, 2005). There are also other reasons for differing LSGs sources of revenue like political (Carroll 2005) or demographic (Miszczuk, 2001) factors, and what is more important to make possibility of avoiding the danger of being dependent on the benevolence of the higher authority (Edling, 1998). From all of the above economic ones seem to be the most important. In Poland we can observe that the structure of local government own revenues has not changed since 2003. There are many analyses of local government own revenues system in Poland (e.g. Jarosiński,

2013) (Będzieszak, 2010) (Kotlińska, 2009) (Sekuła, 2007) which are devoted to analyses of whole population of local self-governments (including rural, urban and urban-rural ones) or analyzing only one kind of them (Przygodzka, 2014) (Olejniczak, 2009) or from a territorial point of view (Smutek, 2012) but it is complicated to find a comparison between urban and rural LSGs. It should be mentioned that LSGs revenues system is universal for all types of local governments of Poland. This issue causes important differences in revenues structure of two types of LSGs mentioned before so the main purpose of this article is a presentation, analysis and comparison of their own revenues system in rural and urban LSGs on example of Lower Silesian voivodeship in changing economic conditions during 2006-2014. From the outlook, there is a need for the local government to be equipped with stable sources of revenues and there is always a question – should sources of rural and urban LSGs revenue be the same? The aim of this article is also to attempt to show how a present system of their own revenues in these two types of local self-governments responded to crisis. It should also point what kinds of revenues are more stable in case of rural and incase of urban municipalities. To analyze it average estimates and also particular types are taken into consideration and compared with their reaction to changing economic conditions. The analysis investigates budgets own revenues structure of all seventy-eight rural and thirty-two LSG of Lower Silesia voivodship. According to Law on Local Government Revenues (2003) regulations there are three main types of LSG revenues in Poland: their own revenues, general purpose grants and conditional grants. So called own revenues include: taxes which are administered and collected by the LSG administration like property (real estate) tax, tax on agriculture, tax on transport vehicles, forest tax. Then there are taxes collected by national tax administration like tax on civil law activities, tax on inheritances and donations, tax on small businesses. There are also locally administered fees like fees dog owners need to pay, tourist fees, market fees, fees on exploitation of natural resources and many more. There are also surcharges (shares) in central income taxes PIT and CIT which are allocated proportionally to the amounts collected within territory of the jurisdiction. Local government also collects revenues from its property use and sell. The estimates come from financial reports from The Regional Chamber of Audit (Regionalna Izba Obrachunkowa) in Wrocław. The research covers the time from 2006 to 2014.

## 2 Materials and Methods

The analysis of accessible financial data from financial reports from The Regional Chamber of Audit in Wrocław proved that the most vital revenues in the case of investigated types of municipalities are shares from PIT, CIT, real estate tax, tax on transportation vehicles, agricultural and forest taxes and revenues from LSG property. To compare the meaning and importance of these revenues a comparative analysis has been carried out. Maximum estimates, minimum estimates, medians, but also the first and the third quartiles separately for urban and rural municipalities in Lower Silesia voivodship in 2006-2014 have been taken into consideration. There are presented: a share of their own revenues in total municipalities in the consequent years, changes in total revenues in urban and rural municipalities, differences between growth rate of own-median and total-median municipalities revenues (percent points,  $y/(y-1)$ ), a share of PIT and CIT shares' in their own revenues municipalities, growth rate of LSGs shares in PIT and CIT municipalities revenues ( $y/(y-1)$ ), share of local taxes and fees in their own revenues, differences in growth rate of LSGs local taxes and fees ( $y/(y-1)$ ) and other main revenues share in their own revenues of LSGs.

All financial data are in nominal units to remain comparable with GDP and other economic indicators. This should let us recognize how LSGs revenues reflect economic changes. To compare differences between these two types of LSGs median, 1<sup>st</sup> and 3<sup>rd</sup> quartile are also presented, and quartile deviation is calculated, because we can observe that there is a number of LSGs where their revenues are far from average so it could blur the picture of the whole sample.

### 3 Results and Discussion

While introducing LSG own revenues analysis it is important to recognize their significance to rural and urban units. As it can be observed (table 1) there is quite a big difference between these two groups. Urban LSG units (U) receive about 60 to 65 per cent of all their revenues as their own revenues. Contrary to rural LSG (R) get usually about 10 percent points less. It could seem surprising but a maximum share of revenues in total revenues in both types of LSG is very similar – over 80 percent, and since 2011 rural LSGs have had a bigger share. As it was expected rural LSGs in general have less efficient revenue base. One quarter of rural LSGs collects under 40 percent of their revenues from their own sources while in case of urban units 1<sup>st</sup> quartile reaches about 50 percent – so it is more than median in rural LSGs. The change of share of their own revenues in total revenues doesn't reflect other changes in revenue sources so it is crucial to analyze also a nominal growth rate of it comparing year to year as it is shown in table 2. After a comparison of changes in total revenues levels in urban and rural LSGs we can notice that rural ones were better prepared for crisis. Comparing averages and median between them it is clear that the increase of revenues was slower in time of crisis but rural governments suffered less than urban. Also looking at 1<sup>st</sup> and 3<sup>rd</sup> quartile we can conclude that rural LSGs were more stable. It has to be underlined that in 2010 and 2011 urban local governments revenues rose a little bit more than in rural but first two years of crisis brought significant slowdown of urban revenues. It is worth to underline that comparing averages from 2012/2013 we can observe a massive rise of maximal change which causes averages to be far from median.

**Table 1.** Own revenues share in total revenues in urban (U) and rural (R) municipalities of Lower Silesian voivodeship (%)

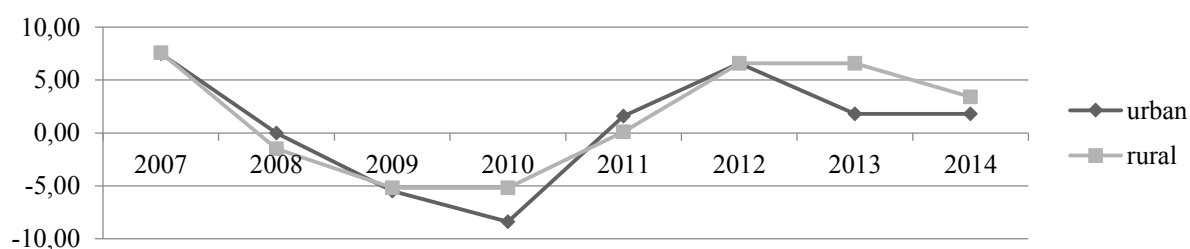
Data\Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
Maximum (U)	82,62	89,61	86,90	81,92	84,92	73,66	75,55	80,49	78,66
3 <sup>rd</sup> quartile (U)	67,95	72,27	70,06	67,67	65,39	66,84	66,31	65,68	66,64
Median (U)	61,32	65,50	63,91	60,44	55,42	58,31	61,44	60,79	62,05
1 <sup>st</sup> quartile (U)	52,30	60,17	55,92	54,94	47,21	48,57	50,05	52,17	52,63
Minimum (U)	38,71	39,21	44,22	41,04	29,79	30,64	40,91	40,40	46,30
Maximum (R)	85,93	84,50	84,87	81,69	83,56	84,75	83,55	83,06	81,86
3 <sup>rd</sup> quartile (R)	54,93	58,67	57,17	54,35	51,68	54,70	54,74	58,04	59,98
Median (R)	45,11	47,60	46,05	43,64	43,69	44,87	44,85	48,03	49,06
1 <sup>st</sup> quartile (R)	37,96	42,36	42,36	39,31	36,78	34,56	39,75	41,99	43,50
Minimum (R)	27,39	25,72	26,37	24,71	22,05	16,73	27,78	30,68	29,80

Source: Own calculation based on Wrocław Regional Audit Chamber data

**Table 2.** Changes in total revenues in urban and rural municipalities of Lower Silesian voivodeship  $y/(y-1)$ 

Data\Year	2007	2008	2009	2010	2011	2012	2013	2014
3 <sup>rd</sup> quartile (U)	1,17	1,10	1,06	1,22	1,10	1,11	1,10	1,11
Median (U)	1,11	1,05	1,02	1,12	1,06	1,03	1,06	1,06
1 <sup>st</sup> quartile (U)	1,05	0,99	0,97	1,07	0,97	0,96	0,99	1,02
3 <sup>rd</sup> quartile (R)	1,21	1,16	1,10	1,24	1,14	1,11	1,10	1,12
Median (R)	1,11	1,09	1,04	1,11	1,04	1,05	1,04	1,06
1 <sup>st</sup> quartile (R)	1,05	1,02	0,97	1,03	0,98	0,98	0,97	1,02

Source: Own calculation based on Wrocław Regional Audit Chamber data

**Fig. 1.** Difference between growth rate of own median and total median revenues changes in rural and urban municipalities of Lower Silesian voivodeship (percent points,  $y/(y-1)$ )

Source: Own calculation based on Wrocław Regional Audit Chamber data

Comparing changes between their own revenues and total revenues (measuring difference between their growth rate in pp. in median) we can notice that a similar tendency can be observed (fig. 1). In case of rural LSGs total revenues have risen more quickly than own between 2008 and 2011 but what is more important they seem to be more predictable than urban revenues. As we look at 2008 and 2009 data we can observe that a difference between the growth of their own and total revenues in case of urban LSGs was rising while in case of rural LSGs it remained rather stable. That may be caused by a bigger share in urban LSGs own revenues of revenue sources that overreact to economic fluctuations. In coming years we can observe that a level of difference also changes rapidly only in case of urban LSGs.

This part of paper has demonstrated that there was a difference in amount of total revenues collected by urban and rural LSGs and their own revenues. It is now necessary to explain the reasons of it. There are two main possibilities – changes in total revenues were caused by changes in general or conditional grants, or some of revenues were lower than in previous years. From our point of view this second issue is more important and that's why in next sections an analysis of changes in level of main own revenues will be presented.

**Table 3.** Share of PIT and CIT shares' in own revenues in urban (U) and rural (R) municipalities of Lower Silesian voivodeship

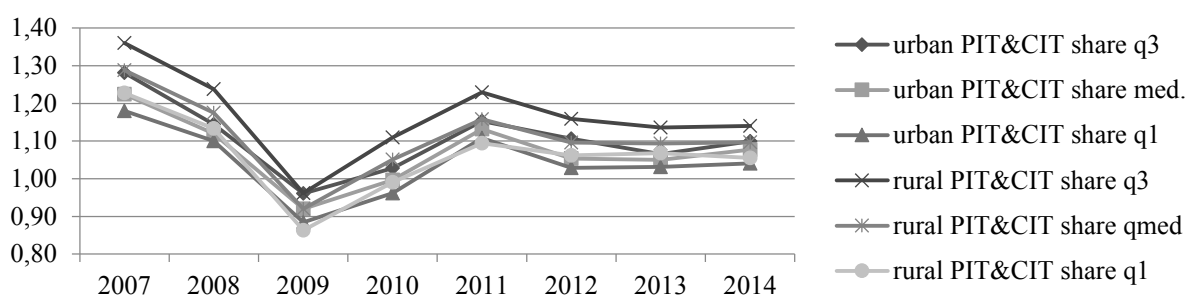
Data\Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
3 <sup>rd</sup> quartile (U)	0,355	0,375	0,388	0,385	0,366	0,389	0,414	0,404	0,392
Median (U)	0,318	0,333	0,366	0,342	0,318	0,356	0,336	0,353	0,353
1 <sup>st</sup> quartile (U)	0,284	0,234	0,303	0,284	0,252	0,273	0,300	0,280	0,289
3 <sup>rd</sup> quartile (R)	0,288	0,283	0,327	0,322	0,314	0,344	0,327	0,327	0,336
Median (R)	0,243	0,250	0,269	0,263	0,252	0,290	0,293	0,291	0,290
1 <sup>st</sup> quartile (R)	0,183	0,212	0,237	0,222	0,203	0,234	0,231	0,223	0,222

Source: Own calculation based on Wrocław Regional Audit Chamber data

Local self-governments receive about 39% of the revenue from personal income from taxpayers residing in their area, and near 7% from corporate income tax from firms

established in their area. That is the main reason to look at this source of municipal revenue in economic crisis situation carefully. As we can see in table 3 there is about 12 pp. difference between rural and urban LSGs share of this kind of revenues in their own revenues. We can also notice that a share of this type of revenue is changing more rapidly in urban LSG. We can observe that quartile deviation in case of urban LSGs is usually little bigger. It could mean that there are smaller differences in tax base of PIT and CIT between rural units than urban.

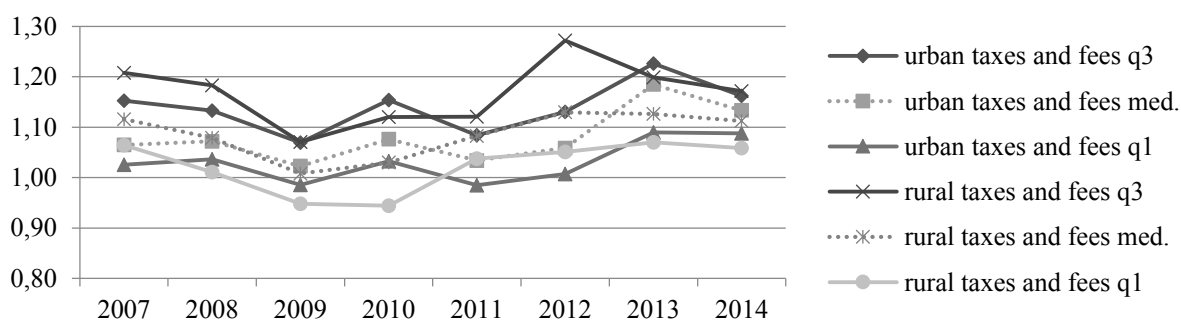
**Fig. 2.** Growth rate of LSGs shares in PIT and CIT in rural and urban municipalities of Lower Silesian voivodeship ( $y/(y-1)$ )



Source: Own calculation based on Wrocław Regional Audit Chamber data

When we look at growth changes of PIT and CIT shares during analyzed period we can notice that a direction and volume of changes are similar in both cases. As it is presented on fig. 2 year 2009 seems to be the worst in the whole period because none of LSGs reached a level of revenues from a previous year. Additionally we can observe that after 2010, a nominal growth of PIT and CIT shares rushed up as the whole Polish economy.

**Fig. 3.** Growth rate of LSGs local taxes and fees in rural and urban municipalities of Lower Silesian voivodeship ( $y/(y-1)$ )



Source: Own calculation based on Wrocław Regional Audit Chamber data

The next group of revenues is quite a large group of local taxes and fees. It is usually reported as one revenue stream but there are big differences between levels of each kind of tax and fee between LSGs. At the beginning we can compare totals of it reported by the Regional Chamber of Audit. It shouldn't be surprising that resulting much bigger share of PIT and CIT surcharge in urban LSGs revenues there is an opposite situation - over 50% of rural LSGs own revenues come from local taxes and fees while usually in case of urban LSGs their share is lower up to 17 pp. It can be observed that quartile deviation in case of urban LSGs is little bigger. As we look at growth change of local taxes and fees we can notice that rural LSGs suffered more from crisis. Picture 3 shows that growth of this group of revenues was lower in rural municipalities between 2008 and 2010 and after 2013. What is important, 1<sup>st</sup> quartile of urban LSGs had each year a slight growth of revenues or were almost even



previous year 2009 and 2011 (0,985 y/(y-1)) while rural ones reported in 2009 and 2010 under 0,95 of previous year revenues.

Taking into consideration other main revenues sources it should be pointed that only a small part of them have a significant share in total revenues. As it was mentioned real estate tax is one of them. Data from table 4 show us that from the budget point of view it is more important source of revenues in rural LSGs. Between 2008-2011y revenues from it were growing slower, but in urban LSGs median growth was usually above 1,07, while in rural in 2009 and 2010 under 1,03. As the maximum rate is set by the Parliament (or Ministry of Finance), LSG have a limited taxing power mainly LSGs may adopt a rate which is lower or the same as the “ceiling”. So a lower growth can be caused by LSG tax policy decisions. Also tax on transportation vehicles has central government “ceiling”, and revenues from agricultural and forest taxes are dependent on local market prices of cereal and wood – that means tax rates and revenues are strongly marked (and crisis) related.

**Table 4.** Other main own revenues share in own revenues in urban (U) and rural (R) municipalities of Lower Silesian voivodeship (median)

Data\Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
Real estate (U)	0,266	0,234	0,233	0,251	0,257	0,255	0,273	0,275	0,259
Real estate (R)	0,327	0,275	0,279	0,282	0,275	0,281	0,295	0,288	0,283
Agriculture (U)	0,001	0,001	0,002	0,002	0,001	0,002	0,002	0,003	0,002
Agriculture (R)	0,064	0,063	0,100	0,096	0,069	0,072	0,104	0,102	0,091
Vehicles (U)	0,009	0,008	0,008	0,009	0,008	0,007	0,006	0,008	0,006
Vehicles (R)	0,011	0,011	0,011	0,012	0,012	0,013	0,012	0,012	0,012
Civil law activities (U)	0,020	0,022	0,023	0,021	0,021	0,018	0,015	0,015	0,014
Civil law activities (R)	0,015	0,021	0,020	0,018	0,018	0,018	0,014	0,013	0,014
LSG property (U)	0,142	0,172	0,157	0,171	0,162	0,146	0,155	0,130	0,130
LSG property (R)	0,048	0,064	0,052	0,057	0,044	0,041	0,045	0,035	0,037

Source: Own calculation based on Wrocław Regional Audit Chamber data

The findings of further analysis indicate that mentioned differences in LSG revenues are caused mainly by the specific revenues as exploitation charges (mostly in rural LSGs), revenues from selling LSG property.

#### 4 Conclusion

The analysis of disproportions between Lower Silesian voivodeship rural and urban LSGs own revenues between 2006 and 2014 proves that in spite of identical system of LSGs' own revenues there are differences between these two groups. It can be seen that both urban and rural LGS own revenues come from shares in PIT and CIT. Rural LSGs due to exclusion of farmers from income tax system are collecting less from this source. Additionally it was observed that a crisis has a relatively strong impact on this source of revenues in both cases. This suggests that shares in income taxes are not stable and efficient source of own revenues during crisis. Rural LSGs are more dependent from agricultural tax and real estate (property) tax while urban LSGs can rely on real estate (property) tax and revenues from LSGs property. So the final question is “should we differentiate systems of own revenues in rural and urban local self-governments' budgets?”. The answer is not simple and obvious. Firstly there is a relatively low acceptance of sharing other than direct taxes between central and local government. Secondly – there is no space for new sources of revenue for local government – taxpayers will definitely not accept new taxes and charges, and there is not much left to charge or tax. We can seek new solutions in real estate taxation, rural or forest (ad valorem taxation

instead nowadays paid amount for sq m). And thirdly, tax base of different types of LSG is also different between each type. So it may be more appropriate to find an alternative to urban/rural division of LSGs and next to adapt the system of their own revenues to their specifics.

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# Performance measurement for pig production by the use of the Balanced Scorecard

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**Annotation:** Strategic management practice has changed during the past years. Farmers have to face adjustments in their pig farm business due to globalization, deregulation of trade, market development and increasing shortage of farmland. Management skills are becoming more important in the future. Especially for growing farms a change in management practice is essential for survival and a healthy business. A management tool which focuses performance measurement, controlling and strategic planning and is able to give an overview over the whole farm is the Balanced Scorecard. With the aim to get some information about the use of strategies and key performance indicators in pig production, farmers were asked about their point of view in a standardized online questionnaire. The data was analyzed by uni- and bivariate statistical methods and there were significant differences found in the usefulness of strategies and different evaluation of indicators by pig breeders, pig fatteners and closed system pig farmers which are important for measuring farm performance and operational success. The results can be seen as a starting point for BSC implementation to pig production systems and can give some hints in the individual development process for a pig farm.

**Key words:** Balanced Scorecard, pig production, performance measurement, ANOVA, key performance indicators

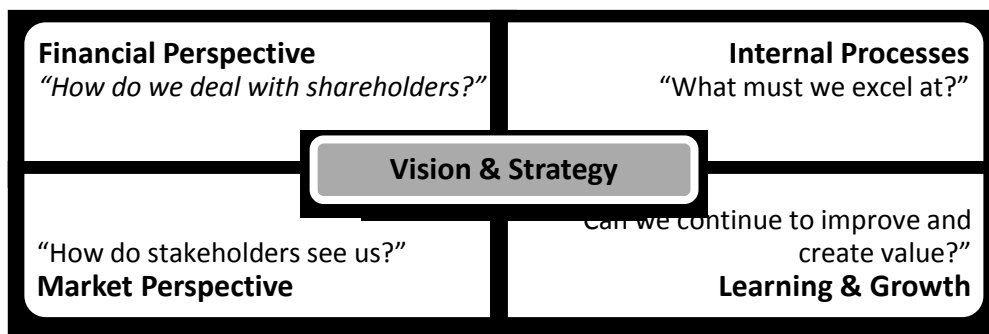
**JEL classification:** Q12

## 1 Introduction

In recent years there are increasing management requirements in pig production due to volatile markets, increasing operating costs, administrative burdens and competitive pressure. Farmers are challenged to force their management skills and there is a demand for them to improve strategic farm management. However, in daily management practice there are numerous instruments such as sow planner and crop field card integrated in farm management, but so far there are no instruments exploited which are able to give an overview of all areas of farm business. The Balanced Scorecard (BSC) is a management tool that is able to close this gap and compensate deficiencies of already used instruments by providing information about performance and management activities on the farm. Additionally to the traditional financial indicators the BSC implements also customer requirements, operational processes and factors for farm development. The Balanced Scorecard (BSC) is a planning and management tool that was introduced first in 1992 in the Harvard Business Review by Kaplan and Norton (table 1).

The proposal of this management approach should contribute to eliminate the shortcomings of classical mainly financial accountancy-based performance measurement systems. The basic idea is to combine performance measures beyond the financial performance measurement systems. Additional to the traditional financial measures there are three more perspectives with criteria to measure performance supplemented to the BSC: customer requirements, internal processes and learning and growth perspective (Kaplan and Norton, 1996).

Fig. 1. Balanced Scorecard – Translating Vision and Strategy to four perspectives



Source: Own presentation modified to Kaplan and Norton (1992)

In the BSC all measures should be consistently aligned to the vision and strategy of a company (business alignment"). Therefore, the performance of a company is reflected by balance between the four perspectives ("Balance") and clear presentation of actual results on a display panel ("Scorecard"). The translation of the previously formulated vision and strategy into business operations has been recognized as a major difficulty and therefore plays a central role in the BSC concept. However, this was mentioned in several studies where the BSC concept was adapted to agriculture (Noell and Lund, 2002; Byrne and Kelly, 2004; Shadbolt, 2007; Lourenzani et al., 2005; Dunn et al., 2006; Lissitsa, 2006; Jack, 2009). For dairy farming and livestock production the BSC concept was tested in few case studies in Denmark, Ireland and the USA (Noell and Lund, 2002; Byrne and Kelly, 2004; Dunn and Etheredge, 2005; Patterson and Richardson, 2007). However, the addition of more perspectives to the basic concept was necessary to illustrate the specific needs and characteristics of agriculture. In this regard, natural resources, lifestyle, people, employees, supply chain, innovation processes and society were mentioned (Lissitsa, 2005; Dunn et al. 2006; Haapsalo et al. 2006). In this study the four original perspectives – finance, market, internal processes and learning and growth – are considered. The concept of BSC focuses vision and long-term strategy with the intent to increase farm performance, whereby implementation of the BSC to pig production may result in a big benefit for management practice. Up to now the BSC concept is not adapted particularly to pig production and in general to farming in Germany. Considering the fact that there are no comparable research studies about the use of the BSC in pig production systems so far, the aim of this study is to provide first approaches for application of the BSC to German pig production systems and to get more information about the use of strategies and indicators by pig fatteners, breeders and closed pig production systems.

## 2 Materials and Methods

In this study a quantitative research approach was used to get more information about the use of strategies and performance indicators in pig production systems. Farmers were questioned about strategies and key performance indicators in the four perspectives of the Balanced Scorecard and how do they rate their relevance for the operational success of pig production. The Design of the standardized online-questionnaire contained a wide range of statements for each BSC perspective that were measured by using five-point Likert-scales. The Survey contains three parts: operational farm information (a), statements for strategies and each BSC perspective (b) and personal information (c). The concept of the questionnaire was based on theoretical considerations on the BSC concept by Kaplan and Norton (1992; 1996) and adjustments to the agricultural sector, which were presented in the literature review. To check user-friendliness before the start of the questionnaire

a pretest with farmers and experts was performed to enhance the understandability. The survey was online in the period from the middle of September to the middle of November 2014 and 78 farmers completed the survey. The response rate was 21.34 %. The data was analyzed by the use of univariate and bivariate methods by using the statistical software IBM SPSS statistics 22 (Field, 2009). Descriptive analysis showed variations in farm structures of pig producers. Based on their specialization in pig production the data set was divided into three groups - breeders, pig fatteners and closed systems pig producers - to get more information about their management needs from the evaluated measures and importance of strategies and indicators for performance in pig production. Appropriate indicators are identified for each group and analyzed by the use of mean comparisons and correlations. Mean comparisons were performed by one-way ANOVA (analysis of variances) to find possible differences between the importance of strategies for the three groups (Field, 2009). For each production system the most appropriate indicators in the four BSC perspectives are presented and discussed. To get more information about cause-effect relationships of the management view of pig farmers, correlations between the indicators in the perspectives were analyzed in addition. A short sample description is given in the following paragraph to get a better understandability of the data set.

In total, data of 78 farm managers were surveyed, which are 97.4 % male and 2.6 % female. The medium farm size of all farms amounts 186 ha with a standard deviation of 436 ha with minimum of 14 ha (smallest farm) and maximum farm size of 3,800 ha (biggest farm). Most of the farmers are from Lower Saxony (50.0 %), North Rhine-Westphalia (19.2 %) and Baden-Wuerttemberg (10.3 %). There were also respondents from Bavaria (7.7 %), Schleswig-Holstein (5.1 %), Saxony-Anhalt (2.6 %), Thuringia (2.6 %), Hesse (1.3 %) and Rhineland-Palatinate (1.3 %). All farmers are farming conventionally and mostly on professional farms (92.3 %), only 7.7 % are part-time farmers. Agricultural business branches besides pig production are crop farming (79.5 %), renewable energy (39.7 %), cattle (11.5 %) and dairy (7.7 %) production, agricultural contractor services (6.4 %), poultry farming (6.4 %) and direct marketing (6.4 %). Most of the respondents have an agrarian qualification, only 3.9 % are without any agrarian qualification. Mostly of the farmers have a mastership examination (28.6 %), degree of higher agrarian school (27.3 %), university degree in agriculture (16.9 %), degree of university of applied science in agriculture (15.6 %) and formal agricultural education (6.5 %). The time of experience in pig production was differentiated into three periods: over 10 years (62.5 %), 5 to 10 years (18.1 %) and under 5 years (19.4 %). The average numbers of employees at the pig farms are 1.8 family workers, 1.7 non-family workers, 1.1 apprentices and 1.5 part-time jobbers. The 78 farmers could be divided into three groups: pig breeders, pig fatteners and closed system pig producers. Pig breeders in the data set have got average number of 584 sow positions per year (min=70; max=1800) and the average number for litters per sow per year is about 2.39. Pig fatteners have got an average number of 2100 fattening places (min=115; max=7000) at their farms and five pig fatteners are also fattening boars ( $\emptyset$  910 boar fattening places). The average number of pig fattening periods per year is 2.78. Farmers in the sample with closed system pig production have average number of 536 sow positions (min=75; max=5000) with an average number of 2.39 litters per sow per year. The average number of their fattening places is about 3868 (min=650; max=48000) with an average number of 2.96 fattening periods per year.

### 3 Results and Discussion

However, to get an overview and starting point for relevant strategies and indicators for Balanced Scorecard development the data was separated to the pig production systems: pig breeders, pig fatteners and closed system pig producers. Hereafter the data was analyzed by univariate and bivariate methods (Field, 2009). Descriptive Results of estimation of strategies by the three groups are shown in Table 1. Significant differences are analyzed by using ANOVA mean comparison analysis with post-hoc test T2 Tamhane and described by letters. The relevance of strategies is different between the three groups. For example profit maximization of the company is significantly much more important for pig breeders than for closed system pig producers. The quality of the animals is the most important strategy for them, as well as profit maximization, decrease of production costs, cost optimization in feeding, daily weight increases and meat quality. However, the strategies growths of the farm, diversification of farm business and cooperation agreements are not significant and the farmers agreed very less that these strategies are important for them. Maybe the small sample size is the reason that not more significant differences could be proven in this mean comparison. Nevertheless, all mean values are showing tendencies for strategy alignment by the groups of pig producers.

**Table 1.** Characterization of pig breeders, fatteners and closed pig farming systems by strategy variables

	Pig Breeders	Pig Fatteners	Closed System	Total
N = number of observations	14	39	25	78
Strategies	MV	MV	MV	MV
profit maximization of the company *	1.14 <b>c</b>	1.41	1.60 <b>a</b>	1.42
profit maximization of pig production n.s.	1.43	1.77	1.92	1.76
Decrease of production costs n.s.	1.71	1.77	1.60	1.76
Cost optimization in feeding n.s.	1.79	1.79	1.60	1.71
Growth n.s.	2.50	2.90	2.72	2.77
Diversification of farm business n.s.	2.71	2.54	2.72	2.63
High quality of animals ***	1.28 <b>c</b>	n/a	1.40 <b>a</b>	1.34
Cooperation agreements n.s.	2.93	2.36	2.76	2.59
Distribution channels ***	n/a	3.05 <b>c</b>	2.84 <b>b</b>	2.95
Daily weight increases ***	n/a	2.21 <b>c</b>	1.64 <b>b</b>	1.93
Meat quality ***	n/a	2.18 <b>c</b>	1.64 <b>b</b>	1.91

MV: Mean Value; n/a: not applicable; Likert-scale from 1 = fully agree to 5 = fully disagree; ANOVA analysis with post-hoc test by T2 Tamhane method (0.05); letters describe significance between cluster (e.g. "a" for significant difference from cluster 2 to cluster 1); significance level: \* =  $p \leq 0.05$ , \*\*  $p \leq 0.01$ , \*\*\*  $p \leq 0.001$ , n.s. = not significant; N = 78.

Source: Own calculations

In the following part results for the evaluation of indicators with regard to their usefulness for measuring farm performance are shown for pig breeders, pig fatteners and closed pig production systems respectively for financial perspective, internal processes, market perspective and learning and growth perspective. In the result presentation for indicators mean comparisons were renounced due to separated request of indicators for each pig production system. The results show mean values and standard deviations for each group. However, differences between the mean values for indicators can be observed in the four perspectives between the three groups. In table 2 the results for the most appropriate indicators for the use in a Balanced Scorecard for pig breeders are shown. Obviously, indicators in the perspectives internal processes, market perspective and learning and growth

are considered more important by pig breeders than indicators of the financial perspective, nevertheless these lagging indicators are used to measure farm performance. For this reason there are only small differences between mean values of indicators in the financial perspective, because they are having all slightly equal relevance for management decisions. Liquidity, change in equity and cash-flow are the most important indicators in this perspective. However, the perspective of internal processes is most important for pig breeders, which is demonstrated by the fact that all pig breeders fully agree to number of sold piglets per sow and year and number of weaned piglets per sow and year as very important indicators to measure their performance in internal processes. Another important indicator is the achieved price for piglets. This indicator is significantly positive correlated ( $r=0.621^*$ ) with equity share of the farm. Correlations are explained by a likewise response behavior of the farmers. For pig breeders the indicators long-term contracts with pig fatteners and sufficient distribution channels are also very high ranked in the market perspective, with the goal to measure farm performance, than price agreements with purchasers and long-term lease agreements for land. These indicators are significant medium high correlated ( $r=0.527^{**}$ ;  $r=0.523^{**}$ ;  $r=0.535^{**}$ ) to the financial indicator return on sales.

**Table 2.** Indicators for the use in a Balanced Scorecard for pig breeders (N=14)

Financial Perspective	MV	STD	Internal Processes	MV	STD
Liquidity/ cash position	1.79	0.802	Number of sold piglets/sow/year	1.00	0.000
Change in equity	1.93	0.616	Number of weaned piglets/sow/year	1.08	0.289
Cash-Flow	1.93	0.829	Achieved price for piglets	1.42	0.515
Direct cost-free performance	2.00	0.853	Piglet losses	1.75	0.866
Farm profit	2.00	0.853	Farrowing rate	1.75	0.754
Return on sales	2.00	0.784	Number of litters/sow/year	1.92	1.084
Equity share	2.00	0.784	Veterinary costs	2.00	0.739
Market perspective	MV	STD	Learning & Growth	MV	STD
long-term contract with farmer/slaughterhouse	1.29	0.611	Relationship between superior and employee	1.50	0.760
sufficient distribution channels	1.29	0.469	Business consulting	1.57	0.646
price agreements with purchaser/customer	1.64	0.633	Personal self-improvement	1.57	0.646
ratio of long-term lease agreements	1.93	1.141	Social acceptance of pig farming	1.64	1.008
land availability	2.14	1.167	Structure of working time	1.64	0.842

Source: Own calculations

Results in the learning and growth perspective are showing that the indicators relationship between superior and employee, personal self-improvement and structure of working time are very similar and high assessed by farmers with the focus of their potential for performance measurement in pig farming.

Pig fatteners agreed little less to the importance of indicators for measuring operational success in pig farming than pig breeders (table 3), which is shown in higher mean values.



**Table 3.** Indicators for the use in a Balanced Scorecard for pig fattening systems (N=39)

Financial Perspective	MV	STD	Internal Processes	MV	STD
Farm profit	1.90	0.912	Feed conversion rate	1.72	0.686
Contribution margin per livestock place	1.97	0.932	Proceeds per kg carcass weight	1.85	0.844
Direct cost-free performance	2.10	0.882	Daily weight increases of pigs (g/day)	2.03	0.778
Return on investment (ROI)	2.13	0.864	Ratio of livestock losses	2.08	0.870
Change in equity	2.13	0.864	Production costs per kg carcass weight	2.08	1.036
Market Perspective	MV	STD	Learning & Growth	MV	STD
sufficient distribution channels	1.97	0.743	Relationship between superior and employee	1.77	0.810
ratio of long-term lease agreements	2.15	0.875	Personal self-improvement	1.79	0.732
land availability	2.28	1.025	Structure of working time	1.79	0.695
building costs	2.31	0.766	Quantity of staff parties	1.87	0.894
land lease per ha and year	2.36	1.088	Business consulting	1.97	0.811

Source: Own calculations

In contrast to the other groups farm profit and contribution margin per livestock place are important financial indicators. In the market perspective the indicators land availability ( $r=0.610^{**}$ ) and land lease per ha and year ( $r=0.561^{**}$ ) are significantly correlated to the financial indicator return on investment. Important indicators in the internal processes perspective are feed conversion rate and proceeds per kg carcass weight for measuring the operational success in pig fattening. These indicators are significantly correlated to the financial indicators contribution margin per livestock place ( $r=0.441^{**}$ ), change in equity ( $r=0.506^{**}$ ) and return on investment ( $r=0.434^{**}$ ). In the learning and growth perspective the farmers in this group evaluated the indicators relationship between superior and employee, personal self-improvement and structure of working time as important indicators to measure farm performance. However, they see the indicator quantity of staff parties also important to reach this goal. Closed system pig producers evaluated a mixture of indicators that are important for pig breeders and pig fatteners, but they evaluated indicators more important for farm performance measurement in contrast to pig fatteners, which is shown by lower mean values. The importance of indicators in same way as the other groups is noticeable by considering the internal processes perspective (table 4), where number of weaned piglets per sow per year is also high important ranked as proceeds per kg carcass weight.

The market perspective has a little lower level in mean values than the other groups evaluated these indicators. Land availability, ratio of long-term lease agreements, land lease per ha and year and sufficient distribution channels are the most important indicators in this perspective for the farmers. In the learning and growth perspective the indicator employee turnover rate was firstly evaluated to the top five indicators. In the financial perspective liquidity, farm profit and change in equity are most important for measuring operational success for closed system pig farmers. Ratio of long-term lease agreements to purchasers is significantly correlated to liquidity ( $r=0.307^*$ ).

**Table 4.** Indicators for the use in a Balanced Scorecard for closed systems in pig production (N=25)

Financial Perspective	MV	STD	Internal Processes	MV	STD
Liquidity/ cash position	1.72	0.891	Number of weaned piglets/sow/year	1.32	0.476
Farm Profit	1.88	0.726	Daily weight increases of pigs (g/day)	1.64	0.810
Change in Equity	1.88	0.927	Proceeds per kg carcass weight	1.80	0.816
Contribution margin per livestock place	1.92	0.954	Deduction amount of deviations from the norm	1.80	0.816
Cash-Flow	1.92	0.909	Farrowing rate	1.84	0.850
Market Perspective	MV	STD	Learning & Growth	MV	STD
land availability	2.08	0.997	Personal self-improvement	1.44	0.507
ratio of long-term lease agreements	2.08	1.115	Relationship between superior and employee	1.52	0.653
land lease per ha and year	2.20	0.866	Structure of working time	1.64	0.757
sufficient distribution channels	2.20	1.041	Employee turnover rate	1.84	0.800
building costs	2.28	0.891	Social acceptance of pig farming	1.88	0.971

Source: Own calculations

## 4 Conclusion

It has to be mentioned that the results are only able to show tendencies in using strategies and key performance indicators that could be relevant for pig production. Due to the small sample size and sampling distribution it has to be mentioned that the data set is not representative for German pig production. Nevertheless, the results can be seen as a starting point for Balanced Scorecard development in pig production. The results are reflecting the actual management view of the farmers concerning the importance of strategies and indicators for performance measurement. To verify the suitability of indicators for performance measurement they have to be checked in practice. The results show that pig breeders and pig fatteners have different evaluations of indicators and strategies, because of different focus to achieve their goal – maximization of farm performance. Closed system pig producers represent a mixture of both. They evaluate slightly more positive than pig fatteners, but ranked some indicators similar to them. As well they evaluated the indicators of the financial perspective similar to the pig breeders. The correlations can indicate that the response behavior of the farmers is very similar in these cases and that shows their point of view to performance measurement. However, growth is not a strategy which is important for pig farmers to achieve their goal of profit maximization of farm performance. This can be explained by the fact that the farms in this data set have an above-average farm size. Their growth capacities are possibly exhausted or restricted. On this account this proven strategy is given little attention by the farmers (Porter, 1998). Nevertheless, the results have shown that there are differences between the groups of pig producers and that they have different preferences for strategies and indicators to achieve operational success in farming. The Balanced Scorecard could provide new impulses to performance measurement in pig production. The results of this study can be a starting point for further research and application of the Balanced Scorecard to pig farming.

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## Are there any differences in efficiency between Czech agricultural holdings managed by male or female farmers?

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**Annotation:** There are differences in the management style of both genders which might lead to different performance of the companies. Therefore, the aim of the paper is to examine the efficiency of holdings controlled by females in comparison with males with focus on agricultural firms. On one hand, the farms managed by females can be less efficient as women may be using traditional technologies either due to lack of knowledge, lack of access to modern inputs associated with new technologies or higher costs to adopt the new technologies. Also discrimination against women in the allocation of credit might weaken their bargaining position. On the other hand, this is truer for developing countries than for developed ones. The most estimates of male-female differences in technical efficiency from production function studies show that male and female farmers are equally efficient farm managers, controlling for levels of inputs and human capital.

In this article we apply Stochastic Frontier Analysis on the Czech farms' accounting data from Albertina database and business register. An unbalanced panel contains information about 117 agricultural holdings for years 2007 to 2012. Altogether there are 526 observations. Traditional inputs (material, services and capital – adjusted for price changes, labour, and land – adjusted for soil quality) are used as explanatory variables in production function in Cobb-Douglas form. A “true” fixed effect model with truncated normal distribution of inefficiency term is estimated. The results are statistically tested and discussed in the context of previous researches. On average, the agricultural holdings are efficient from 57.29 %, which shows that there is a space for improvement. The sample is then divided on males and females and the differences in technical efficiency of their farms are tested. We may conclude that there are no statistically significant differences between efficiency of agricultural holdings managed by males and females.

**Key words:** farms, gender, technical efficiency, Stochastic Frontier Analysis

**JEL classification:** J16, C10

### 1 Introduction

Czech society has experienced a boom in the number of university-educated females in the last 10 to 15 years (Šimpach, 2015). Consequently the business reflects those changes and the positions in the management (or even top management) are now more often taken by females. “The democratization of Central and Eastern Europe brought with it a new economic force – the female entrepreneur – and has enable her to start, own, and manage a significant number of small business” (Lituchy and Reavley, 2004).

The Velvet revolution in Czechoslovakia brought the changes to many sectors and especially to agriculture where the possibility of having private business emerged (Machonin, 1994). “After 1989 and the onset of privatisation, small farms began re-emerging in large numbers

(though many big farms still exist) and the average area of a farm's land decreased again" (Grešlová Kušková, 2013). Also the technical efficiency of farms developed.

The efficiency of agricultural holdings has been examined since Farrel came with the concept in 1950s. First approaches towards the technical efficiency calculations were non-parametric. The parametric approach – stochastic frontier analysis – originated with work of Messen and van den Broeck (1977) and Aigner et al. (1977). They were the first who divided the error term into two parts – noise  $v_i$  and inefficiency  $u_i$ . This later enabled to derive the firm specific inefficiency  $u_i$  from the composed error term  $\varepsilon_i = v_i - u_i$ . Based on this finding it is possible to assess the technical efficiency of particular farms and compare it. The technical efficiency can differ among farms according to their size (see Čechura, 2014), allocation in the less favoured areas, type of land management (see e.g. Malá, 2011 or Kroupová, 2010), age of the farmer etc. Also the gender differences are examined, although mostly in developing countries. "Female farmers, for example, may be using traditional technologies either due to lack of knowledge, lack of access to modern inputs associated with new technologies, or higher costs to adopting the new technologies" (Quisumbing, 1996). Similarly the discrimination against women in the allocation of credit might weaken the bargaining position of women (and thus lower their welfare), but any credit that reaches any member of a household will be allocated efficiently across the productive activities of all of the members of the household (Udry et al., 1995). "The asymmetric distribution of rights, resources, and responsibilities by gender may have more serious implications for allocative efficiency than sex differences do for technical efficiency" (Quisumbing, 1996).

Therefore, the aim of the paper is to assess whether the technical efficiency of the farms depends on the gender of the main manager. First, the used methods and data are described, then the technical efficiency of the farms is estimated and they are divided according to the gender of the main managers. Second, it is statistically tested whether there are differences in technical efficiency and the results are discussed. Last section concludes.

## 2 Methodology and Data

A parametric Stochastic Frontier Analysis is applied on the Czech farms' accounting data. Those were gathered from Albertina database of the Bisnode Ltd. company and from business register. An unbalanced panel contained information about 117 agricultural holdings for years 2007 to 2012. Altogether there are 526 observations, ranging from 2 to 6 for each farm with 4.5 on average. To each company, the gender of the main manager was assigned. As there were only legal companies in a sample, we consider the farm to be managed by female, when she was a chairmen of the board in joint-stock company or executive director in limited liability company. There were 18 farms (82 observations) for female managed farms.

The technical efficiency of farms is derived from the production function in Cobb-Douglas form which was formulated as follows (1).

$$y_{it} = \beta_0 x_{1,it}^{\beta_1} x_{2,it}^{\beta_2} \dots x_{m,it}^{\beta_m}, \quad (1)$$

where  $\beta_0$  represents the constant,  $\beta_j$  ( $j = 1, 2, \dots, m$ ) are parameters of the variables  $x_j$  ( $j$  marks the number of included explanatory variables). The function (1) can be linearized by natural logarithms as (2):

$$\ln(y_{it}) = \ln(\beta_0) + \beta_1 \ln(x_{1,it}) + \beta_2 \ln(x_{2,it}) + \dots + \beta_m \ln(x_{m,it}), \quad (2)$$

The volume of production ( $y_{it}$ , where  $i$  marks the particular farm in time  $t$ ) was explained by the amount of consumed production factors:  $x_{1,it}$  – material and services,  $x_{2,it}$  – capital (long term assets),  $x_{3,it}$  – number of employees calculated as the personal costs divided by the average salary in agriculture in particular region and year and  $x_{4,it}$  – land calculated as the division of SAPS subsidies by the SAPS rate.

A “true” fixed effect model for panel data as elaborated by Greene (2002) was estimated. The composed error term is divided on inefficiency term ( $u_i$ ) and stochastic term ( $v_i$ ). We supposed truncated normal distribution of inefficiency term  $u_i \sim N^+(\mu, \sigma^2)$ . Nor the heterogeneity, nor the heteroscedasticity among farms were explained. The function of the mean of inefficiency ( $\mu_u$ ) contained only constant as same as the function of the variance of inefficiency ( $\sigma^2_u$ ). The stochastic term had normal distribution  $v_i \sim N(\mu, \sigma^2)$  and its variance ( $\sigma^2_v$ ) was explained again only by a constant.

The efficiency was estimated as suggested by Jondrow et al., (1982). They estimated (technical or cost) efficiency as (3)

$$\exp[-E(u|e)]. \quad (3)$$

Null value of  $u_{it}$  implies that the farm is efficient from 100%. If the  $|u_{it}| > 0$ , the farm is producing under its possibilities. There is a production gap which provides the space for improvement.

Consequently it was found by Shapiro Wilk test that the technical efficiency of the farms is not normally distributed. Therefore, non-parametric version of t-test for the differences between two means was used. Particularly the null hypothesis ( $H_0$ : Farms managed by males and females are equally efficient) was tested by Wilcoxon rank-sum test. If the hypothesis is rejected, we are able to conclude that the technical efficiency of farms depends on whether the main farmer is female or male.

### 3 Results and Discussion

First, the technical efficiency was assessed. According to Wald  $\chi^2[4] = 9.13e^7$  with p-value 0.00 the model as a whole was statistically significant. Log likelihood was -504.17. All frontier coefficients were statistically significant from 0 at level of significance  $\alpha = 0.01$ . They had expected signs according to the economic theory – the production is increasing with higher amount of production factors employed. When the consumed material and services or capital increases by 1% the production increases by 0.08%. The highest elasticity is the case of labour, when its 1% increase causes 0.20% increase of production. Increase of land by 1% indicates an increase in production by 0.10%. The heterogeneity and heteroscedasticity were explained only by constants which were in both cases statistically significant. Coefficient lambda is also statistically significant. It provides an indication of the relative contribution of inefficiency and random error term to the whole error component ( $v_i - u_i$ ). The divergence from the frontier is in our case to a great extent explained by heterogeneous inefficiency. The sum of frontier coefficients is lower than 1 which means that farms achieve decreasing returns to scale.

Table 1. TFE model estimation results

Frontier		Mean of inefficiency ( $\mu_u$ )	
Variable	Coefficient	$\delta_0$ [const.]	-51.4676**
$\beta_1$ [ $\ln(x_1)$ ]	0.0774***	<b>Variance of inefficiency (<math>\sigma^2_u</math>)</b>	
$\beta_2$ [ $\ln(x_2)$ ]	0.0780***	$\omega_0$ [const.]	3.9338***
$\beta_3$ [ $\ln(x_3)$ ]	0.1985***	<b>Variance of stochastic term (<math>\sigma^2_v</math>)</b>	
$\beta_4$ [ $\ln(x_4)$ ]	0.0972***	$\gamma_0$ [const.]	-29.3994
$e^{(\sigma^2_u/2)}$	7.14860***		
$e^{(\sigma^2_v/2)}$	4.13e <sup>-7</sup>		
$\lambda$	1.73e <sup>7</sup> ***		

Note: asterisks mark the significance level: \* statistically significant at  $\alpha = 0.10$ , \*\*  $\alpha = 0.05$ , \*\*\*  $\alpha = 0.01$

Source: own elaboration (2015)

On average, the agricultural holdings were efficient from 57.29%, which implies that there is a space for improvement. Half of farms were less or more efficient than 58.08% which shows that there were quite a lot of them highly efficient (75% of them even from more than 95.48%). The majority of farms was managed by male leaders. There were only 82 observations (16% of all) for women (18 farms – 15% from all). The characteristics of farms managed by males and females are described in Table 2.

Table 2. Characteristics of farms managed by males and females

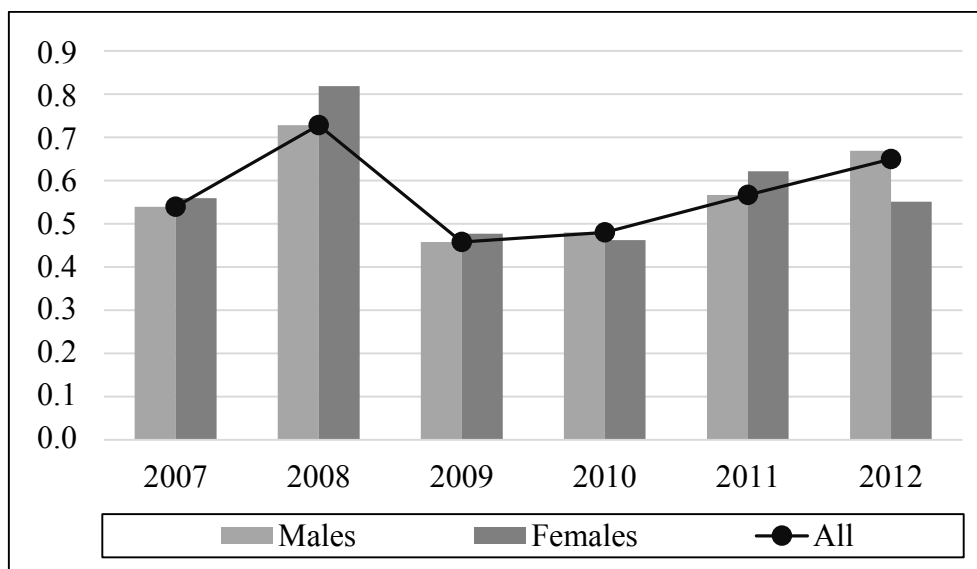
All	526		Male	444	Female	82
Variable	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Production	994 191	2 701 502	864 015	2 563 502	1 699 050	3 281 169
Mater., serv.	1 836 332	3 346 575	1 773 725	3 259 334	2 175 327	3 788 389
Capital	10 000 000	12 300 000	9 479 948	9 800 102	12 900 000	21 100 000
Employees	83	93	79	70	104	171
Soil quality	2 618	5 506	2 505	4 541	3 231	9 125
Efficiency	0.5729	0.3428	0.5702	0.3469	0.5873	0.3209

Source: own elaboration (2015)

It can be seen that average farm managed by female uses 1.3 times more resources (material, services, capital, employees and soil) than agricultural holdings managed by male. As a result, they produce twice as more as farms managed by males. Contrary to that, the average efficiency is almost equal. Females' farms were efficient from 58.73%, but males' from 57.02%. The distribution of efficiency was tested whether it is normal. However, it was found that it does not follow the normal distribution. Therefore, a non-parametric Wilcoxon rank-sum test was used to test the differences between technical efficiency of males and females managed farms. The results ( $z = -0.463$  with  $p$ -value = 0.643) did not enable to reject null hypothesis which implies that there are no statistically significant differences in technical efficiency of farms managed by males and females in the period of 2007 to 2012.

We also looked on the development of technical efficiency over years. As it can be observed from Figure 1 it was almost equal in years 2007, 2009 and 2010, but differs in year 2008 and 2012. Interestingly in the crisis year 2008, the farms where the females were leading are more efficient.

Fig. 1. Average technical efficiency of farms managed by males and females.



Source: own elaboration (2015)

However, when we tested the statistical significance of the results, we found that there were none. As presented in Table 3, the p-values for test criteria of Wilcoxon rank-sum tests are always higher than level of significance  $\alpha = 0.05$ . The null hypotheses of equality of the technical efficiency were not rejected in any year. This shows the consistency of the results throughout the examined period.

**Table 3.** Wilcoxon rank-sum test for the differences in technical efficiency between farms managed by males and females

Year	2007	2008	2009	2010	2011	2012
Technical efficiency - males	0.539	0.728	0.457	0.480	0.566	0.669
Technical efficiency - females	0.559	0.819	0.477	0.462	0.621	0.551
Test criterion	-0.181	-0.278	-0.515	0.173	-0.433	0.844
P-value	0.857	0.201	0.606	0.863	0.665	0.399

Source: own elaboration (2015)

Our conclusions are consistent with other researches of foreign authors. According to the results of Alene et al. (2008) women are as technically and allocative efficient as men in Western Kenya. Similarly Quisumbing (1996) states that “most estimates of male-female differences in technical efficiency from production function studies show that male and female farmers are equally efficient farm managers, controlling for levels of inputs and human capital.” The situation in Northern Ghana is similar in terms that the “enterprises with male spousal influence were less efficient than their counterparts that were independently managed by the women” (Akpalu et al., 2012).

However, other characteristics should be examined further. The situation in Northern Ghana is different according to whether the woman operates only one or more businesses. According to the findings of Akpalu et al. (2012) “enterprises owned by women who managed more than one business operated at relatively lower efficiency levels”. Whereas Kazianga and Wahhaj (2013) using a survey of agricultural households in Burkina Faso show how important is the position of the head of family in the results of land management of a family farm. They concluded that “plots owned by the head of the household are farmed more intensively



and achieve higher yields than plots with similar characteristics owned by other household members. Male and female family members who do not head the household achieve similar yields” (Kazianga and Wahhaj, 2013). Therefore, the challenge for the future research is to examine the further other factors which may influence the differences between farms managed by males and females than the technical efficiency.

#### 4 Conclusion

The aim of the paper was to assess the technical efficiency of agricultural holdings in the Czech Republic in years 2007 to 2012 and to find out whether it differs between farms managed by males and females. A Stochastic Frontier Analysis was employed. A “True Fixed Effects model” with Cobb-Douglas production function was estimated using maximum likelihood method.

In accordance with the results of many studies of foreign authors, also our research found out that there are no statistically significant differences in technical efficiency between Czech agricultural holding managed by males and females in the period of 2007 to 2012. They have probably equal changes on the market as males and their holdings are equally efficient. Also the examination of each year separately, despite that there was a production gap between males’ and females’ farms in efficiency in the height of 0.91 percentage point in year 2008, showed that the differences were not statistically significantly different. The challenge for future research on the topic is to identify other determinants of differences between farms managed by males and females than the technical efficiency which proved to be similar.

#### Acknowledgements

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# Long-term changes in production and structure of Czech agriculture and the devices for modelling of future development of these

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**Annotation:** The paper deals with an analysis of the most important natural indicators that can offer a more detailed information on the long-term development and current position of Czech agriculture.

The paper analyzes the long-term development tendencies and it is assessing the current situation of agriculture in CR. Analyzed are the land resources structure, the crop areas of farm plants, and crop yields of these, the livestock numbers and livestock production. It is based on the historical development of Czech agriculture's efficiency and it mentions changes in farm products consumption, too. The solution connects to accessible data sources (Czech Statistical Office, Czech Office for Surveying, Mapping and Cadastre, CR Ministry of Agriculture). Therefore, the time series are not explicitly limited. Data are analyzed and modeled by means of the time series analysis methods.

The farm crop areas have been diminishing permanently. The crop species diversity has been changing. The crop yields have been increasing following the more intensive application of spraying, crop improvement and modernization of the machinery and technology. Also the allocation of crops into more suitable soil and climate conditions for the given type of culture has contributed to higher yields. From the long-term viewpoint, significant changes are appearing in the structure and use of the plants grown. Growing of cereals (rye and barley, mostly) is giving way to the technical plants areas. The long-term decrease of livestock numbers in the CR is reflected negatively in the production of fattened cattle heads. In spite of the cattle slaughter performance increasing we are not self-sufficient in livestock production. Based on long-term time series, stability in the domestic livestock production can be really expected. As it concerns the future prospect, the considerable improvement of investments into agriculture using multi-resource financing offers positive expectations.

**Key words:** Agriculture, soil, crop areas, crop yields, cattle, livestock production

**JEL classification:** Q 10

## 1 Introduction

Agriculture and the branches connected stand in the most significant positions as it concerns securing of food and public properties (care for the countryside and environment protection). Alvarez-Cuadrado and Poschke (2011) present agriculture as a multi-functional industry having great importance for society as a whole with overlaps into other industries. There are many views assessing the development of Czech agriculture. From the production viewpoint, the fundamental restructuring of Czech agriculture, accompanied by a significant decline of production and employment and deepening deficit of the agrarian foreign trade was taking place during the Nineties of the last century already, before accession of Czech Republic into EU (Doucha and Foltýn, 2008). According to Bašek et al. (2010) the changes were connected with agriculture's adapting to the new economic reality. As given by Bečvářová, Vinohradský and Zdráhal (2010), materialization of the reform of national economy at the beginning of the Nineties brought significant changes in the conditions of future development of Czech economics and of the agrarian sector within it as well. The changes were connected with the overall approaches to the State's economic policies formation and delimitation

of positions of separate industries within Czech economics on the one side, and with defining of forms and effects of State intervention in economics on the other.

Macroeconomic approaches to formation of the industry structure of national economy within the economic reform materialization and starting of the liberalisation processes during this period brought about a significant decline of the support of agricultural undertaking (Rosochatecká, Tomšík and Žídková, 2008). Removal of the barriers of foreign trade with farm and food commodities, when the chances were opening for partial solution of the farm commodities overproduction problems in the European Union Countries as well as in the main overseas countries, affected Czech agriculture negatively. Limitations of production volume appeared, decline of intensity of the natural resources exploitation and changes of the farm production structure. An outstanding impulse for Czech agriculture was formed during the period of preparations for CR accession to the European Union. Our membership brought about the direct competition of the unified market on the one side and on the other side the subsidies within the Common Agricultural Policy with unequal conditions for the Old and New EU Member Countries (Bašek et al., 2010). Agriculture's share on the total GDP shows a declining trend, similar as the development of employment in the agricultural sector. As it is presented by Bečvářová et al. (2010), the decline itself, of the indicators given, is not the problem, rather the efficiency of production factors exploitation is, and the permanent decline of size of the industry. Farming lands area in the CR is currently being reduced by 12 hectares daily. Higher reductions are appearing on higher quality lands (Gebeltová, Řezbová and Pletichová, 2014). Arable lands in the CR are losing their production value as seen from the food security viewpoint, through transfers of the arable land into perennial cultures, permanent grasslands, planting of fast-growing trees, afforestation et al. Prices of farming lands in Bohemia are significantly lower compared with other EU States but their fertility and ways of tillage do not differ from the countries around. Not only size of Czech agriculture is changing but its structure, too (Bašek and Divila, 2008). The concept of structure is being used in the economic theory to present the inner arrangement of an economic quantity. The attention is then paid not to the volume of the quantity rather to its inner setup being subject to changes in time (Hron et al., 2007).

## **2 Materials and Methods**

### **2.1 Data source**

The statistical analysis here is based mostly on the resources of the Czech Statistical Office and the Ministry of Agriculture of Czech Republic. The data used are obtained based on the new ESA 2010 method. Other data sources of the analysis are the National Accounts and statistics of agriculture.

The long-term time series are not limited explicitly. In the analysis of development of the Czech agriculture natural indicators selected methods of time series analysis have been used.

### **2.2 Analytical smoothing of time series**

The shortages of graphical and mechanical time series smoothing are removed using the analytical methods based on expressing the course of time series by mathematical function

$$y'_t = f(t) + e_t, \quad (1)$$

where  $y'_t$  – theoretical (smoothed) value of the time series indicator under study;  $t$  – the time variable, ie., the order numbers of time series sequence ( $t = 1, 2, \dots, n$ );  $f(t)$  – the function of the time variable  $t$ ;  $e_t$  – residual component.

The function parameters are obtainable using the least squares method. The basis for decision making on the appropriate trend function type should be real economic criteria. Looking for the appropriate trend function type is then based first thing on the analysis of empirical data. The criterion to be used here is the index of determination:

$$I^2 = 1 - \frac{\sum_{t=1}^n (y_t - y'_t)^2}{\sum_{t=1}^n (y_t - \bar{y})^2}. \quad (2)$$

The paper presented employs some other criteria based on the comparison of sums of squares of deviations of the empirical and theoretical values, e.g.:

$$\text{Mean Absolute Percent Error (M. A. P. E.):} \quad \text{M.A.P.E.} = \frac{100}{n} \sum_{t=1}^n \frac{|y_t - y'_t|}{y_t} \quad (3)$$

The model with the lowest M.A.P.E. measures values is generally preferred. It is important to realize, anyway, that none of these criteria is of a universal nature, rather they offer a partial information on the quality of the model studied (Hindls, 2000).

Besides the trend functions the adaptive models, too, have been applied in the trend description. Models of this type react quickly on structural changes occurring in time and are very proper for prognosticating the future course of the time series loaded by irregularities and breaks in the trend. For significance testing of the models and their parameters the significance level  $\alpha=0.05$  has been chosen. Statistical computations have been performed in the STATISTICA statistical software, version 12, environment.

### 3 Results and Discussion

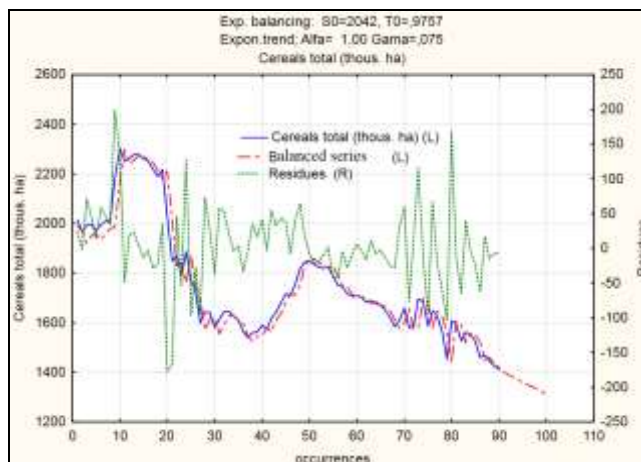
#### 3.1. Crop areas and crop yields

Structure of the crops grown has been registering significant changes as seen from long-term viewpoint. Species diversity is declining, species representation is changing as well as the shares on crop areas. Growing of cereals (rye and barley, mostly) is giving way to the technical plants areas.

As it is obvious from the Czech Statistical Office data, the crop areas of farm plants are diminishing seen from the long-term view (Fig. 1). In 1920, 48.4 % of the today's CR area were sown, in 2014 31.3 % only. The adaptive model applied in smoothing of the time series is forecasting a continued decline of the areas over the next 10 years (until 2024) down to 1,312 thousand hectares from the current 1,418 thousand hectares. The farm crops, perennial cultures excluded, were grown on 2,468.7 thousand hectares in 2014, which is by 8.2 thousand hectares less against the year before. In comparison with 1993 the crop areas diminished in 2014 in all the principal farm crops, excluded was rape only. The areas sown with cereals were by 12.2 % smaller, the areas of potatoes diminished by 77.1 %, quite.

On the other hand, the areas sown by rape grew by 132.5 %. Almost every sixth hectare of the areas sown in 2014 fell on rape.

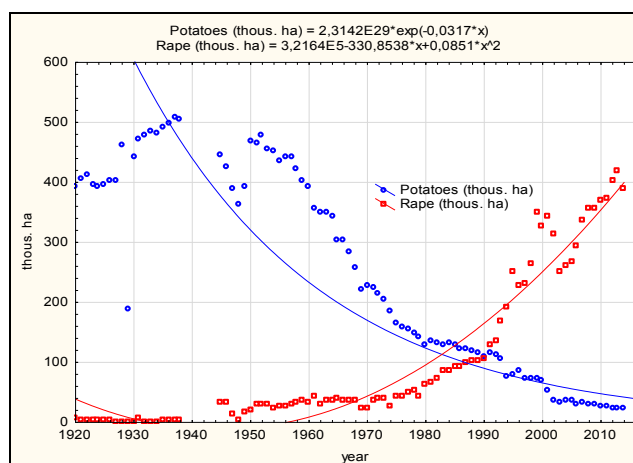
**Fig. 1.** Model of the development (1920-2014) and forecast (2015-2024) of cereals areas in CR



Source: Czech Statistical Office, 2014

The area of potatoes was diminishing over the entire second half of the last century and the trend did not stop with the arrival of the new millennium, either (Fig. 2). In the Fifties, the potato growers were growing potatoes on areas larger than 400 thousand hectares. Over the next decade, the Sixties, the area went down to almost one half. In 1993 potatoes were grown for the last time on an area the size of which exceeded 100 thousand hectares. Anyway, the interest in potato growing was falling on, and the year 2001 was the last one when potatoes were grown on an area larger than 50 thousand hectares.

**Fig. 2.** Development of crop areas of potatoes and rape (in hectare thous.) over 1920-2014



Source: Czech Statistical Office, 2014 (notice: up to 1993 Brassica Rapa included)

Over the years 2012-2014 the potato areas did not exceed 25 thousand hectares. Due to the falling extent of crop areas, the potato growers are covering the local demand at a permanently lower level. If over 1999-2003 the average annual deficit of potato foreign trade made it 181.0 CZK million, then over 2004-2008 it was 317.8 CZK million and over 2009-2013 463.7 CZK million already.

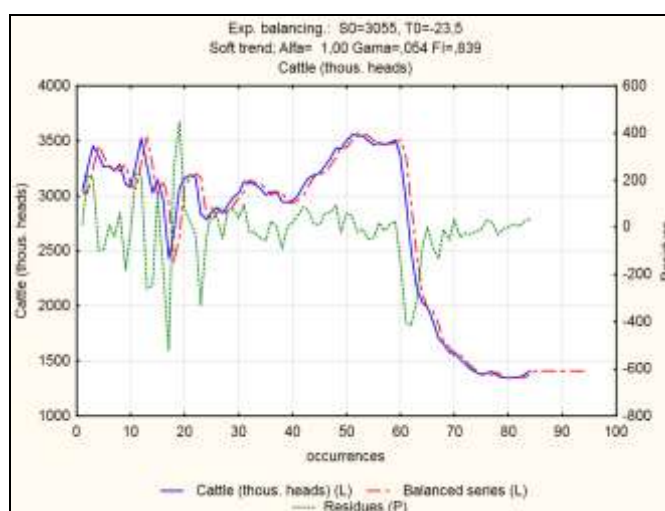
The crop yields from the farm crops harvests kept growing thanks to the more intensive application of sprinkling, crop breeding, and the technology and machinery modernized. The average yield of cereals over 2004-2013 was higher by 158.6 % as compared

with the period 1948-1957. The technical sugar beet yields grew by 124.4 % at an average, the potato yields grew by 92.7 %, the rape yields grew almost three times (by 194.8 %).

### 3.2. Livestock numbers and their performance

The long-term and first of all, significant diversion from cattle breeding in the Czech Republic over 1991-2015 brought about the total decline of the numbers by more than 2 million head (Fig. 3). If in 1990 there were 3.51 million head of cattle bred in the country, in 2015 the number reached 1.4 million head only which was less by three fifths. However, the last two years brought about some growth of the numbers. The total cattle numbers grew by 54.3 thousand head during the 2014 and 2015 years, this 2015 year made it at the highest since 1990. The numbers of cows only, in order to maintain and renew the basic herd, are gradually increasing since 2013. All in all, over the last three years (2013-2015) 28.8 thousand cows raised the total.

Fig. 3. Model of development and forecast of cattle numbers in CR (th. head) over 1921-2015



Source: Czech Statistical Office, 2014

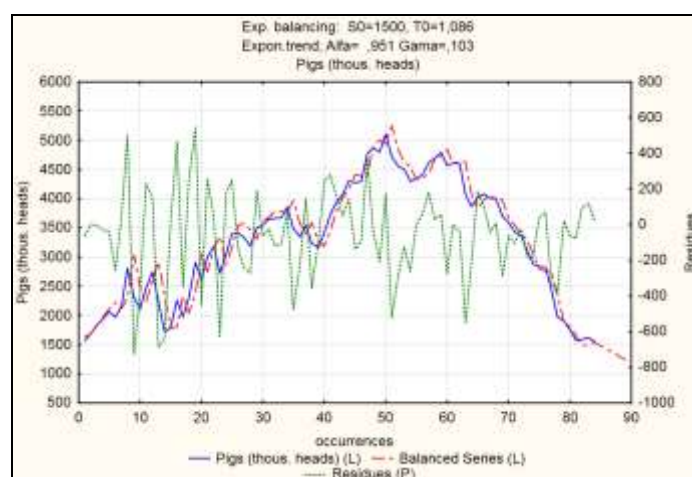
The decline of milk production in the Nineties was tightly connected with the declining numbers of cows. If in 1989 still 4.89 milliards litres of milk were produced in the CR, in 1997 the domestic production reached 2.70 milliards litres only. The years following bring a stagnation of production but the period of 2011-2014 years is showing a slight revival thanks to the farmer prices increasing. In 2014 the largest volume of milk was produced in Bohemia over the last 18 years.

Decline of the total numbers of pigs started in the first half of the Eighties - already in Socialism (Fig. 4). After 1990 the decrease fastened. Pig numbers fell from 4.79 million head in 1990 down to 1.56 million head in 2015. Two thirds of pig numbers vanished from Czech agriculture. Following the long-term decrease of cattle and pig numbers the production of kind also diminished. While in 1989, 525 thousand tons of live weight cattle and 763 thousand tons of live weight pigs were produced, in 2014 the total weight of cattle and pigs slaughtered reached 170 thousand tons (cattle) and 305 thousand tons (pigs), only. The production volume in cattle fell down by more than two thirds, in case of pigs made it three fifths.

The long-term development of poultry numbers does not show any optimistic outlook either. While in the Eighties the numbers exceeded 30 million head in each year, over the 2010-2015 period there were always less than 25 million recorded. Poultry production was rising until

2008. While in 2008, 329 thousand tons of live weight poultry were produced, in 2014, 247 thousand tons only went to further processing. During 6 years only, the poultry production fell through by a quarter. The total poultry numbers decreased between the 1984 record year and 2015 by 34.2 %. The hen numbers only decreased during this period by more than three fifths. The year 2015 has brought a slight revival. The egg production was decreasing since 1985 following the decline of hen numbers. In 1984 the egg collection reached the historical maximum of 3.70 milliards pieces but it fell down to 2.24 milliards till 2014.

**Fig. 4.** Model of development and forecast of pig numbers in CR (thous. head) over 1921-2015



Source: Czech Statistical Office, 2014

## 4 Conclusion

Fundamental restructuring of the agricultural sector in CR took place during the Nineties of the last century, which means, before the accession to EU. Since the accession a further deepening of the structural dysbalance of Czech agriculture follows, together with gradual integration of Czech Republic into the Common Agricultural Policy. The growing EU support on the one side brings a positive effect on the economic situation of Czech farmers, while on the other side this brings negative changes in production structure and in the relationship of agriculture towards natural resources. The behaviour of farming subjects often orientates on gaining the subsidies more than on market conditions, regardless of the current production structure.

More than a half of the Czech Republic territory is currently serving to agricultural purposes. The territory really employed for farm crops growing, perennial cultures excluded, is diminishing significantly here. It follows the decline of the total of crop areas. This is not a trend of the recent years, it has been developing for decades.

The overweight of crop production and expansion of the extensive farming ways can be considered a significant structural change. Recent years brought about a decline of the arable lands areas for the benefit of perennial grass areas, both at Czech and European levels.

In the Czech Republic the species diversity of crops grown diminished, growing of cereals (mostly rye and barley) is giving way to technical crops growing, the areas of which, on the contrary, are increasing. Crop production orientates more on profitable crops, first of all on rape growing. Almost every sixth hectare sown in 2014 was taken by rape.



Crop yields are increasing in the long-term view. The increase is caused by introduction of new varieties and new growing technologies on the one hand, and by the more efficient harvest process facilitated by the new generation of machinery, on the other. The increase of crop yields, in general, facilitates a possible decrease of crop areas, free of a negative impact upon the total harvest volumes.

The long-term time series of livestock numbers and performance do not present any extreme fluctuations in recent years. The livestock numbers are slowly increasing, the production volume of cattle in Czech Republic was decreasing over the last 24 years. A slight increase (by 3.5 %) has only been recorded in 2014. While in 1989 cattle of total live weight almost 1.5 million tons was supplied on the market, in 2014 only 722 thousand tons, ie., not the full half of that, was supplied for further processing. In spite of the livestock performance increasing, we are not self-sufficient in livestock production.

Any further reduction of production capacities is undesirable. The structural dysbalance causing manifestations of negative effects in the countryside is a threat for long-term competitiveness. The functioning, competitive and structurally balanced agro-food sector has irreplaceable importance for the modern Czech society.

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# The calculation of the minimum area of agricultural land required to self-sufficiency of average Slovak farm family

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**Annotation:** Year 2014 was declared as the World year of the family farms. Also the new Rural Development Programme of the Slovak Republic for the years 2014-2020 focuses on issue of small farmers, young farmers, as well as family farmers. The paper is based on underlying data of the Research Institute of Agricultural and Food Economics of the Slovak Republic.

The aim of the article is to calculate the acreage of small farm, which will be self-sufficient for one average Slovak farm family. Average farm family represents four members. The model of small family farm consists from plant and also from animal production. The paper specifies farm size, which is the minimum area of agricultural land required for existing one farm respectively for one farm family. The paper is based on national Slovak statistics and EUROSTAT data. Data related to Slovak agriculture and farm development are analyzed through the set of basic statistical methods and also through the linear regression.

Calculation in the article is in the theoretical way. On this model is possible to solve issue of minimum area with respect to farm specialization. The model in this paper is based on the assumption that the farmer is engaged in the production of all basic commodities of plant production and animal production. This model is very hard realized in practice but on other side there are small farmers who usually specialize in certain special commodities. In the calculation of agricultural land area are calculated total household expenditures per year without food expenditure because the food will be produced on farm and will be consumed by the members of family.

The Slovak average family expenditures are in amount 25 872.91 Euro per year and they have to be covered by farming activities. They need to have 88.66 hectares of arable land for covering family expenditures. In this amount of area is not included area of agricultural land required for the production of basic essential commodities - crops needed for human nutrition, calculated on the basis of average consumption per person per year. Area of agricultural land needed for planting and livestock consumption for family food production is in the size of 0.845 hectares. The result size of agricultural land required for the farm family life with 4 members is 89.503 ha.

**Key words:** family farms, economical results, domestic expenditures

**JEL classification:** Q12

## 1 Introduction

Entrepreneurship on the agricultural land belongs among the oldest economic sectors of every country. Slovakia and its countryside was for many centuries a typical agrarian country. Despite the areal industrialization after 1950 agriculture remained its characteristic feature. Evidential sector organization of agricultural production was created as a result of manufacturing expansion. It was caused by industrialization process. It caused largely one-side orientation of rural regions towards the agricultural activities. In the current era of globalization, especially after the accession to the EU, the position of agriculture is changing especially in the trend of EU Common agricultural policy (CAP) reforms. (Horská, et al., 2013)

Whilst the elimination of the CAP is an extreme and unlikely scenario, the farmed area choice under this hypothesis can be regarded as a good proxy for describing how farm structure

would change in the absence of EU policy action or, to some extent, in the presence of a totally decoupled policy. Under the Baseline scenario, the majority of the farmers state their intention to not change the amount of farmed area, whilst a significant number of farms would expand their land size (about 25%). Only a small portion of the EU farms (about 5%) state an intention to reduce their current farmed area. (Bartolini and Viaggi, 2013)

The production efficiency is one of the key prerequisites for the competitiveness of enterprises in every business. The assessment of production efficiency in agriculture is limited by weather conditions and by large variability of farms not only within the member states but also among EU regions. Nevertheless, the identification of production efficiency and its main determinants can reveal the weaker regions and show ways how to improve their farming performance in new Common Agricultural Policy after 2013. (Špička, 2013)

Determinants of economic performance of small and medium enterprises (SMEs) evaluate Hudák,– Rovný - Kučera (2011). They concluded that the performance of agribusinesses disparities within the business of small and medium-sized farms (legal entities, Ltd. and self-employed farmers) is particularly marked in the amount of returns, respectively incomes of self-employed farmers per unit of area. The amount of returns should not be the general aim because high value of returns is caused by the high consumption of inputs (costs), which is reflected primarily in the productive regions of the Slovak Republic (SR) and the Czech Republic (CR). In contrast of it, in disadvantaged areas (LFA) is a value of returns reflection of higher revenue shares of Mainstream Support.

These economic disparities between regions (productive and LFA) and extreme cost intensification can disturb the ecological imbalance and can cause negative externalities. It contradicts to the demands of sustainable development of agriculture in within the meaning of the objectives of agricultural policies of individual states and the EU CAP.

Hudáková (2012) emphasizes that the economic differentiation of entrepreneurial enterprises is reflected in all size groups of enterprises, because economic performance and amenities of business forms is differentiated. Profit or loss of SMEs can be completed in the short term by Cash Flow indicators. SMEs can reach higher productivity of human labor per worker; they are more flexible but less liquid and more indebted.

Key differences in the primary agricultural production in Slovakia compared to the situation in the EU are significant. One is the difference in the size of farms, where average size in Slovakia and in the Czech Republic is also after 10 years significantly higher than in other EU members. It is therefore important for Slovakia assessment farms or plants and in terms of the size of cultivated land.(Serenčėš, Tóth, Rábek, Čierna and Piterková 2014)

Farming in different production areas of the Czech Republic in the case of "economically normal" conditions is profitable, when proper production focus and agricultural supports are used. This corresponds to the years 2011-2014. (Foltýn, Zedníčková and Humpál, 2013)

Impact of political, economic, technological, technical and legal and social environment influences the success or failure of enterprises. A significant impact on the economic differentiation of small and medium-sized enterprises has foreign direct investments and means from supporting the financial resources of the European Union and national resources. Qualification level and its quality, managerial decision making process and decision effectiveness have significant share on the economic differentiation of enterprises. (Chrastinová, Stanková and Belešová, 2013)

The present problem in agriculture is problem of ageing farmers and their efficiency. Comparison of the economic performance of farms managed by young farmers and those managed by older farmers did not show large differences. Contrary to the European statistics, which suggest that young farmers' holdings are more efficient, the young farmers' holdings in the Czech Republic (CR) perform below average. On the other hand, these farms indicate a higher work productivity. (Zagata, Hádková and Mikovcová, 2015)

The aim of the article is to calculate the acreage of small farm, which will be self-sufficient for one average Slovak farm family. The self-sufficiency means the amount of money, which covers all domestic expenditures per one year (of one family). Average farm family represents four members. The model of small family farm consists from plant and also from animal production. This issue is in article compared with results of experts from research institutes, universities and especially with experts from agricultural practice.

## 2 Material and Methods

The material from which the article is processed consists of primary and secondary sources. The primary sources are the data from Agrarian Paying Agency from Information list of farmers for the years 2005-2012.

The secondary sources are databases of the Slovak Statistical Office and Eurostat.

The article includes calculations which are based on the idea that a four-member household can have their expenses covered by their agricultural profit. We provided that the family farm will produce also food for their own consumption. For this calculation we chose the most produced commodities in the Slovak conditions: wheat, barley, corn and oil rape.

In this paper we calculate with these following indicators:

- the average consumption of commodities consumed by people (in  $\text{kg}\cdot\text{person}^{-1}\cdot\text{year}^{-1}$ ),
- average yields of chosen commodities (in  $\text{tonnes}\cdot\text{ha}^{-1}$ ),
- the size of agricultural land per one inhabitant (in  $\text{ha}\cdot\text{person}^{-1}$ )
- own costs of different commodities (in  $\text{Euro}\cdot\text{ha}^{-1}$ ),
- the utility of individual livestock species (in kg or in litters),
- The average daily weight gains of individual livestock species (in kg),
- Own costs of 100 feeding days (resp. own costs on 1 l of milk, resp. on 1000 feeding days in  $\text{Euro}\cdot 100\text{ feeding days}^{-1}$ ),
- Feeding rations of individual livestock species,
- Average yields per hectare of commodities needed as feed for livestock.

Own costs in plant and animal production cover these following indicators: seeds, fertilizers, feed, pharmaceuticals, chemical protective equipment, other direct materials, personnel costs, depreciation of fixed assets, repairs and maintenance, veterinary services and animal breeders, agro-chemical services, costs of ancillary activities, general and administrative expenses. In the article we are not calculating with labor costs separately but all personnel costs are includes in commodity own costs, which are calculated by the Research Institute of Agricultural and Food Economics in Bratislava, in the Slovak Republic (RIAFE).

These indicators we transform on calculation for one family farm.

### 3 Results and Discussion

Table 1 shows the calculation of agricultural land necessary for the production of primary commodities of crop production which are necessary to meet basic human needs. In this case we used the average consumption of those commodities on the basis of the Research Institute of Agricultural and Food Economics. Furthermore in calculation of plant commodities we used the average yields per hectare of individual crops for the years 2008-2012 and there were also used data of actual costs for individual commodities.

**Table 1.** The calculation of acreage and own costs per 1 unit of plant commodities based on average consumption per 1 inhabitant in Slovakia

Plant commodities	Consumption in kg. 1 inhabitant <sup>-1</sup>	Average yield 2008-2012 in t.ha <sup>-1</sup>	Area of agricultural land in m <sup>2</sup> .1 person <sup>-1</sup>	Own costs in v Euro. 1 person <sup>-1</sup>
wheat	108.00	4.52	238.94	15.39
barley	23.99	3.88	61.77	4.21
rye	6.75	2.88	23.47	1.51
corn	54.50	7.29	74.74	8.58
rapeseed	51.16	2.53	202.05	25.19
sunflower	2.77	2.43	11.41	0.98
peas	0.82	1.99	4.12	0.45
potato	45.00	15.76	28.55	10.06
sugar beet	226.00	61.13	36.97	7.70
fruit	53.00	9.60	55.21	31.54
vegetables	101.50	12.14	83.61	5.03
grapes	16.20	3.94	41.14	7.61
<b>TOTAL</b>			<b>861.97</b>	<b>118.24</b>

Source: EUROSTAT, 2014, Slovak Statistics, 2014, own calculation

Table 1 shows that plant commodities necessary to cover basic nutritional needs required area of agricultural land in amount of 0,0862 ha and for its growing is necessary 118,24 Euro to cover expenses related to their cultivation. In these costs are offset the cost of seeds, fertilizers, protective equipment, depreciation of machinery and other direct costs based on the methodology of calculating from RIAFE related to own costs of individual commodities of crop production.

Table 2 shows the calculation of acreage and production costs per animal commodities on the basis of average consumption per capita in the SR. Calculation was based on the following indicators:

- Average consumption of analyzed commodity per 1 inhabitant per year,
- Utility of individual livestock species,
- The average daily weight gains of individual livestock species,
- Own costs of 100 feeding days (resp. own costs on 1 l of milk, resp. on 1000 feeding days),
- Feeding rations of individual livestock species,
- Average yields per hectare of commodities needed as feed for livestock.

**Table 2.** The calculation of acreage and own costs per unit of animal commodities based on average consumption per 1 inhabitant in Slovakia.

Animal commodities	Consumption in kg. inhabitant <sup>-1</sup>	Area of agricultural land in m <sup>2</sup> .person <sup>-1</sup>	Own costs in v Euro. person <sup>-1</sup>
milk	160.0	391.86	64.00
beef	4.3	180.25	22.18
pork	33.8	427.25	64.22
poultry meat	19.9	185.45	26.00
eggs	207.0	66.77	15.11
<b>TOTAL</b>		<b>1,251.58</b>	<b>191.51</b>

Source: own calculation

Table 2 shows that animal commodities (meat, milk and eggs) necessary to cover basic nutritional needs require area of agricultural land is in amount 0.125 hectares and to cover expenses is necessary 191.51 Euro. In these costs are offset the cost of feed and bedding, medicine and disinfectant materials, depreciation of machinery and other direct costs based on the methodology of calculating from RIAFE related to own costs of individual commodities of animal production.

**Table 3.** Calculation of acreage and own costs per unit of plant and animal commodities based on the average consumption per 1 household in SR

	Area of agricultural land in m <sup>2</sup> .person <sup>-1</sup>	Own costs in v Euro. person <sup>-1</sup>
Plant commodities	861.97	118.24
Animal commodities	1,251.58	191.51
TOTAL (1 unit)	2,113.55	309.75
<b>TOTAL (household = 4 persons)</b>	<b>8,454.20</b>	<b>1,239.02</b>

Source: own calculation

Table 3 demonstrates the calculation of acreage and own costs per unit of plant and animal commodities based on the average consumption per 1 inhabitant in Slovakia. It shows also total acreage for one household and own costs calculated per 1 household. Our calculations show that one average household in Slovakia with 4 members needs to cover their nutritional needs 0.845 hectares of agricultural land. Costs for growing crops respectively for livestock are associated with it in amount of 1,239.02 Euro.

To calculate the area of agricultural land to cover its costs for the production of basic commodities, to cover the costs of livestock breeding and to cover basic household expenses without food expenditure, there were selected as benefiting the following commodities: wheat, barley, grain maize and rapeseed.

For the calculation of the profit we used data of the Research Institute of Agricultural and Food, where we obtain the average values of the profit and subsidies per 1 ha of agricultural land for five years. The reason for the selection of five years was the fact that in individual years are significantly different prices, which significantly affect results (profit or loss).

For calculating the area of agricultural land we used the equal representation of the four most grown crops on arable land in Slovakia, which is also in terms of profit generation the most interesting.

From Table 4 is known that in the five-year reporting period the highest profit per 1 ha of agricultural land has reached rapeseed (197.62 Euro.ha<sup>-1</sup> of agricultural land) and grain maize (154.82 Euro.ha<sup>-1</sup> of agricultural land). Mentioned commodities also had the highest subsidy (rapeseed 253.31 Euro.ha<sup>-1</sup> of agricultural land and grain maize 158.11 Euro.ha<sup>-1</sup> of agricultural land).

**Table 4.** Development of profits after tax excluding subsidies and subsidies for the individual selected commodities (Euro.ha<sup>-1</sup>)

Wheat	Profit after tax	Subsidies	Barley	Profit after tax	Subsidies
2008	100.70	127.20	2008	186.95	117.74
2009	- 82.31	144.93	2009	- 27.93	113.41
2010	79.75	141.92	2010	- 40.62	90.29
2011	187.56	140.42	2011	172.89	133.30
2012	44.78	175.79	2012	53.22	157.25
Average	66.10	146.05	Average	68.90	122.40

Grain maize	Profit after tax	Subsidies	Rapeseed	Profit after tax	Subsidies
2008	51.07	110.77	2008	417.10	294.26
2009	56.47	194.33	2009	9.95	223.01
2010	121.72	116.39	2010	129.15	213.88
2011	265.54	161.53	2011	361.16	244.86
2012	279.31	207.54	2012	70.74	290.53
Average	154.82	158.11	Average	197.62	253.31

**Source:** The costs and returns of agricultural products in the Slovak Republic, the year 2008 – 2012

For needed calculation of the area of agricultural land there have been calculated total household expenditures per year without spending on food because food will be produced at its own costs and are subsequently consumed by households. To the expenditures were imputed also own expenses to produce its own products as the basis for life and indispensable commodities in terms of their average annual consumption in Slovakia.

**Table 5.** Calculation of the expenditure necessary for the basic functioning of households (in Euro)

	Expenditures for 1 person	Expenditures for 4 persons
Household expenditures	7,545.52	30,182.08
Expenditures on food and non-alcoholic beverages	1,386.07	5,544.29
Household expenditures without expenditure on food and non-alcoholic beverages	6,159.45	24,637.79
Cover its costs for commodities	308.78	1,235.12
Expenditures TOTAL	6,468.23	25,872.91

**Source:** www.statistics.sk, 2014 and own calculation

Household expenditures for agricultural activity which must be covered from profit is in amount of 25,872.91 Euro per year. (Table 5). For calculation of the area of agricultural land to cover household expenditures 4 basic and economically most interesting commodities were already above mentioned (wheat, barley, grain maize and rapeseed). Reason for selection these 4 commodities is the fact that in terms of crop rotation is not suitable to cultivate in the same area the same crop every year. In the Table 6 is shown the area of individual crops analyzed above together with the amount of income to cover all expenses listed in Table 5.

**Table 6.** Calculation acreage of agricultural land to cover all household expenses (Euro, ha)

	Profit after tax from 1 hectare	Subsidies per 1 hectare	Income from 1 ha of the agricultural land	Acreage in ha	TOTAL income
Wheat	66.10	146.05	212.15	22.165	4,702.15
Barley	68.90	122.40	191.30	22.165	4,240.05
Grain maize	154.82	158.11	312.93	22.165	6,936.02
Rapeseed	197.62	253.31	450.93	22.165	9,994.69
<b>TOTAL</b>	<b>487.44</b>	<b>679.87</b>	<b>1,167.31</b>	<b>88.658</b>	<b>25,872.91</b>

**Source: own calculation**

From the Table 6 is clear that household composed from 4 members needs for cover their costs acreage of 88.66 hectares of arable land. From this point if there will be more acreage households would produce a profit. It is possible therefore economically define that the calculated area is a turning point. This calculated acreage does not include area of agricultural land required for the production of basic commodities - crops necessary for human nutrition calculated on the basis of average consumption per person per year (Table 1).

Area of agricultural land required for cultivation and animal husbandry required for household food production is in amount of 0.845 ha. We added this above calculated amount to the value of acreage shown in Table 5. The final value of agricultural land required for the life of a household with 4 members is in amount of 89.503 hectares.

Calculated acreage is a turning point when the household does not create a profit but only covers all its expenses necessary for life. By increasing of this acreage will automatically increase the gain but only in respect of mentioned structure of crops. It should be noted that in terms of different crop structure will be achieved different results of profit or loss. It is because the main factor except of yield there is price for which farmers are able to realize their production.

In the Slovak conditions there are few authors who are oriented in the problems of small farms and their efficiency. It is because of 75% of farms are big. The results of this article are not comparable with results of other author, because they used different methodology. It is problem also to compare with results of other countries, because of different system of accounting. On the Research institute of animal production in Slovakia there are some results about minimum acreage for farming in animal production. E.g. There is minimum 50 pieces of dairy cows with 100 hectares of agricultural land for one profitable family farm or to have 592 pieces of sheeps with area of 100 hectares of agricultural land to be profitable. (Huba, 2015)

On the other hand there exists the basic problem in Slovakia as is discussed in previous chapters. It is the fact that there are very few farms which their products process into the final



products respectively semi-finished products. These final products or semi-finished products have a higher added value and farmers are benefiting from its own production.

In this case for evaluation of production would be needed lower area of agricultural land to ensure basic expenses. Article deals with purely agricultural primary production. There is not analyzed processing of agricultural commodities.

#### 4 Conclusion

Year 2014 was declared as the World year of the family farms. Also the new Rural Development Programme of the Slovak Republic for the years 2014-2020 focuses on issue of small farmers, young farmers, as well as family farmers. The paper is based on underlying data of the Research Institute of Agricultural and Food Economics of the Slovak Republic. It was calculated acreage of small farms which should make a living of one average Slovak family which would deal with production of crops and also with livestock breeding. It is thus possible to discuss with experts from research institutes, universities and especially with experts from agricultural practice what is the minimum required area of agricultural land necessary for make a living of one farmer respectively of his family. Calculation in this work is theoretical. There is possibility to solve this issue of minimum area with respect to specialization by using this model.

Model at work is based on the assumption that the farmer is engaged in the production of all basic commodities of plants as well as livestock production what is very difficult to implement it in practice. On the other hand it is the small farmers, who often specialize in certain commodities.

Based on research at work but also to the observation in practice it can be stated as follows: Small farms will never compete with large farms, engaged in primary production of basic and long-term profitable commodities in crop production as their place in the Slovak agriculture is specialized in plant production, as well as partially in livestock production (breeding cattle, pigs, sheep and goats, poultry except hens respectively also fur breeding small livestock). From this results we can see that there is no afraid for big farms of emergence, promoting, allocation of land and preferential crediting of young, small and family farmers.

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# Are V4 countries competitive in production of main oil-bearing crops in the perspective of production self-sufficiency and foreign trade development?

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**Annotation:** National level of self-sufficiency of EU member states is not from the perspective national agricultural policies as important as in countries outside the EU as there exists Common Agriculture Policy. Measuring national rate of self-sufficiency clearly depict level of competitiveness, as in countries with low level of self-sufficiency usually the competitiveness of production and processing lag behind. Authors also use trade coverage indicator. In the framework of European Environmental Policy, specifically due to the European Bio Fuels Policy, significance of oil-bearing crops increased. Therefore the main aim of the article is to analyse competitiveness of selected V4 countries with respect to production of most widely cultivated oil-bearing crops in the region – oil seed rape and sunflower. Authors need to derive necessary information from national competent authorities (Ministries of Agriculture, National Statistical Offices, Eurostat, etc.). Information about foreign trade have been collected from the Market Access Database of the European Commission. Based on the available data we can expect conclusions, that European Bio Fuels policy had significant effect on production amounts in all analysed countries as its harvested area increased from 3 to 9 %. All countries evince self-sufficiency in oilseed rape production. Results of trade coverage evidence high competitiveness in production of oilseed rape by large exports of raw and processed material to Western Europe. Contrary to rape, CZ is not self-sufficient in sunflower due to decrease in production area and increase in consumption over last few years. But SK is self-sufficient in production of sunflower, its competitiveness is underlined by net exports of sunflower both in value and volume terms.

**Key words:** Self-sufficiency, trade coverage, competitiveness, V4 countries, oilseed rape, sunflower.

**JEL classification:** Q17, Q18.

## 1 Introduction

National level of self-sufficiency of EU member states is not from the perspective national agricultural policies as important as in countries outside the EU as Common Agriculture Policy (CAP) and single market exists. But still the national food self-sufficiency belongs to the internal factors of national security and therefore some governments pay special attention to food self-sufficiency rates. Also EU pays special attention to monitoring self-sufficiency. (Ernst&Young, 2013; Martinez-Palou and Rohner-Thielen, 2011) European parliament calls on commission to support actions against food waste and believes that improving efficiency of food chains can lead to increased self-sufficiency in EU member states (European Parliament, 2011). According to the Eurobarometer (EC, 2014) main responsibilities of EU farmers should be mainly supply of the diversity and quality products (supported by 38% of respondents), maintenance of economic activity and employment in rural areas (36%), protecting the environment (32%) and sustaining food-self-sufficiency (29%). The responsibility to ensure self-sufficiency in food production was leading priority in Slovenia, Austria, Ireland and the Czech Republic or Poland, but not important priority in Hungary, Romania and all Baltic states.

In some countries food self-sufficiency belongs among strategic security factors and therefore governments tend to apply different policies to ensure increase in domestic food supply. (Simelton, 2011; Diagne et al. 2013; Anderson, 2012; Wegren 2013) There exist several methods that might be applied. In developing countries, introduction of food imports restrictions by quotas and tariffs increases food production, but also leads to the exclusion of ensuring food for the poorest population. (Warr, 2011) But existence of the single market does not allow member countries to introduce internal tariffs or quotas and therefore national self-sufficiency should be increased by support and growth of production efficiency (Azadi, 2011). But too strict focus on self-sufficiency may lead to inefficient allocation of productive agricultural resources if expanded domestic production does not conform to the country's comparative economic advantage (Hassan et al., 2000).

Before all Visegrad countries (Czech Republic, Hungary, Poland, Slovakia) entered the European Union in 2004, there were created estimations on effects of EU expansion. Anderson and Tyers (1995) estimated changes in aggregated V4 self-sufficiency in grains (86 -> 97%); sugar (97 -> 135%); dairy (100 -> 135%) or in total agricultural production (102 -> 138%). From the perspective of 10 years in the EU it can be concluded, that self-sufficiency rate in some commodities changed significantly (Kotyza and Slaboch, 2014; Gebeltova 2012).

In the framework of European Environmental Policy, specifically due to the European Bio Fuels Policy, significance of oil-bearing crops increased. Production of 1st generation bio-fuels is connected with production of vegetable oils and starch and therefore it has direct impact on volume and value of production. Although production of 1st generation bio-fuels appears unsustainable as it uses land suitable for food commodities (Naik et al., 2010), in many European countries bio-fuel policy made oilseed rape one of the most profitable crops (Weightman, Gladders and Berry 2011; Homolka and Bubenikova, 2013) and resulted in increase of production. Higher profits were also determined by increasing price of oil (Gorter, Drabik and Just, 2013) and therefore it will be interesting to follow how prices of oil bearing crops will be influenced by fluctuations on world oil markets and changes in policy approaches toward 1<sup>st</sup> generation biofuels.

Although usage of 1st generation biofuel will be limited by the EU directive, while support will be aimed at 2nd generation fuels (EC, 2012), production of oil bearing commodities will remain important. Directive proposal (EC, 2012) does not ban production of fuel crops on farmland, but only sets that 1st generation fuels should account for no more than 7% of energy consumption in transport by 2020. Based on the strategic and policy reasons, article analyses self-sufficiency and competitiveness of selected V4 countries with respect to production of most widely cultivated oil-bearing crops in the region – oil seed rape and sunflower.

## 2 Materials and Methods

The aim of this article is to evaluate, based on an analysis, the self-sufficiency rate (SSR) and competitiveness of the selected Visegrad countries in mostly cultivated oil bearing commodities – oil seed rape and sunflower. Authors included Czech Republic, Slovakia and Hungary; Poland was not included due to lack of necessary data. Commodities were evaluated between years 2000 and 2013, for the trade coverage analyses calculations were based on data between 2002 and 2013. This time period has been chosen with respect to the EU accession in 2004 and an introduction of compulsory share of bio-components in the transportation fuels.

Authors needed to derive necessary information from national competent authorities (Ministries of Agriculture; National Statistical Offices – Hungarian Central Statistical Office, Czech Statistical Office and Statistical Office of the Slovak Republic). Information about foreign trade have been collected from the Market Access Database of the European Commission. Gained data were double checked by information published by national statistical offices.

The self-sufficiency rate index is calculated according to formula 1 (Lohar, 1981), where consumption is accounted as the sum of individual national consumptions (human consumption, industrial consumption, etc.).

$$SSR = \frac{\text{domestic production}}{\text{consumption}} * 100 \quad (1)$$

Groups of products are also evaluated with respect to coverage of import of agricultural resources by export (TC; Trade Coverage) calculated according to formula 2 (OECD, 2005). TC values exceeding 100% mean positive balance of trade (Szczepaniak, 2012) and may be interpreted as a comparative advantage of the country in production of the given commodity. (Lubinski, Michalski and Misala, 1995; Belova et al. 2012). TC is evaluated for years between 2002 and 2013. These years are directly connected to a period evaluated for the self-sufficiency rate. Data have been gathered from Market Access Database of the European Commission in the form of the harmonised system (HS4 and HS6).

$$TC = \frac{\text{export}}{\text{import}} \quad (2)$$

Basic index and chain index for development of sown areas according to the following formulas (3 and 4) are then calculated for particular commodities. Although calculated indexes are not presented in the text, values were calculated for the purposes of the analyses.

$$\text{Basic Index} = \frac{X_t}{X_0}; \text{ where } X_0 \text{ is the starting year and } t=1,2,3..n \quad (3)$$

$$\text{Chain Index} = \frac{X_t}{X_{t-1}}; \text{ where } t=1,2,3...n \quad (4)$$

Since production efficiency and yields are an important factor of the achieved food self-sufficiency (Azadi, 2011) yield (t/ha) and total harvest area (ths. ha) are compared in the examined countries. Those data have been gathered in the national statistical offices.

### 3 Results and Discussion

Oil bearing crops belongs amount the most frequently cultivated crops in the Czech Republic, Hungary and other member countries of the EU, mainly due to intensive harvesting of oilseed rape and sunflower - their share on the arable land is indicated in the Table 1. In Hungary, sunflower together with oilseed rape covered 18.5% of arable land; cultivation of sunflower dominates as it covered 13.6% in 2014. On contrary, Czech agriculture is characterised by dominance of oilseed rape (13% in 2014) and by minor share of sunflower (0.62%) mainly due to not feasible climate conditions. Arable land in Slovakia was covered by 16% of oil crops; although cultivation of oilseed rare dominates (9.7% in 2013) cultivation of sunflower is not negligible (5.9%). From the time perspective it can be concluded, that between 2000 and 2013 Hungary experienced largest increase of arable land coverage (share of main oil crops doubled), followed by Slovakia (+41%) and the Czech Republic (+27%).

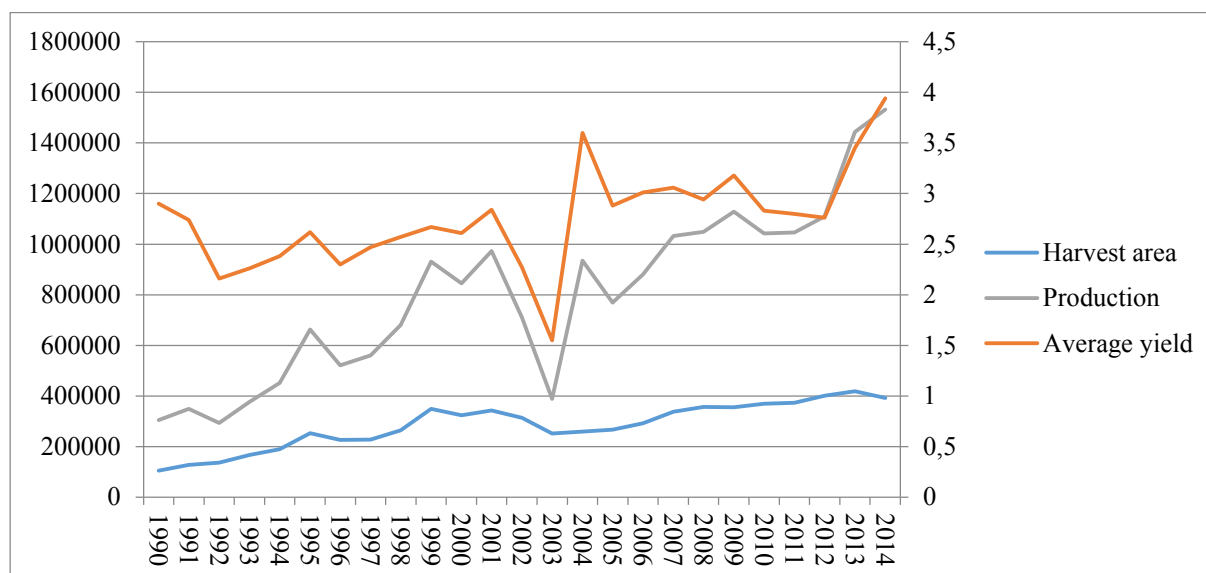
**Table 1.** The proportion of oilseed rape (R) and sunflower (S) on arable land (2000-2013, %)

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE (R)	10.5	11.1	10.1	8.1	8.4	8.7	9.5	11.1	11.7	11.7	12.2	12.4	13.3	13.9
HUN (R)	2.58	2.44	2.86	1.57	2.33	2.7	3.15	4.99	5.49	5.8	5.99	5.41	3.82	4.58
SVK (R)	6.3	7.3	8.6	3.6	6.4	7.4	8.6	10.9	11.4	11.7	11.6	10.1	7.5	9.7
CZE (S)	0.99	0.93	0.79	1.59	1.29	1.3	1.54	0.8	0.81	0.85	0.9	0.95	0.82	0.71
HUN (S)	6.6	7.1	9.2	11.3	10.6	11.3	11.8	11.3	12.2	11.8	11.6	13.4	14.2	13.8
SVK (S)	4.7	4.4	4.4	9.2	6.3	6.4	7.6	4.5	5.3	5.8	5.8	6.3	6.4	5.9

Source: Processed by the authors based on data from statistical Offices

## OILSEED RAPE

At the beginning basic characteristics (harvested area, total production and average yield) are presented. In the Czech Republic, harvested area of oilseed rape significant increased and it has more than quadrupled. In 1990 oilseed rape was cultivated only on 105 ths. hectares while in 2014 it covered about 400 ths. ha. Growing of harvested area resulted in increase of total Czech production. In 2014 total production was almost five times higher to production in 1990 as harvest yielded 1.5 million tonnes. Production was also determined by increasing average yield from 2.9 in 1990 to 3.45 t/ha in 2013. Average yield of the reported period 2000 - 2013 reaches 2.84 t/ha. In 2003 bad weather conditions greatly affected the average yield per hectare and overall production. Production use is relatively balanced in the Czech Republic, about a half of production is used for production of FAME (Fatty Acid Methyl Ester - component of bio-fuels) and the other half is used for other purposes.

**Fig. 1.** Development of oilseed rape production in Czech Republic (1990-2014; ha; t/ha; tonnes)

Source: Processed by the authors based on data from statistical Offices

In Slovakia, production of the oilseed rape varies considerably. Similarly to Czech Republic production of oilseed rape fell in 2003 also due to the weather conditions. Between 2003 and 2010 total harvested area tripled; it rose from 50 to 150 ths. ha., but fell back to 100 ths in 2010 and rose again in 2013. Similarly to fluctuations in harvested area, also total

production of seed was volatile. Since 2003, production increased significantly; while in 2003 only 50 ths. tonnes of rapeseed was produced, in 2008 production exceeded 400 ths. tonnes. In subsequent years, production fluctuates between 220 and 380 ths. tonnes. Average yield of the reported period 2000 - 2013 reaches 2.14 t/ha. Increasing significance of FAME could be tracked also in Slovakia. While between 2000 and 2004 rapeseed was consumed mainly on food production, after 2004 the situation changed. In 2012, only 30 ths. tonnes (14 %) was used for food production and the rest (180 ths. tonnes) was used for production of FAME.

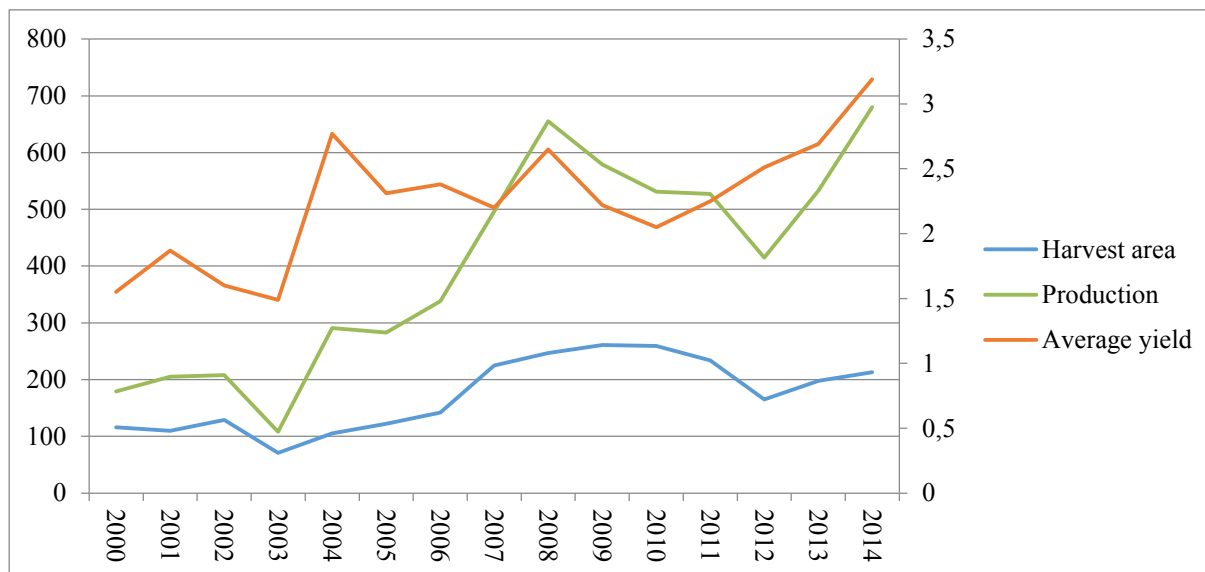
**Fig. 2.** Development of oilseed rape production in Slovakia (2000-2013; ha; t/ha; tonnes)



**Source:** Processed by the authors based on data from statistical Offices

In Hungary, development of oilseed rape production is very similar to Slovakia, also Hungarian harvest was influenced by bad weather conditions in 2003. But since then production area has tripled from 80 ths. ha to 250 ths. ha until 2010; total production rose from 110 ths. tonnes to record 650 ths. tonnes in 2008. This year's production was affected by the relatively high yield per hectare (2.65 t/ha). Average yield of the reported period 2000 - 2013 reaches 2.24 t/ha. After 2010, harvested area of oilseed rape decreases and remain relatively constant until 2014. Although production area fell, total production has been rising since 2012 mainly due improvement in productivity (3.15 t/ha in 2014).

Trade coverage indicator was calculated for trade volumes (tonnes) and trade values (EUR). Based on the obtained results it can be concluded, that all countries exhibit aggregated trade surplus in oilseed rape and related products (seeds – HS1205; oil and fractions thereof – HS1514; Oilcake and other solid residues – HS230641). Only Slovakia performed trade deficit in trade values in 2003, in the year defined by unfavourable weather conditions. Oilcake and other solid residues was the main export category of Czech producers until 2006. Since 2006 seeds has been dominating export volumes; their share fluctuates between 45 and 65%. Since 2010 oil and fractions thereof has been most important commodity group with respect to export values. Oil also remains the most expensive item. According to the available data Czech oil was exported for 0.8 – 1.1 EUR/kg; seeds were exported for 0.4 – 0.6 EUR/kg and oilcake and other solid residues were traded for 0.14 - 0.27 EUR/kg. Imports of oilseed rape products to the Czech Republic was quite volatile; from the perspective of trade values oil and seeds were the main imported commodities with share of about 90%.

**Fig. 3.** Development of oilseed rape production in Hungary (2000-2013; ths. ha; t/ha; ths. tonnes)

Source: Processed by the authors based on data from statistical Offices

Hungarian trade characteristics are different; seeds creates about 80% of export measured both in value and volume. Hungarian import was in the first years (2002 – 2006) dominated by trade with oil, but after 2006 seeds started to dominate. In 2012 and 2013 seeds created 60% of trade value and volume. Seeds are also dominant export commodity in Slovakia as they share 80% in volume and 75% in value mainly to the Czech Republic, Austria, Hungary and Germany. Imports of oil creates about 80% trade value; main partners are Czech Republic and Poland.

In conclusion, the Czech Republic performs balanced proportion of trade in raw seeds; processed oil and or oilcake. On contrary Slovakia and Hungary export mainly raw seeds and import processed oil with higher value added. It can be concluded, based on the information provided, that oil processing industry does not evince comparative advantage in Slovakia and Hungary.

**Table 2.** Trade coverage of oilseed rape (2002-2013, %)

Rape	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TC CZE (t)	1091	317	233	1042	260	1851	617	551	427	280	338	363
TC CZE (Eur)	623	201	163	694	218	1371	446	262	338	231	341	308
TC HUN (t)	1225	770	5222	1211	3290	844	400	1490	943	672	413	245
TC HUN (Eur)	449	275	1346	547	2041	958	331	859	518	489	366	218
TC SVK (t)	534	127	575	607	448	511	237	426	247	205	381	474
TC SVK (Eur)	289	97	250	235	193	138	123	231	181	162	265	255

Source: Processed by the authors based on data from Market Access Database

Situation on the individual market that perform trade surpluses with oilseed products indicates certain level of comparative advantage. This fact is confirmed by rate of self-sufficiency. Czech Republic and Slovakia are self-sufficient in production of oilseed rape; their production exceed domestic consumption significantly. Domestic consumption is in all countries heavily influenced by European legislation on compulsory share of bio-components



in the transportation fuels. Total production capacity of FAME increased between 2007 and 2013 by 250% from 323 ths. tonnes to 818 ths. tonnes/year (European Biodiesel Board, 2015). In 2013 over 60% of the production capacity was located in the Czech Republic, while Slovakian and Hungarian production facilities had identical capacity of 158 ths. tonnes of FAME/year. Increase of biofuel production had significant effect on total production in all countries.

**Table 3.** Rate of self-sufficiency of selected countries – oilseed rape (2002-2013, %)

Self-sufficiency	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	141	76	135	103	122	147	176	143	123	131	113	145
HUN	x	x	x	x	x	x	x	x	x	109	103	107
SVK	147	86	147	155	182	171	170	148	134	138	102	182

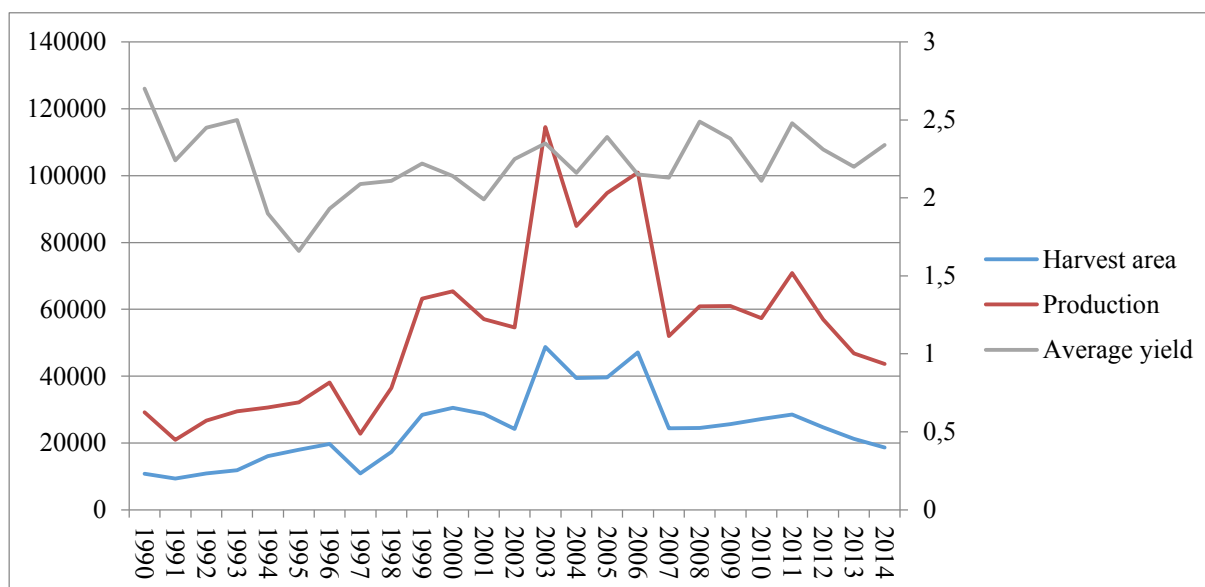
Source: Processed by the authors based on data from statistical Offices

x – Data of consumption are not available in that country

## SUNFLOWER

At the beginning basic characteristics (harvested area, total production and average yield) are presented. In the Czech Republic, production of sunflower is only marginal. Total share on arable land has never exceeded 1%; in 2014 it covered only 0.62%. Over last 23 years production was quite volatile; between 1990 and 2003 area rose (with certain downswings) from 10 ths. ha up to 48 ths. ha; afterwards it was relatively stabilised (until 2006). In 2014, sunflower was harvested on the area of about 19 ths. ha. Average yield of the reported period 1990 - 2013 reaches 2.2 – 2.5 t/ha and it directly influence total production. The highest production of about 85 – 115 ths. tonnes was reached between 2003 and 2006, but then it fell to 43 ths. ha in 2014.

**Fig. 4.** Development of sunflower production in Czech Republic (1990-2014; ha; t/ha; tonnes)

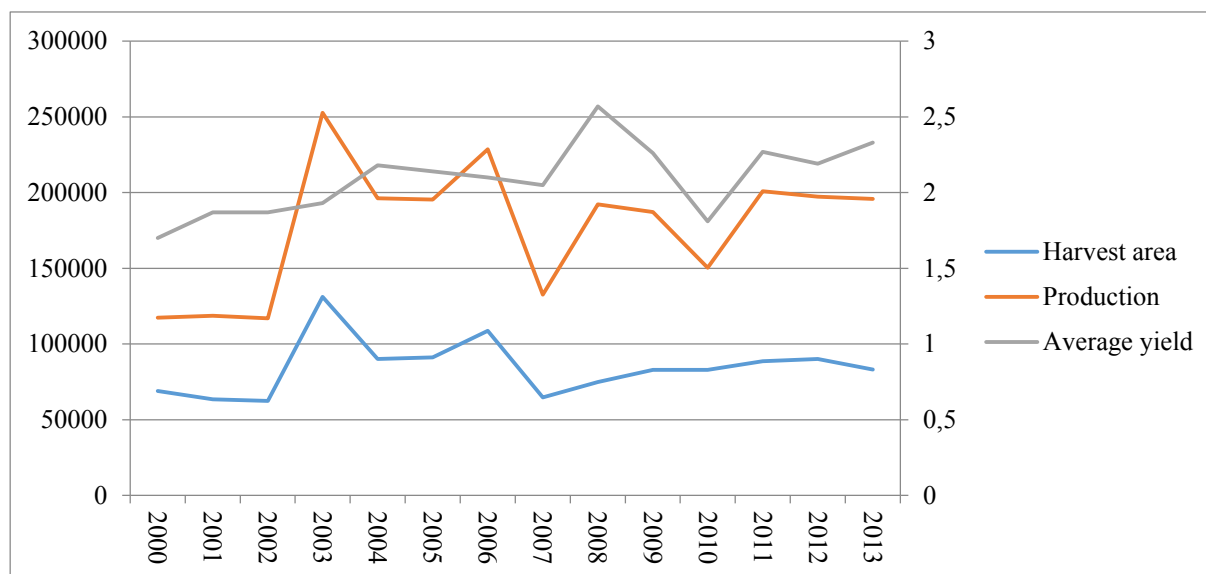


Source: Processed by the authors based on data from statistical Offices

Main production characteristics of Slovakia are defined in the figure no. 5. In the second half of the 2000s, production area has been constantly increasing and has reached 83 ths. ha in 2013 and it covered about 6% of Slovakian arable land. Volatility of yields (1.7 – 2.6 t/ha;

2.1 t/ha was the long-term average) had significant effect on total production that oscillated around 200 ths. tonnes. In comparison with CZE, Slovakian production was four times higher.

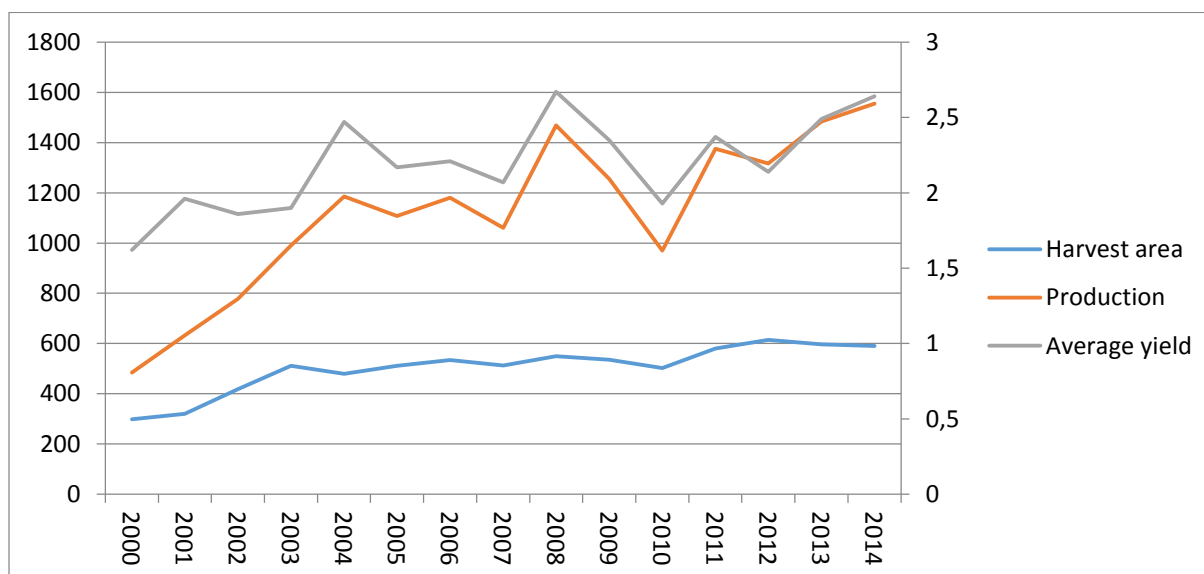
**Fig. 5.** Development of sunflower production in Slovakia (2000-2013; ha; t/ha; tonnes)



Source: Processed by the authors based on data from statistical Offices

In Hungary, between 2000 and 2013 total harvested area doubled (Fig. 6) and reached 590 ths. ha. Sunflower belongs among the most important plants in Hungary as it covers about 14% of arable land. Average yields are a similar to Slovakia; equals to 2.19 t/ha. Similarly to harvested area, also total production increased significantly. The difference between production in 2000 and 2013 is 320%!

**Fig. 6.** Development of sunflower production in Hungary (2000-2013; ths. ha; t/ha; ths. tonnes)



Source: Processed by the authors based on data from statistical Offices

Trade coverage indicator (table 4) was also calculated for trade volumes (tonnes) and trade values (EUR). Both Hungary and Slovakia are having trade surplus in trade with sunflower and related products (seeds – HS1206; oil – HS1512; 230630 – oilcake and other solid residues of sunflower seed), while the Czech Republic experience long-term deficit. Between 2004 and 2011 sunflower seed created about 80% of Czech export, but since 2012 trade in oil

and oilseed cake has gained. Sunflower oil dominated import values as its share reached 65%. But comparing imports from the volume point of view, seeds and oil are more equal. They likewise creates 45% of import in the last 3 years.

At the beginning of the analysed period, Hungarian import was characterised by no imports of oil and large imports of oilseed cake and other solid residuals (share 90% on trade in volumes). But importance of this commodity group has rapidly fallen since 2005 and was replaced by imports of seeds. In 2013, oilseed cake created only 12% while seeds 80% of imports (measured both in value and volume). Hungary performs the highest trade coverage from all analysed countries and therefore it is crucial to describe its exports in more details. Between 2002 and 2006, Hungarian export is influenced mainly by trade in seeds; for example in 2006 seeds were the only category exported, no oil and no seedcake was exported. In 2010 situation changes significantly. Significance of seeds is limited and oil becomes the leading export category. Specialisation in sunflower production was exploited, processing industry was developed. While price of exported seeds is lower (in average - 0.17 EUR/kg); price of oil is higher (in average +0.08 EUR/kg) compared to imports. Authors therefore suggest that higher quality seeds are pressed to oil and the lower quality material is exported.

Slovakian imports are created mainly by imports of sunflower oil. Oil shared about 70% of trade volumes and 80 – 90% in trade values, with one exception – in 2011 seeds created main part of imports. Trade volumes in export are dominated mainly by sunflower seed, it has been increasing its significance from 70 to 90% in the last years, while trade volumes of oil and oilcake remains marginal. Although from the volume perspective is trade in oil marginal, in value terms its share is higher (20 – 35%). With respect to prices, trade with sunflower material is the most expensive. While CZE and HUN imported and exported oil for about 0.9 – 1.0 EUR/kg in 2013, according to the statistics, price of oil reached 1.4 – 1.5 EUR/kg in Slovakia. The largest difference occurred in 2011, when Slovakian oil was exported for 3.16 EUR/kg, compared to 1.2 EUR/kg in CZK and 1.1 EUR/kg in HUN. Similar difference can be also observer in the case of seeds.

**Table 4.** Trade coverage of sunflower (2002-2013, %)

Sunflower	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
TC CZE (t)	92	137	126	98	102	125	132	89	93	57	90	71
TC CZE (Eur)	55	59	70	53	46	63	88	55	46	32	69	68
TC HUN (t)	301	726	512	829	501	735	1246	864	548	479	917	355
TC HUN (Eur)	478	896	547	637	244	697	1145	864	443	552	991	520
TC SVK (t)	3235	2180	1410	848	381	676	522	358	280	291	190	403
TC SVK (Eur)	675	444	499	308	171	346	301	163	165	145	118	195

Source: Processed by the authors based on data from Market Access Database

Rate of self-sufficiency (table 5) present interesting development trends in Czech Republic and Slovakia. In Slovakia, the self-sufficiency rate has significantly increased (almost 9x) between 2002 and 2013 and in the last year domestic production was almost 20 times higher than consumption. Significant increase of self-sufficiency in the last years was caused by rapid reduction of Slovakian consumption (six times lower) while production remained constant. Situation is different in the Czech Republic. In 2013, production does not cover domestic

production from almost ½, although until 2012 production was sufficient. But combination of increasing consumption in last 5 years (consumption almost tripled from 35 to 95 ths. tonnes) and falling production influenced self-sufficiency rate significantly.

**Table 5.** Rate of self-sufficiency of selected countries - Sunflower (2002-2013, %)

Self-sufficiency	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	120	245	152	133	169	103	188	186	157	142	106	55
HUN	x	x	x	x	x	x	x	x	x	194	174	125
SVK	222	157	351	273	223	204	240	291	264	804	1315	1957

**Source:** Processed by the authors based on data from statistical Offices

x – Data of consumption are not available in that country

Production of oilseed rape and sunflower has been significantly influenced by the legislation on compulsory component of transportation fuels. Based on the FAME production characterisations presented by Vaněk (2008), increased production capacities that took place between 2007 and 2013, would require additional material (in the case of rape) from 261 ths. ha in the Czech Republic, 152 ths. ha in the case of Hungary and 68 ths. ha in the case of Slovakia. As trade with bio-fuels was not included in the processed analyses, authors were not able to indicated direct effects of national biofuels policies on total production. But with respect to unit prices related to foreign trade (table 6) it is possible to conclude, with respect to climatic conditions, that production of FAME resulted in higher value added compared to trade with analysed groups (oil, seed and oilcake). As climatic conditions are not favourable for large production of sunflower in the Czech Republic, FAME produced from oilseed rape provides higher value added comparing to production of oil. Hungary, with respect to favourable conditions for sunflower production, has ability to produce FAME both from oilseed and sunflower (Hingyi, Kürthy and Kocsis, 2007), but comparing unit price of FAME to unit price of oils in 2013, bio-fuel component offers also higher value added. From this point of view rapid increase of FAME production capacities in both countries are more than logical.

**Table 6.** Unit price in foreign trade (2013, EUR/kg)

2013	FAME (HS 38260010)		Oil – Sunflower (HS 1512)		Oil - oilseed rape (HS 1514)	
	Imp	Exp	Imp	Exp	Imp	Exp
CZE	0.95	0.96	1.03	0.98	0.85	0.88
HUN	0.96	1.00	0.87	0.94	0.83	0.82

**Source:** Processed by the authors based on data from statistical Offices

#### 4 Conclusion

Based on the analyses it has been possible to conclude the following. Oilseed rape self-sufficiency rate indicated that domestic production covered domestic consumption; it contributes to the trade surplus. This situation may indicate certain competitive advantage among other EU member states. Results of the trade coverage indicator presented, that trade surpluses are lower when analysing trade values comparing to trade volumes. This situation could be interpreted that imported products are declared with higher unit price. Production

of oilseed rape shows differences in productivity. Hectare yields are the highest in the Czech Republic; between 2000 – 2013 average yield was 2.84 t/ha. Due to the fact, that oilseed rape belongs among the most frequently produced plants, larger yields might be in part explained by specialisation of Czech producers.

Concerning sunflower it is possible to conclude that the Czech Republic has lost its self-sufficiency in 2013 as local production decreased and consumption was increased significantly. On contrary, Slovakian downswing in consumption (from 100 to 10 ths. tonnes) and almost unchanged level of production led to rapid growth of self-sufficiency. Producers in the Czech Republic reach the highest long-term yield (2.25 t/ha) but difference among Czech and Hungarian producers (2.19 t/ha) is minor. As it was already presented above, yield differences in production of oilseed rape were much larger (0.6 t/ha), therefore only minimal difference in sunflower yields and high share on arable land could indicate certain level of specialisation. Decreasing Hungarian level of self-sufficiency is caused by increasing consumption; it rose by 300 ths. tonnes in last 3 years.

Slovakia and Hungary has positive trade balance in both oil crops, while Czech has negative trade balance in sunflower products. Czech Republic has lower values of trade coverage in trade values for sunflower, it means that Czech Republic imports rather higher value-added items (e.g. oil) while exporting seeds and oilcake.

Based on the results it can be expected, that production area will not change significantly in the near future. All member states of the EU were obliged to introduce certain level of bio-substance into transportation fuels, this level was observed by all analysed countries. As no further increase in amount of compulsory bio-content is expected, there is no reason to increase significantly production of oil-bearing crops, *ceteris paribus*.

Increasing production of oilseed rape and sunflower, in combination with decrease of arable land, may lead to ecology and biodiversity problems. In the Czech Republic, 7867 hectares of arable land are lost every year; Slovakia loses about 2723 hectares annually. On contrary amount of arable land has been lately increasing in Hungary with one exception; between 2009 and 2010 amount of arable land decreased by 170 ths. hectares.

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## Agricultural market of post-Soviet countries and its comparison with selected group of countries

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**Annotation:** Agricultural trade is growing within and also between individual regional markets. An example of such a trend is evident in the Commonwealth of Independent States. A special position of agriculture is the main reason for limited trade cooperation among the countries. None of the countries want to lose its self-sufficiency and control over its agriculture and foodstuff market. During the nineties, former Soviet Union countries lost a significant portion of their agriculture and foodstuff production capacities. The result was a significant reduction in export and massive growth of imports. The low level of self-sufficiency as well as the increasing negative agricultural trade balance were a stimulus for the government to reconsider their policies related to agricultural market development.

The objective of this paper is to identify the main changes and trends related to agricultural market development. The paper focuses on changes related to agricultural trade value development realised by the CIS countries. The agricultural trade is analysed using the Lafay index. The whole analysis is conducted according to the harmonised system (SITC 3 rev.) in current USD.

The results show that the agriculture and foodstuff production capacity of Russia and all the CIS countries has increased over the last decade; self-sufficiency is improving especially at CIS level. Individual countries encourage their mutual cooperation – they have already established an entity similar to a free-trade zone and in the future they would like to establish a custom union or common market. The level of protection of their market is increasing – especially in the Russian Federation. An effort to provide enough space for growth of domestic production capacities is especially visible with respect to the applied ban on selected foodstuff imports.

**Key words:** Commonwealth of Independent States, Russian Federation, agrarian trade, export, import, Lafay index.

**JEL classification:** Q13, Q17, F15

### 1 Introduction

Agricultural trade is considered as a specific part of foreign trade. This characteristic is given by the special features of agriculture in a national economy. During the last decades, we have been witnessing a decline in the share of agricultural products in international trade (Serrano & Pinilla, 2012), even though it is documented that agricultural trade contributes to welfare gains (Hertel & Reimer, 2005; Ngepah, 2014). However, welfare gain can be negatively influenced by volatility of agricultural prices (Goswami & Nag, 2012), by structural obstacles to free trade (Mulgan, 2008), or by the countries' inability to finish the current WTO Doha Round (Anderson, 2010).

Due to its special position within the national economy, agricultural trade is subject to high protectionism all around the world (Disdier, et al., 2008; Blandford, et al., 2003; Anderson, et al., 2006). This phenomenon has been affected by the existence of the World Trade Organization (Grant & Boys, 2011) itself or by trade agreements that can lead to removal



of tariffs and non-tariff barriers (Furtan & van Melle, 2004). On the other hand, Hart, et al. (2015) point out that, short-term, trade openness has a negative impact on the efficiency of the agricultural sector. Compare to their finding about positive impact in long-term that correspond with the findings of Hassine & Kandil (2009).

The former Soviet Union (USSR) represented an important food and agricultural producer (Deininger, 1995). After the USSR disunion, the Russian economy collapsed and its production capacities were significantly reduced. Individual post-Soviet countries reduced their agricultural and food production performance and their export capacities were paralyzed (Mathijs & Swinnen, 1998). The former Soviet Union split into fifteen countries. Three of them became EU members and the rest decided to cooperate. The Russian Federation initiated the cooperation within the frame of the Commonwealth of Independent States. At a certain point in time, the Commonwealth (CIS) consisted of nine countries and some of them were associated. Until 2013, the cooperation within the CIS had covered eleven countries: Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Uzbekistan and Ukraine. However, some countries decided to discontinue their cooperation especially owing to the Russian Federation expansiveness. Still they are very important trade partners for each other and have remained mutually important trade partners.

The aim of this paper is to identify the main trends and changes related to agricultural trade of the CIS countries. The paper focuses on changes related to agricultural trade value development realised by these countries (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Uzbekistan, and Ukraine). The paper analyses trade performance development not only in the current CIS members, but also in the former associate countries. The analysed time period is 2005-2013.

## 2 Materials and Methods

This paper analyses the CIS agrarian trade performance value. The analysed trade categories/characteristics are: export, import and trade balance. Trade value development is analysed not only at general level. Trade performance development is also analysed at the total population level (per habitant/capita) and according to/taking into account the number of people employed in agriculture (per farmer). Except for the value development, the paper also analyses import/export coverage ratio development and agrarian trade competitiveness. It also enables comparison of CIS agrarian trade performance development with selected groups of countries (European Union, OECD members, developing countries and the world).

The aim is achieved by applying standard statistical methods including descriptive statistics (basic index, chain index, geo-mean). Agricultural trade competitiveness is analysed using the Lafay index (Burianova & Belova, 2012). The whole analysis is conducted according to the harmonised system (SITC 3 rev.) in current USD. Agrarian trade performance is represented by aggregations SITC 0, 1 and 4.

The Lafay index (Lafay, 1992) considers a difference between each item of normalized trade balance and the overall normalized trade balance.

For a given country  $i$ , and for any given product  $j$ , the Lafay index (1) is defined as:

$$LFI_j^i = 100 \left( \frac{x_j^i - m_j^i}{x_j^i + m_j^i} - \frac{\sum_{j=1}^N (x_j^i - m_j^i)}{\sum_{j=1}^N (x_j^i + m_j^i)} \right) \frac{x_j^i + m_j^i}{\sum_{l=1}^N (x_j^i + m_j^i)} \quad (1)$$

where  $x_{ij}$  and  $m_{ij}$  represent exports and imports of the product  $j$  from the country  $i$ , towards and from a particular region or the rest of the world, respectively, and  $N$  represents the number of items. Positive values of the Lafay index indicate the existence of comparative advantages in a given item; the larger the value, the higher the degree of specialization (Zaghini, 2003).

### 3 Results and Discussion

The CIS members and associate countries have recorded significant growth of their agricultural production performance especially within the last decade. Only in the period 2005 – 2013, their agrarian GDP value performance increased by 163%. During the analysed time period, the value of agricultural GDP increased from USD 55 billion to more than USD 128 billion (the average inter-annual growth rate reached 11.4%). The main leader of the growth is the Russian Federation. The Russian agricultural GDP value recorded growth from USD 32 billion to USD 71 billion. Table 1 provides information about selected countries' agrarian trade development (tab.1).

**Table 1.** Analysed countries' agricultural trade value development (billions of USD)

Reporter	2005	2007	2009	2011	2013	Chain index	Basic index
Import							
Azerbaijan	0.44	0.90	0.96	1.36	1.54	1.171	3.525
Armenia	0.30	0.52	0.60	0.76	0.82	1.136	2.774
Belarus	1.55	2.07	2.22	3.05	3.93	1.123	2.529
Georgia	0.43	0.81	0.73	0.87	1.14	1.129	2.640
Kazakhstan	1.25	2.21	2.38	3.92	4.42	1.171	3.544
Kyrgyzstan	0.17	0.37	0.50	0.71	0.84	1.225	5.063
Rep. of Moldova	0.26	0.42	0.49	0.65	0.74	1.140	2.846
Russian Federation	15.77	24.97	26.62	36.89	40.64	1.126	2.577
Ukraine	2.55	3.87	4.69	5.91	7.59	1.146	2.980
Export							
Azerbaijan	0.32	0.50	0.52	0.71	0.87	1.132	2.687
Armenia	0.11	0.17	0.13	0.22	0.39	1.168	3.468
Belarus	1.31	1.76	2.22	3.79	5.35	1.192	4.075
Georgia	0.30	0.29	0.29	0.38	0.70	1.112	2.345
Kazakhstan	0.66	2.02	1.60	1.74	2.48	1.179	3.731
Kyrgyzstan	0.08	0.16	0.15	0.22	0.24	1.154	3.150
Rep. of Moldova	0.56	0.46	0.54	0.73	0.85	1.053	1.509
Russian Federation	3.78	8.13	9.12	11.04	15.72	1.195	4.162
Ukraine	4.12	5.56	8.45	11.37	14.95	1.175	3.633

Source: Own calculation based on UN Comtrade 2015

The growth of agricultural production performance was accompanied by growth of individual countries' agricultural trade performance – especially of export value performance. During the period 1991 – 2004, individual post-Soviet countries recorded significant growth of agrarian import (tab. 3), while the value of export development stagnated (tab. 2).

**Table 2.** Comparison of CIS agrarian export value development and selected group of countries' agrarian export value development (billion USD)

	2005	2007	2009	2010	2011	2012	2013	Geomean
CIS	7.29	13.76	24.46	24.64	32.27	44.98	44.66	1.254
EU-28	320.85	415.03	432.41	457.71	547.79	538.34	586.37	1.078
OECD	469.19	606.15	639.74	694.84	829.84	829.92	887.12	1.083
Developing countries	205.05	291.02	347.59	441.33	548.77	564.59	534.43	1.127
World Total	674.24	897.17	987.34	1 136.17	1 378.61	1 394.52	1 421.54	1.089

Source: Own calculation based on UN Comtrade 2015

These tables (2, 3) also enable comparison of CIS agrarian trade performance with selected groups of countries' agrarian trade performance value development.

The period 2005 – 2013 was different in that the majority of the countries witnessed significant agrarian export performance growth. Within the analysed time period, the inter-annual growth rate of export (ca 25%) exceeded the inter-annual growth rate of imports (circa 15%) for the whole group of analysed countries. The whole Commonwealth and its associated countries recorded the growth of their export performance from USD 7.3 billion to USD 44.66 billion. The agrarian import increased from USD 21 billion to USD 65 billion.

**Table 3.** Comparison of CIS agrarian import value development and a selected group of countries' agrarian export value development (billion USD)

	2005	2007	2009	2010	2011	2012	2013	Geomean
CIS	20.99	33.82	41.44	48.52	57.21	60.97	65.36	1.153
EU-28	339.67	443.32	455.15	472.47	562.76	537.57	576.01	1.068
OECD	530.61	669.60	685.44	731.72	877.58	859.42	898.89	1.068
World Total	674.24	897.17	987.34	1 136.17	1 378.61	1 394.52	1 421.54	1.089
Developing countries	162.99	257.42	314.66	400.28	499.19	477.91	433.09	1.130

Source: Own calculation based on UN Comtrade 2015

**Table 4.** Export/import coverage ratio development (%)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
CIS	34.73	32.93	40.69	52.57	59.03	50.78	56.41	73.77	68.33
EU-28	94.46	94.66	93.62	93.66	95.00	96.88	97.34	100.14	101.80
OECD	88.42	89.27	90.52	92.32	93.33	94.96	94.56	96.57	98.69
Developing countries	125.81	122.32	113.05	106.50	110.47	110.26	109.93	118.14	123.40

Source: Own calculation based on UN Comtrade 2015

Based on the above facts, the following statements might be made. CIS agrarian trade performance is currently extremely dynamic. Export dynamics in particular are considerably higher than what is typical for the majority of the countries operating within the global and regional markets. The inter-annual growth rate of export is much higher than the inter-annual growth rate of import, resulting in stabilization of agrarian trade negative balance value development. While in the past the value of the CIS members' agrarian trade balance –

especially Russian agrarian trade balance – was extremely negative (the only exceptions were Moldova and Ukraine), the negative value growth has currently been reduced.

During the last decade, the analysed post-Soviet countries have managed to stabilize their negative trade balance and their total negative balance is only about USD 20 – 25 billion. However, this value seems relatively high – for the CIS members and especially for Russia, these results can be considered success. While in 2005 the proportion of the negative trade balance value in all the analysed countries' agrarian trade turnover reached almost 50%, in 2013 it was less than 20%. Individual countries have significantly increased their trade performance – especially the mutual one. They have also reduced their import dependency as a result of their own agrarian production performance growth. The mutual trade performance recorded growth from circa USD 6 billion in 2005 to circa USD 17 billion in 2013.

The import/export coverage ratio increased from 35% (in 2005) to almost 70% in 2013 (tab.4). None of the remaining monitored groups of countries have reached such significant improvement of their agrarian trade performance and structure. The current agrarian trade development trend is the result of individual countries' agricultural production self-sufficiency ambition. Majority of former Soviet countries decided to accept ambitious programmes to encourage their domestic production performance and to reduce their food dependency. Although this might lead to higher self-sufficiency, it might have a negative effect/impact on foreign exchange earnings as mentioned by Siddig & Mubarak (2013).

**Table 5.** Agrarian trade competitiveness (LFI index)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
CIS	-4.30	-4.03	-3.42	-3.42	-4.05	-4.15	-3.40	-2.77	-3.20
EU-28	-0.15	-0.07	-0.10	-0.05	-0.11	0.00	0.01	0.04	-0.06
OECD	-0.06	-0.01	-0.01	0.09	0.01	0.09	0.11	0.18	0.19
Developing countries	0.26	0.08	0.02	-0.19	0.03	0.08	0.01	0.40	0.61

**Source:** Own calculation based on UN Comtrade 2015

The Russian Federation is an example of such a policy. In 2010, the Russian President approved the Food Security Doctrine of the Russian Federation. The doctrine calls for extensive import substitution. The Doctrine establishes the following minimum production targets as the share of domestic production in the total supply of basic agricultural commodities: grain – 95%, sugar – 80 %, vegetable oil – 80%, meat and meat products – 85 %, milk and dairy products – 90 %, fish products – 80 %, potatoes – 95%, edible salt – 85 %. These goals should be achieved by 2020 (Russian Presidential Administration, 2014). This situation does not correspond with the findings of Laiprakobsup (2014) who discovered that the liberal government reduce the financial measures in agriculture.

**Table 6.** Export in USD/habitant/head/capita (in current USD prices)

	2005	2007	2009	2011	2013
CIS	26.72	50.40	89.06	116.00	159.02
EU-28	646.47	830.00	858.97	1 082.52	1 157.14
OECD	391.59	498.79	519.05	664.63	703.17
World Total	103.89	135.00	145.12	197.94	199.53
Developing countries	38.75	53.59	62.39	96.01	91.15

**Source:** Own calculation based on UN Comtrade 2015

**Table 7.** Import in USD/habitant/head/capita (in current USD prices)

	2005	2007	2009	2011	2013
CIS	76.92	123.93	150.89	205.68	232.73
EU-28	684.39	886.59	904.13	1 112.11	1 136.71
OECD	442.85	550.99	556.12	702.86	712.50
World Total	103.89	135.00	145.12	197.94	199.53
Developing countries	30.80	47.40	56.48	87.33	73.87

Source: Own calculation based on UN Comtrade 2015

The current EU-Russian agrarian trade ban applied by the Russian Federation can also be considered as a part of above mentioned policy.

On August 6, 2014 President Putin issued the Decree No. 560 “On Special Economic Measures to Protect Russia’s Security” (Russian Presidential Administration, 2014), authorizing the Russian government to administer a one-year ban on import of agricultural products, raw materials and food from Australia, Canada, Norway, the USA and the EU. This ban concerns both agricultural and other products.

Newnham (2015) highlights the fact that this kind of sanction can have a negative impact on newly democratic states and might lead to political and economic imbalance. An expected reaction of the Western European states was their sanction on Russian agricultural and machinery products. Naghavi & Pignataro (2015) emphasizes that this sanction might strengthen the position of current kind of politics against the outside world. The question is thus if this kind of “economic war” can be successful and lead to expected outcomes. As Beladi & Oladi (2015) mention, elasticity of substitution is an important factor of the effectivity of any sanction.

**Table 8.** Export in USD/farmer (a person economically active in agriculture, in current USD prices)

	2005	2007	2009	2010	2011	2012	2013	Geomean
CIS	417	801	1 456	1 487	1 977	2 804	2 836	1.271
EU-28	25 064	34 713	38 719	42 459	52 601	53 571	60 488	1.116
OECD	11 891	16 112	17 813	19 810	24 216	24 798	27 147	1.109
World Total	527	694	755	865	1 045	1 052	1 069	1.092
Developing countries	165	232	273	345	427	437	412	1.121

Source: Own calculation based on UN Comtrade 2015

Competitiveness is a very specific feature of the CIS countries’ agrarian trade development. Individual countries’ agrarian sector competitiveness is extremely limited. Their agricultural sector as an entity does not have a comparative advantage at all (tab.5). The CIS members’ agrarian trade is competitive only at commodity or food products level and its competitiveness is mostly reached in relation to their own CIS market or in relation to markets which are associated with the CIS market.

Agricultural trade of individual post-Soviet countries has been undergoing a permanent restructuring process. Its character is changing year by year. A relatively positive trend is evident especially if we analyse the CIS and associate countries’ agrarian trade performance development at per capita level. Agricultural trade performance both per head and per farmer is constantly increasing. At the same time, the growth rate of export values is considerably higher in comparison with the growth rate of import values.

**Table 9.** Import in USD/farmer (a person economically active in agriculture, in current USD prices)

	2005	2007	2009	2010	2011	2012	2013	Geomean
CIS	1 201	1 969	2 467	2 928	3 506	3 801	4 150	1.168
EU-28	26 535	37 079	40 755	43 828	54 039	53 495	59 419	1.106
OECD	13 447	17 799	19 086	20 862	25 609	25 680	27 507	1.094
World Total	527	694	755	865	1 045	1 052	1 069	1.092
Developing countries	132	205	248	313	388	370	334	1.124

Source: Own calculation based on UN Comtrade 2015

Tables 6 - 9 provide an overview of the analysed countries' agrarian export and import value per capita and per farmer development. The tables also enable comparison of the analysed countries' trade performance with the trade performance of other selected groups of countries. Based on the data provided, it might be concluded that the CIS countries' trade performance is changing fast and it is possible to expect that, within the next ten years, the character of the CIS countries' agrarian trade will change dramatically. However, the question is what the impact on overall competitiveness of the Russian economy would be. As Makin & Ratnasiri (2015) point out, support of one sector may lead to a decline in another one.

#### 4 Conclusion

The results show that the agriculture and foodstuff production capacity of the CIS countries has increased over the last decade; the self-sufficiency is improving especially at the CIS level. Individual countries encourage their mutual cooperation – they have already established an entity similar to a free-trade zone and in the future they would like to establish a custom union or common market. The level of protection of their market is increasing – especially in the Russian Federation.

The most significant changes over the analysed period are:

- Strengthening of CIS/analysed countries' agricultural production.
- Strengthening of CIS/analysed countries' agricultural trade performance – especially export performance.
- Strengthening of the comparative advantages of CIS/analysed countries' agricultural export.
- Strengthening of CIS/analysed countries' mutual agrarian trade cooperation.
- The value of CIS countries agrarian trade is increasing especially because of their commodity structure restructuring.

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## The Czech agrarian foreign trade – ten years after the EU accession

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**Annotation:** The EU accession influenced both territorial and commodity structure of the Czech foreign agrarian trade. The Czech agrarian foreign trade is dominated by EU market. The share of non-EU countries in Czech export and import activities is marginal. While in the past Czech exports were dominated by raw commodities, in nowadays Czech exports are based on semi finalized or already finalized agricultural and foodstuff products. The Czech agrarian imports are dominated by non-competitive products. Despite of decreasing the share of agricultural trade in total Czech Foreign trade activities, the values of agrarian exports and imports are constantly increasing. The aim of the article is to identify the main tendencies and trends in territorial and commodity structure of the Czech foreign agrarian trade and paper is also identifying changes which have occurred in period after the EU accession. The paper provides the following results. The EU share in the Czech agricultural trade reaches about 90% in the long-term. Within the EU, the Czech Republic is oriented strongly on trade with new member states. In relation to the third countries, the CIS, EFTA and OECD countries belong to the most important export territories. Imports to the Czech Republic from third countries come mostly from developing countries. The Czech agricultural exports are based on a relatively small number of commodity aggregations, which represent a substantial part of the export value. The share of processed and semi-processed products increases and exceeded already 70%. The Czech agricultural market still does not have any profiled structure of comparative advantages.

**Key words:** Czech agrarian trade, EU-Member States, commodity/territorial structure, competitiveness

**JEL classification:** Q 17, Q 13

### 1 Introduction

The Czech foreign agrarian trade has experienced essential changes after the country joined the European Union. These changes related to its value, volumes, structure as well as competitiveness (Svobodová, 2014). Its strong orientation on EU-markets leads to critical dependence of the Czech agrarian trade on the development within the EU (Pohlová, 2013). This dependence has both positive and negative aspects (Burianová, 2011). The participation of the Czech Republic in the project of the Single Market can be named as one of the positive aspects (more than 500 million customers and high purchasing power). High level of liberalisation belongs to other positives (Jeníček, Krepl, 2009) as well as the opportunity to penetrate markets in 28 Member States. European producers (positively perceived also by Czech Producers) are also protected from imports from third countries. This may lead to many controversies, nevertheless a positive impact can be seen in the elimination of otherwise highly competitive imports (Burianová, Belová, 2012; Bojnec, Ferto, 2012). On the other hand, an extreme dependence on economic cycles of the EU Members, considerable over-regulation, a significant distortion of the European agricultural market caused by the rules of common policies and regulatory instruments can be some examples of the negative aspects.

The Czech agrarian exports experience very positive trends in many aspects in recent years (Basek, Kraus, 2009). The access to the European Union has led to the stabilisation

of the negative trade balance and to the dynamic growth of the agrarian export values. The access to the EU also influenced positively the restructuring of the Czech agrarian sector and food industry (Machek, Špička, 2014). Foreign direct investments helped to strengthen the competitiveness of many domestic production capacities (Aulová, Hlavsa, 2013). The Czech agrarian export is continuously transforming from exports of raw agricultural products to exports with higher level of processing and thus to products of higher value added and higher prices (Mezera, Špička, 2013). Contrary, imports are often not competitive, in many cases agricultural and food products from tropical and subtropical zones (Pohlová, 2014). The agricultural sector of the Czech Republic plays an important role in ensuring the supply of the Czech market by temperate zone products. Currently, the agrarian sector is able to cover the domestic demand of temperate zone products by about 70% (Valder et al., 2011).

## 2 Materials and Methods

The aim of the article is to analyse trends in territorial and commodity structure of the Czech foreign agrarian trade and to identify changes which have occurred during the last decade. The main emphasis has been put on the period after accession to the EU. Primarily such changes are identified, that occurred in relation to the EU-Member States and to third countries. The article is based on data of the Institute of the Agricultural Economics and Information in Prague, the Czech Statistical Office and Eurostat. Analysed time series covers the period 2005 – 2013, focused on territorial and commodity structure of the Czech agricultural trade. An analysis of the commodity structure is based on the international tariff nomenclature for the classification of product HS2. This system enables to classify commodity structures of the agricultural trade into 24 aggregations (HS1 – 24) (for details see <http://www.foreign-trade.com/reference/hscodet.htm>). The territorial structure of the Czech agricultural trade is analysed (according to the CZSO methodology) extra in relation to EU-countries and extra to third countries (non EU-Member States). In this respect, the EU represents three specific territorial groups (EU-28 – the European Union as an integration of 28 states, EU-15 – so called “old” Member States and EU-13 – so called “new” member states). From the analytical perspective, the article is aimed mainly at trends in export and import values and the balance of the agricultural foreign trade. The value of the Czech agricultural trade is analysed in current prices in Czech Crowns (CZK). Elementary statistical and mathematical methods are used to fulfil the aims of the article. The methods are used to evaluate time series and gained data. Time series are complemented by calculation of the annual growth rate, respectively, the growth index is calculated (through the chain index). The growth index/geomean (Hindls et al., 2007) is usually referred as a percentage and indicates the percentage increase of the value of the time series at time compared to the previous period. Because of limited space only every second year is mentioned in individual tables. The article evaluates also comparative advantages of the Czech agricultural exports, both in relation to EU-Member States and third countries. Paper is identifying the main changes in structure and value of Czech agrarian trade which were recorded during the analysed time period. To identify comparative advantages, the Lafay Index (LFI) is used (LFI index – Lafay, 1992). Because of limited number of pages the authors are not able to provide all tables and calculations as a part of this paper. The paper only summarises the basic findings coming from individual analyses. If anyone is interested to get more detailed information – the authors are ready to provide them.

### 3 Results and Discussion

Agricultural trade after the accession of the Czech Republic to the EU recorded a positive trend. Agricultural exports more than doubled - from CZK 78.5 billion in 2005 to more than CZK 160 billion in 2013; imports also grew significantly from CZK 103.5 billion to more than CZK 184.6 billion in the same period. Although the value of the Czech agricultural trade grows very quickly, it is worth noting that agricultural trade represents only a marginal share of the total trade of the Czech Republic. Nevertheless agricultural trade experienced higher dynamics. The share of the Czech agricultural trade rose from 4.3% to 5.7% during the surveyed period. From 2005 to 2013, its average annual rate exceeded the average annual growth of the foreign trade as a whole. While the agricultural trade turnover grew in the period by an average rate of 8.3%, the value of foreign trade as a whole experienced an average growth by 6.2% in the same period.

The annual growth rate of agricultural exports reached the level about 9.4%, while the annual growth rate of agricultural imports stood at 7.5%. such trend led to the stabilisation of the negative balance of the Czech agricultural trade, which stood at about CZK 30 billion. It is worth to stress that the share of negative balance in the total value of foreign trade turnover is gradually reducing – from the maximum of about 18% to less than 7% at the moment. Currently, the Czech Republic reaches historically the best results in the development of its agricultural trade balance – the negative balance reaches the level about CZK 24 billion.

Territorial structure, especially, experienced significant changes. Most of exports and imports are realized with the EU-countries. The share of the EU as the most important partner is currently about 92%. This fact also means a gradual strengthening of the Czech dependence on the EU; in 2005, this share reached already 87%. Czech Republic realizes about 50.2% of export relations within the EU with the EU-15 countries and about 49.8% to the EU-13. In this respect, a gradual strengthening of the EU-15 position as a trading partner is evident, because the share reached just 48% in 2005. Taking into account agricultural imports, the EU pays also a dominant role. The most important importers are the EU-15 countries (Germany, Italy, Austria, the United Kingdom, France, the Netherlands and Belgium), however their share is gradually reducing at the expense of EU-13 (Slovakia, Poland, Hungary etc.). The growth rate of exports is still the highest in relation to EU-15, followed by EU-13 and third countries. Concerning imports, the highest growth rate reach EU-13, followed by EU-15 and third countries. It must be emphasized that the increasing share of the EU-28 in the Czech agrarian trade performance is threatening its long term stability. Any kind of negative trend or event related to EU market can affect the structure and value of Czech agrarian trade. Too high level of dependency on the EU-market does not provide enough stimuli for its inter-regional development.

The share of third countries in the total Czech agrarian trade has been decreasing (however during the last years the share of third countries slightly increased – especially because of more intensive trade especially in relation to EFTA countries and ACP countries. Nevertheless the share of third countries in total Czech agrarian trade turnover was during the analysed time period reduced from 15.6% to 11.4%. The main reason consist in the accession of the Czech Republic to the EU. As a EU-member, the Czech Republic was obliged to withdraw from many bilateral and multilateral trade agreements related to countries out of the EU. On the other hand, the Czech Republic focused its attention especially on the EU

after the accession and the trade contacts outside the EU were underestimated. Also public authorities did not support trade activities and trade potential related especially to Africa and Asia.

As mentioned above, the Czech Republic reaches a negative and gradually stabilizing balance in agricultural foreign trade in long-term horizon. This negative balance can be observed in relation to EU-15 (about CZK 30 billion in recent years), on the other hand a growing positive balance is reached in relation to EU-13 (increase from CZK billion to more than CZK 17 billion during the surveyed period). The value of the negative trade balance in relation to third countries has been stabilised at the current level about CZK 12 - 13 billion.

**Tab. 1.** Value and territorial structure of the Czech agricultural foreign trade in 2005 – 2013 – 1st part (CZK 1,000)

Export	World	EU 28	EU15	EU13	Third countries
2005	78 519 645	68 675 188	33 647 143	35 028 045	9 844 457
2007	96 879 927	89 049 423	43 250 122	45 799 301	7 830 504
2009	101 707 702	94 287 719	48 904 582	45 383 137	7 419 983
2011	120 380 667	111 320 140	53 359 010	57 961 130	9 060 527
2013	160 594 073	147 063 521	73 864 192	73 199 329	13 530 552
Average annual growth rate	1.094	1.100	1.103	1.097	1.041
Import	World	EU 28	EU15	EU13	Third countries
2005	103 522 390	85 004 088	58 609 373	26 394 715	18 518 302
2007	129 333 033	109 718 697	73 182 737	36 535 960	19 614 336
2009	133 735 224	114 775 173	76 942 690	37 832 483	18 960 051
2011	156 673 575	132 924 092	88 463 501	44 460 591	23 749 483
2013	184 673 983	158 884 199	103 023 371	55 860 828	25 789 784
Average annual growth rate	1.075	1.081	1.073	1.098	1.042

Source: CZSO, 2014

### 3.1 Changes in commodity structure of the Czech agricultural foreign trade

The commodity structure of the Czech agricultural trade has been developing very dynamically in recent years. The most important Czech agricultural export aggregations are following: HS4, HS10, HS22, HS21, HS24, HS19, HS23, HS15, HS12 and HS17. The share of above mentioned aggregations in the Czech agricultural exports reached in the period 2005 – 2013 about 70%. Milk and milk products, cereals, food preparations, beverages and tobacco products reach about 40% (in 2013) of the Czech agricultural export. The over-average dynamics of agricultural exports were evident in case of aggregations HS14, HS15, HS09, HS23, HS24, HS06, HS16, HS05, HS02 and HS18. The share of these aggregations has increased during the surveyed period from 24% (in 2005) to nearly 40% (in 2013). On the other hand, the lowest dynamics in growth experienced exports of aggregations HS17, HS08, HS20, HS13, HS22, HS03, HS04, HS11, HS01, HS21 and HS010. Their share has reduced in the monitored period (2005 – 2013) from 66% to 54%. When comparing the character of aggregations with high and low levels of export growth rates, it can be concluded that such aggregations come gradually to the fore, which represent processed products with higher value added.

Tab. 2. Commodity structure of the Czech agricultural exports – 2005 - 2013

Export, 1,000 CZK	HS	2005	2007	2009	2011	2013	GeoMean inter-annual growth rate
World	4	10 457 443	15 519 267	12 559 153	15 988 911	19 122 838	1.078
World	10	6 800 617	7 330 016	8 965 376	12 552 326	13 066 315	1.085
World	22	7 317 064	10 296 033	10 193 990	8 956 466	12 727 199	1.072
World	21	6 258 431	7 891 703	9 116 353	9 352 117	12 001 789	1.085
World	24	3 449 202	4 763 375	6 886 471	8 606 426	10 639 150	1.151
World	19	3 260 322	4 559 129	5 229 991	6 816 994	9 964 350	1.150
World	23	2 888 494	3 935 370	3 716 223	6 239 580	9 449 735	1.160
World	15	2 064 838	3 346 445	3 822 079	4 935 872	9 382 369	1.208
World	12	4 582 860	7 210 393	6 793 961	5 207 897	9 296 359	1.092
World	17	8 079 454	5 032 496	5 280 955	6 273 635	8 927 580	1.013
World	1	3 833 864	4 225 753	4 484 571	5 761 901	7 325 728	1.084
World	2	2 869 582	3 379 136	3 847 247	5 095 825	6 417 008	1.106
World	18	2 715 770	3 627 582	3 552 923	4 226 367	5 734 280	1.098
World	16	1 682 293	2 283 192	3 080 900	3 649 271	4 974 150	1.145
World	8	3 265 063	2 363 587	2 371 450	2 589 554	3 907 802	1.023
World	11	1 964 587	2 448 737	3 111 387	3 109 088	3 665 360	1.081
World	20	2 020 137	2 562 751	2 002 564	2 436 463	2 954 193	1.049
World	7	1 349 671	2 064 876	2 015 869	2 588 820	2 705 838	1.091
World	9	824 203	1 341 922	1 436 602	1 998 575	2 697 179	1.160
World	3	1 292 148	1 332 316	1 312 297	1 795 252	2 347 521	1.077
World	13	741 945	570 437	973 411	979 716	1 125 122	1.053
World	5	435 700	513 816	623 637	806 165	1 096 980	1.122
World	6	328 550	272 070	313 975	361 865	986 472	1.147
World	14	4 170	2 901	4 003	25 315	31 439	1.287

Source: CZSO, 2014

The commodity structure of imports is very concentrated. The most important import aggregations in the long-term are HS02 (Meat and edible meat offal), HS21 (miscellaneous edible preparations, HS08 (edible fruit and nuts), HS19 (preparations of cereals), HS22 (beverages, spirits and vinegar), HS23 (animal fodder), HS07 (edible vegetables), HS15 (animal and vegetable fats, oils) and HS18 (cocoa and cocoa preparations). These ten aggregations represent about 70% (in 2013) of the agricultural import value. The highest rate of growth (over-average) experienced aggregations HS14, HS11, HS10, HS02, HS15, HS12, HS09, HS16, HS03, HS05, HS04, HS19 and HS01. Above mentioned aggregations have increased the share in the Czech agricultural import from 39% in 2005 to about 47% in 2013. There is evident in this regard, that a dynamic increase of highly processed products typical for the period before accessing the EU has been stopped. Currently, imports of such aggregations are growing, which are used for further processing in the Czech Republic.

Tab. 3. Commodity structure of the Czech agricultural imports – 2005 - 2013

Import, CZK 1,000	HS	2005	2007	2009	2011	2013	GeoMean - inter-annual growth rate
World	2	10 027 359	12 569 481	15 957 485	19 756 548	23 416 416	1.112
World	4	7 220 951	10 455 049	10 282 424	12 437 741	14 280 438	1.089
World	21	8 771 029	10 370 625	10 045 308	11 483 875	14 170 417	1.062
World	8	11 733 000	11 375 335	11 214 648	12 085 118	13 874 020	1.021
World	19	6 474 465	7 985 387	8 961 995	10 384 088	12 481 957	1.086
World	22	7 090 946	9 314 117	9 751 606	11 421 294	12 470 470	1.073
World	23	7 139 113	7 723 863	8 430 205	8 964 346	12 091 975	1.068
World	7	6 967 224	9 749 147	9 285 586	10 472 681	11 700 135	1.067
World	15	3 709 860	3 861 715	6 289 721	7 375 174	8 507 994	1.109
World	18	5 005 132	6 196 283	6 109 259	7 167 255	8 332 342	1.066
World	24	4 762 263	6 596 839	4 399 332	5 973 665	7 735 146	1.063
World	20	4 791 564	6 552 509	6 238 452	6 475 143	6 811 053	1.045
World	17	3 666 696	5 047 409	4 402 732	4 638 795	5 983 609	1.063
World	16	2 666 028	4 155 727	4 375 721	4 723 841	5 365 416	1.091
World	12	2 374 083	2 306 664	2 245 143	4 137 284	5 314 060	1.106
World	9	2 310 525	3 285 918	3 440 663	4 714 661	4 666 842	1.092
World	3	1 838 499	2 113 732	2 284 224	2 806 716	3 697 716	1.091
World	6	2 614 307	2 973 683	3 205 286	3 570 384	3 629 773	1.042
World	10	1 169 670	2 677 064	1 895 392	2 380 460	3 295 159	1.138
World	1	1 042 658	1 007 645	1 892 524	1 867 680	2 009 130	1.085
World	5	952 842	1 168 799	1 180 008	1 509 748	1 897 043	1.090
World	11	627 821	1 117 629	1 104 652	1 337 538	1 793 614	1.140
World	13	511 416	668 329	672 225	786 354	853 303	1.066
World	14	27 709	29 807	41 157	119 073	99 698	1.174

Source: CZSO, 2014

Czech Republic maintains a positive balance in relation to commodity aggregations HS10 (cereals), HS01(live animals), HS04 (dairy produce), HS12 (oil seeds and oleaginous fruits), HS17 (sugars and sugar confectionery), HS24 (tobacco and manufactured tobacco substitutes) and HS11 (products of the milling industry, malt, starches). Negative trade balance is generated within aggregations HS02 (meat and edible meat offal), HS08 (edible fruit and nuts), HS07 (edible vegetables), HS20 (preparations of vegetables and fruit), HS06 (live trees and other plants), HS23 (animal fodder), HS18 (cocoa and cocoa preparations) and HS 19 (preparations of cereals). It therefore follows that most of aggregations of negative trade balance are represented by non-competitive products, in many cases from tropical and subtropical areas.

The above mentioned information concerning the commodity structure of the Czech agricultural trade makes evident positive changes in the field of value added. The proportion of trade non-processed items is continuously reducing at the expense of processed products which reach currently about 72%. From this perspective, it can be stated that the Czech agricultural exports are becoming more similar to standards of developed countries and share of processed products in total exports is close to the share of processed imports in total imports (76%).

### 3.2 Changes in competitiveness of the Czech agricultural foreign trade

Competitiveness of the Czech agricultural export has been developed in long-term horizon. There must be distinguished two dimensions of competitiveness – the Single Market of the EU and third markets. Within the EU-market, Czech Republic is able to achieve comparative advantages in case of aggregations HS10, HS01, HS12, HS24, HS04, HS17, HS15, HS11, HS16, HS22, HS03 and HS13. On the other hand, a low level of competitiveness is typical for aggregations HS02, HS07, HS08, HS20, HS06, HS18, HS19, HS23, HS09, HS05 and HS14. High level of comparative advantages is experienced in trade in cereals, live animals, oilseeds, tobacco and tobacco products, milk and milk products. An extreme un-competitiveness can be found out in trade in meat products, vegetables, fruit and nuts.

While in relation to EU countries the Czech agrarian exports are quite competitive, in relation to “third countries” the level of competitiveness is much lower. It is evident that the Czech Republic is able to maintain comparative advantages mostly within aggregations HS04, HS17, HS22, HS12, HS19, HS23, HS11, HS01, HS13 and HS18. It concerns mainly exports of milk and milk products, sugars and sugar confectionery, beverages and spirits as well as oilseeds. On the other hand, an un-competitiveness is experienced in relation to aggregations agregacím HS08, HS03, HS02, HS09, HS07, HS16, HS20, HS21, HS05, HS15, HS06 and HS24. Extreme critical negative values of the LFI were found out in trade in fruit and nuts, fish and sea products, meat and meat products, coffee, tea, mate and spices, vegetables, preparations of fish and crustaceans, preparation of vegetables, fruit and food preparations.

## 4 Conclusions

Based on findings concerning the trends in commodity and territorial structure of the Czech agricultural trade, following conclusions can be stated. The Czech agricultural trade is developing very dynamically over time. The values of the Czech agricultural exports and imports experience a significant growth, while the export growth rate exceeded the import growth rate in recent years. The current value of the negative trade balance is stabilized.

When looking at the territorial structure of the Czech agricultural trade, it is apparent that its orientation is focusing gradually more on EU-countries. These countries are not only key export and also import partners. The EU share in the Czech agricultural trade reaches about 90% in the long-term.

The commodity structure is profiling significantly in recent years. The Czech agricultural exports are based on a relatively small number of commodity aggregations, which represent a substantial part of the export value. Among them, there can be found milk and milk products, cereals, beverages and spirits, food preparations, tobacco and tobacco products, preparations of cereals, residues and waste from the food industries, oilseeds, vegetable oils and oils, sugars and sugar confectioneries. The share of processed and semi-processed products increases and exceeded already 70%. Another positive aspect is also increasing export-import coverage.

The key aspect of the Czech agricultural trade is its competitiveness, which is continuously profiling. The Czech agricultural market still does not have any profiled structure of comparative advantages and thus it misses a definitively defined commodity structure, especially in relation to the EU-Member States.

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# Economic Effectiveness of Agricultural Holdings in the Czech Republic

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**Annotation:** Economic effectiveness and financial stability are the main characteristics of companies. Agricultural holdings would have to know how to cope with their financial situations. For this reason they need to have knowledge of financial management. Profitability indicators play an important role because they show the financial stability of enterprises. Liquidity ratios show whether companies can meet their obligations, such as paying wages. The aim of this paper is to analyze and evaluate the development of the economic effectiveness of agricultural enterprises in the Czech Republic. Data were obtained from the Albertina database for a period of six years, from 2007 to 2013, for limited liability companies, joint-stock companies and cooperatives in the agricultural sector. The effects of different variables of financial analysis, such as profitability ratios, activity ratios, liquidity ratios and leverage ratios, are studied in this research. The results show that the years 2007 and 2008 were very risky for enterprises. Although the indicators show that Czech farmers had a satisfactory level of economic efficiency, the financial crises had an obvious impact. The results also indicate that the agricultural sector was able to overcome these obstacles. Liquidity ratios, in particular, showed good results. After the financial crisis, the economic indicators rebounded.

**Key words:** Economic effectiveness, financial analysis, profitability ratios, activity ratios, liquidity ratios, leverage ratios.

**JEL classification:** M21

## 1 Introduction

Economic effectiveness has considerable importance in today's globalized world, with its highly competitive business environment. If companies want to survive in a changing entrepreneurial world and be financially healthy, they need to respect the two main objectives. They have to use all resources effectively (for example, financial resources, human resources and information resources), and they have to use methods of financial management focused on competitiveness and financial health. This rule applies especially to agricultural enterprises (Brožová, 2011).

Since agricultural companies are constantly facing new challenges and have to be able to deal with those challenges in this dynamic world, Agricultural Law no. 252 was ratified in the Czech Republic in the year 1997. The purpose of this law was to create conditions that ensure the ability of Czech agriculture to provide basic nutrition, food safety and needed non-food raw materials, protect elements of the environment such as land, water and air, and take care of the land-scape and stop the increasing urbanization of the country. The next aim of the Agricultural Law was to adopt the conditions of the Common Agricultural Policy of the European Union, which is supposed to create conditions for the development of economic activity and improve the quality of life in rural areas (Smutka et al., 2014). The output of agricultural companies is influenced by many factors which affect agribusiness from both the inside and outside. One internal factor is, for example, the level of production

intensity achieved. An external factor is, for example, the amount of subsidies (Homolka and Fábera, 2013, Řezbová and Škubna, 2013). There are many risks in the agricultural sector. Farmers have to face large uncertainties such as the weather, market situation, storage conditions, etc. Policy changes associated with agriculture can be quite risky, such as the period of the liberalization and globalization of agricultural markets, for example (McNamara and Weiss, 2001).

There are many authors who pursue financial effectiveness in their research. They also use financial ratios. For example, Kopta and Kouřilová (2007) assessed the financial health of agricultural enterprises focused on ecological farming. Brožová and Vaněk (2013) used three types of financial indicators (profitability, liquidity and leverage) for organic farms and conventional farms. Rosochatecká (2002) stated indicators of profitability and productivity. In addition, Kopta (2005) used, in his research, financial indicators, especially profitability ratios and economic results.

The aim of this paper is to analyze and evaluate the economic effectiveness of Czech farmers during the period from 2007 to 2013 in the agricultural sector.

## 2 Materials and Methods

Data were obtained from the Albertina database, and the time series cover the years from 2007 to 2013. Limited liability companies, joint-stock companies and cooperatives in the agricultural sector were analyzed.

Ratio indicators typical for financial analysis are used in the paper, specifically the evaluation of the selected indicators of groups of profitability, activity, liquidity and leverage, the use of which, according to Sinha (2009), worked in process. For this reason, the methodology is based on the calculation of profitability ratios, activity ratios, liquidity ratios and leverage ratios.

Ratios used in this research:

- From profitability ratios (Růčková, 2008), Return on Assets (ROA) is used, calculated as net income divide by assets. Return on Sales (ROS) is calculated as net profit divided by sales. And Return on Equity (ROE) is calculated as net profit divided by equity.
- From activity ratios (Mohana and Rao, 2011), Inventory Turnover Ratio (ITR) is used, calculated as sales divided by inventory. Inventory Turnover (IT) is calculated as inventory divided by sales, and then multiplied by 365. Receivable Turnover (RT) is calculated as sales divided by receivables. The ratio of Day's Sales Outstanding (DSO) is calculated as receivables divided by sales, and then multiplied by 365.
- From liquidity ratios (Kislingerová and Hnilica, 2008), the Cash Position Ratio (CPR) is used, calculated as current financial assets divided by current liabilities. The Quick Asset Ratio (QAR) is calculated as current assets minus inventory, divided by current liabilities. And the Current Ratio (CR) is calculated as current assets divided by current liabilities.
- From leverage ratios (Scholleová, 2009), the Debt Equity Ratio (DER) is used, calculated as liabilities divided by current equity. The Debt Ratio (DR) is also used, calculated as liabilities divided by assets.

### 3 Results and Discussion

A system of indicators focused on profitability provides an overview of the ultimate effectiveness of entrepreneurial activity in this sample of agricultural enterprises. Data have been obtained for a sufficiently long period, which enables one to create an idea of the level and balance of profitability indicators. From the point of view of the levels of indicators used in the measurement, the results for the year 2009 differ significantly from the average values. In this year, due to losses incurred, the used indicators have negative values. The ROS indicator was negatively affected by a significant drop in prices for agricultural products. These can fluctuate over the years. Since the year 2010, prices have been stabilized at a favourable level; this indicator has the necessary level and introduces a presumption of overall profitability for the entrepreneurship.

The achieved values of the indicators ROA and ROE have had a favourable development for agricultural enterprises since 2009, which demonstrates the economic stability of enterprises in agriculture. Achieved values in the used sample are identical to sample enterprises tested by FADN. According to FADN, profitability by legal entities of total capital (income from agricultural activities divided by total assets) exceeded 3.70 % in 2012 (Zelená zpráva, 2012).

**Table 1.** Selected statistics of the calculated profitability ratios for the Czech enterprises, 2007-2013

	2007	2008	2009	2010	2011	2012	2013
ROS	8.21	4.72	-0.48	3.75	8.30	6.24	7.12
ROA	2.84	1.30	-0.10	0.64	2.56	3.15	3.78
ROE	4.26	2.20	-0.16	1.25	3.83	3.01	4.00

Source: Own processing

The activity of using production factors also has a significant economic effect in agricultural businesses. It all comes down to speed and turnover time, mainly for receivables, liabilities and supplies. There are significant specifics of agricultural production with regard to the necessary required inventory of a biological character, such as young animals and a company's own feed and seed. The level of supplies must bridge the seasonal character of production.

**Table 2.** Selected statistics of the calculated activity ratios for the Czech enterprises, 2007-2013

	2007	2008	2009	2010	2011	2012	2013
ITR	1.71	1.51	1.16	1.44	1.70	2.00	2.45
IT	118.50	128.40	150.00	132.00	120.40	113.60	101.80
RT	3.37	3.16	3.21	3.38	3.47	3.62	4.08
DSO	70.33	74.31	73.40	70.10	68.61	70.50	71.60

Source: Own processing

Liquidity ratios are decisive for the assessment of the financial situation of agricultural enterprises. These indicators show primarily the ability of a company to meet its financial liabilities, mainly trade liabilities. A sufficient level of cash flow is needed to avoid a situation in which the enterprise becomes insolvent. CPR values in the entire following period were at an acceptable level and ranged between generally accepted limits, from 0.2 to 0.5, which indicates favourable conditions for the maturity of short-term liabilities in trade relations. Even in 2009, the values of liquidity were acceptable in spite of the loss. In addition, the values

of QAR and CR were favourable for companies during the whole period, showing that they have the necessary financial resources to remain solvent.

The achieved values of liquidity indicators in the following period indicate that this set of agricultural enterprises was stabilized in terms of their financial situation, and could be characterized as creditworthy entities in the field of trade relations.

**Table 3.** Selected statistics of the liquidity profitability ratios for the Czech enterprises, 2007-2013

	2007	2008	2009	2010	2011	2012	2013
CPR	0.36	0.24	0.35	0.35	0.34	0.38	0.35
QAR	1.31	1.14	1.17	1.15	1.20	1.24	1.30
CR	2.82	2.61	2.73	2.57	2.62	2.86	2.78

Source: Own processing

The use of long-term debt in entrepreneurship in the agricultural sector has its justification. The share of long-term debts and liabilities in the total capital of the company has to correspond with the principles of correct funding, i.e. it should be a balanced proportion of equity and liabilities. The above mentioned principle was unequivocally fulfilled during the given period. For most agricultural enterprises, equity is allocated as fixed. These results are lower than the obtained results presented by FADN, where in 2012 the debt ratio (liabilities divided by assets) for legal entities was ascertained in the amount of 27.48 %. The indebtedness of equity therefore shows very good results. This low debt makes agricultural enterprises more financially stable, and also proves their solvency in case they need to get a bank loan.

**Table 4.** Selected statistics of the calculated leverage ratios for the Czech enterprises, 2007-2013

	2007	2008	2009	2010	2011	2012	2013
DER	25.00	26.46	25.02	23.70	23.66	23.43	23.01
DR	15.37	16.20	15.38	14.71	14.70	14.21	13.87

Source: Own processing

After the financial crisis in 2008, the global economy suffered big losses. Pokorná and Smutka (2009) said that the financial crisis affected not only developing countries, but developed ones as well. Despite a high unemployment rate, the economy has recovered over the course of time since the second half of 2009.

The findings of this research show that since the financial crisis, economic indicators have rebounded. The same is true for the research from Huawei and Jian (2012).

The results show that the year 2008 was very risky for enterprises. Prices of agricultural commodities went down but prices of purchased material increased. The main reason for this situation was the low realization prices. Homolka and Fábbera (2013) said the same, and they added that companies manage with a smaller ratio of assets per hectare against the comparable average in the Czech Republic.

The values of profit before taxation were negative for selected enterprises before the year 2008. This was due to the impossibility of renewing the long-term assets. Střeleček et al. (2012) also mentioned this problem in their research. Homolka and Fábbera (2013) discovered this reality for the year 2009. Kopta (2009) stated that negative profit before taxation affected primarily agricultural holdings in mountainous and sub-mountainous regions.

## 4 Conclusion

The aim of this paper is to analyze and evaluate the economic effectiveness of Czech farmers during the period from 2007 to 2013 in the agricultural sector. Four types of financial indicators, i.e. profitability ratios, activity ratios, liquidity ratios and leverage ratios, were used for this analysis.

According to the given results, it can be stated that the indicators show a satisfactory level of economic efficiency for Czech farmers. The impact of the financial crisis, which dates to the years 2007 and 2008, is obvious in most of the calculated ratios, but the influence of the crises can be observed with a lag and is most significant in 2009, except for the DER and DR ratios, where the worst values were calculated for the year 2008. Nevertheless, there were still excellent results for some of the ratios used (e.g. liquidity ratios) in 2008, resp. 2009. But for the rest of the used indicators, the years 2008 and 2009 resulted in worse values. The results also indicate that the agricultural sector was able to overcome these obstacles, and the end of the observed period is represented by values which are comparable to the period before the crisis. The analysis doesn't reflect the impact of subsidies on the calculated ratios, but the impact of other external factors, such as the weather or storage conditions mentioned above, is also not obvious from the analysis, so it could be said that Czech farmers are able to face up to these risks well.

In general, the economic crisis had no such influence on agriculture because the demand for food is relatively independent. People will buy food in all phases of the global economy, i.e. crisis, recession, etc. Junková and Matušková (2011) mentioned in their research that there is a strong probability that the agricultural sector will survive the economic crisis better than any other sector.

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## Open data and rural development

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**Annotation:** The main aim of the paper is the analysis of open data collections in the fields of agriculture, forestry, water management, food industry and countryside and their importance for rural development. The methodical approach consists of primary analysis of the current state of open data usable for regional development including selection of model data. Open data is a well-supported agenda within the government administration, public or national institutions in the Czech Republic and other European countries. Open data is free data available on the Internet in structured and machine-readable form. The structure and format of open data should allow its mass processing provided a legal permission by the data owner. This enables further data processing using software applications. Publication of open data is an important tendency. The paper presents benefits of open data consisting mainly in supporting the economy and transparency of the public administration. The published data is the source of innovation, business opportunities and job offers.

**Key words:** open data, rural development, open licencing, data sharing, data formats.

**JEL classification:** Q1, P25, L86

### 1 Introduction

#### 1.1 Open data

Open data is free data available on the Internet in a structured and machine-readable form. The structure and format of open data should allow mass processing for which the data owner provided a legal permission. This enables further data processing using software applications (Otakar Motejl Foundation, 2015). Publication of open data is an important tendency not only within semantic web (Kozaki et al, 2014). Open data is currently well-supported component of all government administration levels as well as many national and public institutions around the world. Majority of requests within the project “Information for everyone” ([informaceprovsechny.cz](http://informaceprovsechny.cz)) were demanding a data provision, while partial information inquiries were not frequently required.

Besides being a major element of semantic web, publication of open data is also breaking through in other areas such as social sciences, government administration or media. Various metadata standards and data format standards are being used for the content transformation and data structure (Spampinato and Zangara, 2013).

#### 1.2 Public licences

Every piece of work and data published is limited by licence. Licence is permission for activity otherwise permitted. Licence agreement is a separate contractual type; provider gives a permission (licence) to an acquirer to act his absolute rights to intangible. (Boháček et al 2008). The most commonly used licences for publishing digital objects are:

- Creative Commons licence (CC)

- Licence Creative Archive
- GNU Free Documentation Licence
- Open Data Commons Open Database Licence (ODbL)

### 1.3 Rural development

Inequality of economic and social relations between towns and rural regions is generally recognized; it is caused by quite a few historical, geographical, political and economic phenomena. In the period of information society development, the use of information and communication technologies is considered as one of the crucial tools for rural development and use of its potential. Generally, it can be stated that a contribution for the country is caused by information availability, high-quality communication, availability of services and education and so on. However, it is also necessary to state that these common phenomena without creation of mutual relations and engagement of all appropriate regional structures will not independently create required results (Vaněk et al, 2011).

The main aim of the paper is the analysis of open data collections in the fields of agriculture, forestry, water management, food industry and countryside and their importance for rural development. The methodical approach consists of primary analysis of current state of open data usable for regional development including selection of model data. The paper also analyses the licencing and data formats for publishing. The paper deals with further analyses of licences and open data formats.

## 2 Materials and Methods

Open Definition (2015) describes open data such as: “Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and share alike.”

Publishing of national data in the Czech Republic is primarily based on the following provisions:

- Act No. 106/1999 Coll., about Freedom of information laws by country, as amended.
- Act No. 123/1998 Coll., about rights to be informed concerning environment, as amended.
- Directive of European Parliament and Board No. 2003/98/ES and its amendment by Directive No. 2013/37/EU. Directive on the re-use of public sector information, also known as PSI Directive

Public documents applying open data are e.g.:

- Concept of cataloguing of open data of Prison service of the Czech republic
- Methodology of open data publishing of public administration of the Czech republic
- Action plan for open governance

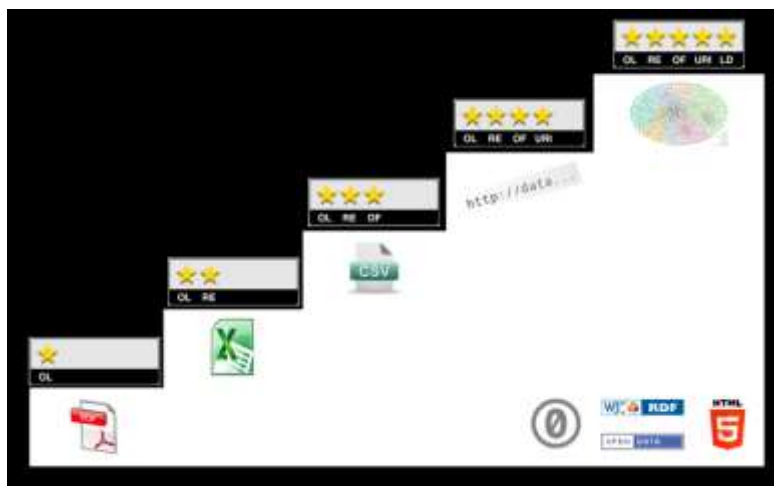
The format of open data was separated into five categories by Tim Berners-Lee (2006), each category marked with the corresponding number of stars. High ranking indicates better accessible data format, while low number stars symbolizes format least usable for machine processing. The overall ranking is as follows:



- 1 star – document scanned as a picture (or pdf)
- 2 stars – data in xls table (Microsoft Excel format)
- 3 stars – data in csv format (non-proprietary format)
- 4 stars – data in open W3C format
- 5 stars – data is linked within the boundaries of a context

"Star" evaluation of open data quality is associated with a typical figure 1.

Fig. 1. 5 star deployment scheme



Source: 5stardata.info, 2015

Currently the main problem is the vast diversity of data formats, which limits uniformed accessibility. Unified format and structure of open data did not succeed in many relevant areas. One of the requirements for open data is machine-readability, however at present state open data is being published in many heterogeneous formats with dissimilar structure. A lot of approaches are based on specific cases and their transference is limited due to format incompatibility (Klug and Knoch, 2014). Data files are being published using proprietary structures, which can hinder the search for usable data sets and requires user structure and semantics description to be available along with the actual data (Hofman and Rajagopal, 2014). At the moment, there are few attempts for data format standardization, for instance publishing various data sets in RDF1 (Silva et al, 2013), but none of those deals with the issue as a whole across all the fields. Also those attempts do not include structure, validation and transformation together. Other issues are high rate of redundancy and low machine-readability of data file descriptions (Fernández et al, 2013). Data content, its format, structure and quality are diverse even in cases where data is published using principles of linked data (Böhm et al, 2012).

This generates the necessity to create various conversions and on-the-fly solutions during data analysis and processing. The resulting difficulties when implementing data structure and formats within end user applications have negative effect on overall solution clarity. Use of software applications (mobile or desktop) specifically designed for end users is required to maintain a level of data usability for the end user. Only then comes output in "Less work for the clerk, more comfort for the user."

## 2.1 Open data in regions

The following chapter provides a chosen source of open data that has an impact on regions in the Czech Republic.

**The Vysočina region** is nowadays the only one region in the Czech Republic, excluded Prague region, which publishes useful open data. Data is available at: <http://opendata.kr-vysocina.cz> and contain data from 16 spheres. The region publishes data under its own licences in different, mostly 3 stars formats. Data store is a part of publishing of open data.

**The Děčín town** publishes 7 categories of open data under indefinite licence on its web pages. The data is above all in 1 and 2 stars quality.

**The Ministry of Finance of the Czech Republic** currently publishes 40 open data sets at: <http://data.mfcr.cz/>. Data is available in different formats, but 2 stars data in xls and pdf formats prevail. The Ministry of finance publishes data under its own licence.

Another open data repositories with the potential for regions growth are e.g.: data from the Registry of Territorial Identification, Addresses and Real Estate, open data of the Czech Statistical Office or data published by the Czech Hydrometeorological Institute, data about environment is available on site of Czech Geoportal: <http://geoportal.gov.cz/> or the European project called "Farm-Oriented Open Data in Europe" (Řezník et al, 2015).

**Czech National Open Data Catalogue** at the website <http://portal.gov.cz>. It has two major parts: Firstly, list of open data sets from public administration and national institutions since April 2015. Secondly, the Registry of Contracts that provides scanned copies of all public tender contracts with metadata in XML for automated processing. The Registry of Contracts contains records since 2013.

The most of institution publish quite poor data or its data is not available online. There are not so many organizations that participate in the open data initiative.

## 3 Results and Discussion

Nowadays, there is a lack of available open data in the area of regions. State administration authorities create documents based on open data on the basis of the Act No. 106/1999 Coll., documents are national, but are not published online or are published just in the form of scanned document, which is not usable for further publishing. The main imperfection of open data in the Czech Republic is an insufficient coordination. The issue of machine readable data handled by legislation based on the direction No. 2013/37/EU in § 3 paragraph 7 „Machine readable format is, for purpose of this Act, format of data file with structure which enables program equipment easily find, recognize and gain specific information from this data file, including particular figures and their internal structures. “

### Classification of open data

Openness of open data is possible to understand several ways:

- *technical openness*, i.e. publishing of data in standard machine readable format;
- *legislative openness*, i.e. publishing of data under open licence;

- *availability and originality*, i.e. particular data sets are published as one whole and they are not converted (i.e. it is data, not statistics, on its basis the statistics can be calculated);
- *clear arrangement*, i.e. cataloguing of data sets in data catalogue for easier research. (Mráček et al 2014)

### Benefits of open data

- *increase of the effectivity*: provided data can be shared and analysed;
- *support of economics*: data is source of innovation, business opportunities and job offers – it is possible to use perhaps in transport, logistics, health care or banking. Companies work with data as with a raw material, they create applications over this data which generate added value and gain;
- *transparency*, increase in efficiency and supervision of public administration: published data enable supervision of how taxes are being administered or what are the costs of organizations supported by us;
- *involvement of citizens* in making decisions: citizens can, thanks to data and analyses, participate in running of state more qualified;
- *data journalism*: open data is irreplaceable information source for journalists. (Berg et al, 2012)

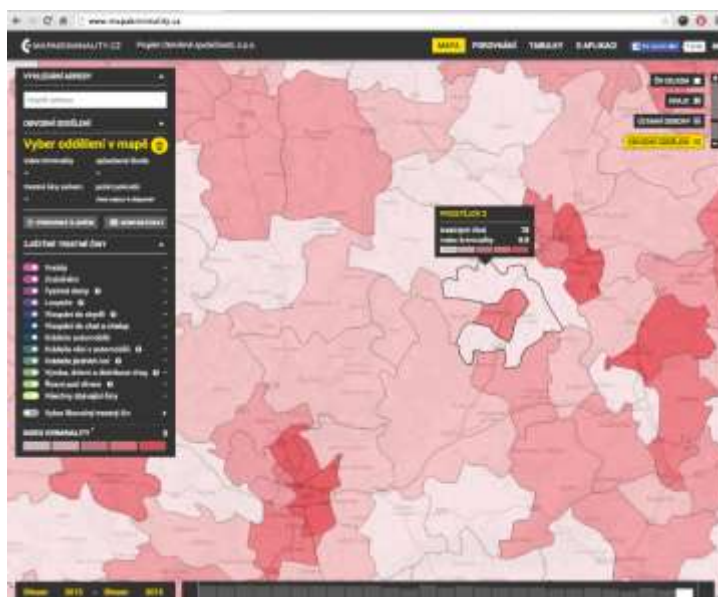
Publishing of open data is a demanding process, at the end should not be only publishing of data but also practical utilization, preferably in the form of a web application. Currently, the trend over the open data is to build web applications that are used to improve raw data analyses formation. This initiative is supported by the fund of Otakar Motejl who announces competition about the best application using open data every year. (Boček et al, 2012)

Chosen applications with impact on development of regions based on open data of public administration. Applications were selected based on the following criteria: received significant award from authorities in the field (e.g. thr Open Society Fund Prague, Křišťalová Lupa (Crystal Magnifier), have an impact on regional development.

- *Public official noticeboards (edesky.cz)* Application transparently depicts documents put up on electronic public official noticeboards of towns and municipalities. Source data is gained from public official noticeboards of particular regions, towns and municipalities.
- *Transparent region* (<http://www.transparentni-kraj.cz/>) Web visitor has a possibility to find out state of economic activities in any region, compare it with other regions or find out which regions are the worst in key industries.
- *FondyEU.eu* – The main aim of the project Fondyeu.eu is to increase information transparency about recipients and their projects who got financial support from the structural funds of the European Union.
- *MapaKriminality.CZ* – Applications show information about criminality in the Czech Republic. More information in the Figure no. 2.

- *Outdoor swimming pools of EU* - Mobile applications for Android making accessible data about water surfaces suitable for swimming, which are registered and checked by the European Environment Agency.

Fig. 2. Map of criminality



Source: czechcrime.org

The Ministry of Agriculture of the Czech Republic currently publishes nearly no data in the format of open data. But his subordinate component Czech Agriculture and Food Inspection Authority operates a successful project “Potraviny na pranýři” (the Food Pillory) which focuses on publishing the results of official controls for food and restaurant operations.

Table 1. Open data applications

Application	Licence	Aggregated data sources / records	Type of provider	Target users	Languages provided
edesky.cz	Various	1104/>173 000	Private	Citizens	Czech
Transparent region	-	14/>1500	Private	Citizens	Czech
FondyEU.eu	Various	7/ >80000	NGO	Citizens	Czech
MapaKriminality.CZ	Various	1/>100000	NGO	Citizens	Czech
Outdoor swimming pools of EU	-	1/>20 000	private	Citizens	Czech
The Food Pillory	Own	1/>700 000	public	Citizens	Czech

Source: author

## 4 Conclusion

The paper presents that the benefits of open data consist mainly in supporting the economy and transparency of public administration. The published data is the source of innovation, business opportunities and job offers. Publishing of state data in the Czech Republic is primarily based on the provisions of the Act no. 106/1999 Coll., On Free Access to Information, as amended. Currently, there is very few available open data in the regions. State authorities under the Act no. 106/1999 Coll., create open data documents but the data is not published online or is published in inappropriate formats, e.g. as a scanned document and therefore totally unsuitable for further use. The main drawback of open data in the Czech

Republic is a lack of coordination. Issue of machine-readable data is handled by modifying the legislation based on Directive 2013/37/EU. Publishing of open data is a demanding process, at the end should not be only publishing of data but also practical utilization, preferably in the form of a web application serving for analysis and visualization of raw data for uninitiated public. Among one of the most famous projects belongs the Food Pillory, the project of the State Agricultural and Food Inspection. The analysed data implies that most providers of data create their own licences; conditions to further dispose of open data. Based on the analysis of literary sources it was found that currently the most suitable licence for rapid and efficient distribution of digital documents is file of licences, developed by *Creative Commons*.

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## Changes in the Assessment of Conditions of Living in Regions of the Czech Republic

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**Annotation:** Population's conditions of living, the state and development of these, represent a very important indicator of the entire economic situation and first of all of the perspectives of further development of the given territory. Taking into account that they set up a multidimensional (multivariate) quantity including on one side indicators determined objectively that are, as a rule, of quantitative nature, and on the other side indicators representing the subjective assessment of the conditions of living by the given respondent, methods that are up to the complexity of the analysis have to be chosen for the assessment. As a proper device for selection of the relevant indicators and assessment of their mutual effect, the multivariate statistical methods seem to be applicable here, first of all the principal component analysis and the cluster analysis. A review then will be prepared based on the results of the analyses, of the changes discovered in the assessment of conditions of living in the CR Regions over the period of years 2005 - 2013 and the positions of the Regions will be defined as seen from the given viewpoint within CR at the same time

**Key words:** Conditions of living, statistical analysis, regional disparities, small municipalities

**JEL classifications:** C38, Q51, R11

### 1 Introduction

Securing an even development of Regions belongs to the fundamental tasks of regional policies of both the Czech Republic and European Union. It is a longterm process during which gradual reduction of differences between the Regions should take place in the economic, social and environmental conditions as well as securing a proper quality of the inhabitants' living in the Regions.

Assessment of the changes in the Regions' development as well as assessment of the conditions of living or the quality of life in the Regions represents a comparatively complex task since a large number of indicators is to be surveyed here, be it those discovered objectively (of quantitative nature, as a rule) or those reflecting the inhabitants' subjective look.

Regional disparities are tightly connected with the quality of life in the Regions, and the most important factors surveyed that affect the quality of life are most of all the availability and accessibility of jobs, of education and of both the public and private services. (Klufová, 2010). It is, of course, important to take lots of other indicators into account, those affecting the inhabitants' conditions of living, both of the objective and subjective type. In the assessment of regional development the role is played by stable conditions - mainly those geographic and climatic - given to the Region, on the one side, and by the inhabitants' approach on the other side, as well as the state and further development of important indicators.

Every Region has its own specificities and priorities as it concerns the future development, but all of them have one thing in common, anyway, that is the regional policy trying to secure

the economic progress and satisfactory conditions of life for the population. (Svatošová, 2012) The fundamental target of regional management is first of all the Region's progress and the citizens' quality of life improvement.

The improvement of life quality and growth of the inhabitants' degree of satisfaction needs devices facilitating the assessment of success of the life quality formation. The information on the citizens' degree of satisfaction offers a significant basis to the regional management for decision making and self-assessment, therefore it is needed for the citizens' satisfaction to survey and measure it. (Křupka, 2010) Quality of life is the object of interest of medicine, psychologists, sociologists, environmentalists, politologists, technicians, economists etc. The peoples' quality of life can also be assessed from the economic point of view (the GDP/head, prices, consumer basket etc.) According to the UN, the Human Development Index has been defined. (Šubrt, 2008)

The separate Governments and political institutions are developing the index numbers of life quality in the regions or within whole states. It has been discovered anyway, that they are remaining backwards in four areas: (1) indexes vary greatly in their coverage and definitions of domains of QOL (quality of life), (2) none of the indexes distinguish among the concepts of input, throughput, and output, that are used by public policy analysts, (3) they fail to show how QOL outputs are sensitive to public policy inputs, and then (4) none have examined convergent validity against each other. Therefore, the indexes are useful, but they need an improvement. (Hagerty et al., 2001)

According to Červenka (2003) it is possible to perform the level of living measurement two ways. The first one is based in the objective direct enumeration of the volume of goods and services consumed, possibly also of financial incomes and properties, free time, expenditures from the budget spent on public services but also the volume of harmful matters emitted into waters and atmosphere, the life expectancy, the infant mortality, the level of crime etc. The second way of the level of living expression is based on the idea that the level of living can be presented as the level of fulfillment of the material or immaterial needs and aspirations of an individual or a household by goods and services. (Červenka, 2003)

Corresponding to the EU membership is the Czech Republic obliged to perform the annual sample survey on incomes and conditions of living of households and household members – the national modification of the all-European survey EU-SILC (European Union - Statistics on Income and Living Conditions). Corresponding to the Act 89/1995 on the State Statistical Service and with respect to the Act 101/2000 on the Protection of Personal Data, the Czech Statistical Office organizes the SILC 2015 sample survey. The survey on the conditions of living is performed based on the data on accommodation, employment, incomes and health, obtained from the households and household members. The data are employed for evaluation of the measures of income poverty, material deprivation and low work intensity from which consequently the summary indicator of social deprivation is constructed. Furtherly, the statistics of family accounts (SRÚ) surveys the economy of private households and it offers information on the levels of their expenses and the consumption structure, information on the consumption differences in households ordered by various viewpoints, or on the effect of various factors (e. g., price movements, market situation) upon the structure of expenditure and the households' consumption habits. (CZSO, 2015)

The official statistics approach the level of living assessment using the assessment of quantitative, objectively verified indicators. Incomes and expenses of the population are



surveyed this way, same as the consumption of goods and services, properties, volume of funds spent on public services, indicators indicating pollution of the atmosphere, level of crime and other measures ordered by household types and income classes. (Stejskal, Stávková, 2010)

This assessment represents one aspect only, covering the issue given partially only. If the definition is speaking about satisfying the needs, it is needed, too, to know how the population is satisfied. It is also needed to analyze the subjective feelings of the inhabitants, to know their opinion what is the level up to which their needs are satisfied. (Červenka, 2009)

Many authors mostly from the sociological and psychological areas of research differ the subjective quality of the conditions of living, coming out from the individual assessment, from the objective quality of the conditions of living being described by the quantitative measures as given above. (Džuka, 2004) Surveys reflecting the subjective assessment then represent suitable annexes to official statistical indicators and the two together supply the starting basis for complex assessment of the level of living and conditions of living of the population in the given area.

The importance of such a complex assessment of the population's level of living and quality of the conditions of living has been confirmed by conclusions of the UNDP Commission for Measurement of Economic and Social Progress (CMEPSP), the aim of which is to be a design of indicators (measures) to be applied in the measurements needed. It comes to be seen that measurement of production of the economy is not a sufficient indicator and that it is necessary to transit to the measurement of population's level of satisfaction. (Report by the Commission, 2009) A multidimensional (multivariate) statistical system is to be set up, including the following dimensions:

- Material level of living (incomes, consumption, properties)
- Health
- Education
- Personal activities including those at work
- Participation in the government and politics
- Social relations and connections
- Environment (current and future conditions)
- Uncertainty (both economic and personal]

All this represents a very demanding task both in the area of data collection and in the area of assessment especially. There are mutual connections between indicators in the multivariate data populations where separate indicators do not apply the same force. Hence it is difficult to discover the way how to perform a qualified assessment in order to assess the state of life quality and to compare the levels of this quality between inhabitants living in different regions.

As far as the quality of life subjective assessment is concerned, this brings the request for a demanding construction of a questionnaire for the population. It has to be designed such that it be well assessable, concise if possible and to be able to offer all the important information at the same time.

## 2 Materials and Methods

The aim of the analysis performed was to determine factors holding fundamental importance in the assessment of conditions of living in the Regions and of the changes taking place, and also to establish an order of the Regions in terms of the assessment of objective (quantitative) indicators and in accordance with the subjective assessment by the respondents.

In order to assess the conditions of living in the CR Regions both the measures of objective nature have been chosen as well as those representing subjective assessment by the respondents. At the first stage the univariate statistical analyses have been applied for data processing; furtherly, also a multivariate method - the principal component analysis - has been used as a device of the data mining procedure. (Anderson, T. V., 1984, Hebák et al., 2004) Based on the analyses done a selection of indicators has been formed having fundamental importance for assessment of the conditions of living and the changes of these.

Out of the quantitative (objectively ascertained) indicators, 5 measures have been selected: Incomes from the State social support, Net money incomes, Share of the households with incomes below the subsistence level, proportion of Accomodation expenses, Unemployment rate. The resource for selection of indicators representing subjective respondents' opinion were data from the Czech Statistical Office survey „Incomes and Conditions of Living of the CR Households“ (Příjmy a životní podmínky domácností ČR). Here, 5 measures again have been selected: Share of the respondents reporting that accomodation expenses are a heavy loading on them, Share of the respondents reporting big troubles when deciding on the distribution of their low incomes, Share of the respondents who cannot afford to cover an unexpected expenditure at 8,500 CZK (or 9,300 CZK), Share of the respondents troubled by crime problems, vandalism and environment pollution at their places of living. Selection of the chosen indicators over CR Regions has been further completed with indicators informing of the Share of inhabitants living in the small municipalities.

The analysis has been performed based on data available from the years 2005 and 2012, eventually 2013, too, in order to find out, whether any changes happened in the Regions and what changes they were. For the processing of multivariate data the principal component analysis (Khattree, R.- Naik, N. D., 1999) was chosen as the most suitable method, on the basis of which the following reduction of the number of indicators is possible and indicators vital for the solution of the exercise can be selected. Principal component analysis can also be employed as the basis of a complex assessment, when based on the variables selected and their weights in the model, a summary indicator can be established, serving as the criterion of ordering the Regions according to the viewpoint considered. The main principle of the principal component analysis is transformation of the set of original variables into new hypothetical variables. These are called components. The components are ordered by the size of their contribution to the explanation of total variance of the original variables. In principle, the task is to form more general variables from the original large volume of data, but the loss of information contained in the original variables remains minimal. Further information is supplied by the coefficients of correlation of separate variables with the component given. This information together with the weight of the component can serve as the starting point to quantify „weights“ of the separate indicators of the area given.

In order to form homogeneous groups of Regions with similar assessment of the conditions of living then the cluster analysis has been employed (Stankovičová, Vojtková, 2007). The aim

of cluster analysis is grouping of the population of units given, characterized by a group of properties, into several comparatively homogeneous groups (clusters) such, that the objects within the clusters are similar to each other as much as possible, while the units belonging to different clusters are least similar to each other. The outcome of the analysis depends on the selection of variables, the chosen level of distance between the objects and the selected computation algorithm.

Considering the nature of data and the need to form clusters of about the same size, the Ward method (Hebák, 2004) has been chosen based on the Euclidean distances matrix. In order to find out whether there are relationships between the subjective assessment and living in the Regions including a higher share of small municipalities, methods of correlation analysis have been employed (Kába, Svatošová, 2012). All the analyses have been performed using the SAS statistical programme system.

### 3 Results and Discussion

Based on univariate analyses, the level and variation of the separate selected indicators from the 2005 and 2012 years have been assessed as well as changes that happened during the years studied.

Based on high values of the coefficient of variation, the indicators can be discovered having a more significant impact upon deepening of the regional disparities. In 2005 these were the three indicators (see Table 1), i. e., Share of the households with incomes below the subsistence level, Problems with crime and Rate of unemployment. Then in 2012 two indicators - Share of the households with incomes below the subsistence level and Problems with crime.

**Table 1.** Values of the coefficient of variation for the indicators selected

Coefficient of variation	Year 2005	Year 2012
Above 40 %	Share of the households with incomes below the subsistence level Problems with crime Rate of unemployment	Share of the households with incomes below the subsistence level Problems with crime
20 – 39 %	Big troubles with incomes distribution Polluted environment	Big troubles with incomes distribution Polluted environment Rate of unemployment
10 - 19%	Total household incomes Incomes from the State social support Accommodation expenses Accommodation expenses are a heavy loading Household could not afford to cover unexpected expenditure at 8,500CZK	Total household incomes Incomes from the State social support Accommodation expenses Accommodation expenses are a heavy loading Household could not afford to cover unexpected expenditure at 9,300 CZK

Source: Own processing

Considering the changes in the indicator values over the two years studied, then in case of the Total household incomes an increase occurred in all the Regions. In all the Regions, practically, an increase occurred in the Accommodation expenses (except Pardubický Region) and the same holds for the share of the respondents reporting that Accommodation expenses are a heavy loading for them. The Rate of unemployment decreased in most Regions, an increase occurred in the Liberecký, Jihočeský, Královéhradecký and Pardubický Regions. Comparatively big changes have been reported in the Share of households living below

the subsistence level. The highest increase was in Ústecký Region and also in Praha, Středočeský and Vysočina Regions. The most outstanding decrease was in Plzeňský Region. The Share of respondents troubled with crime grew in Pardubický and Vysočina Regions. Environment pollution deteriorated in Středočeský, Královéhradecký, Vysočina and Zlínský Regions. The Share of the respondents who cannot afford to cover an unexpected expenditure at 8,500 (9,300) CZK increased in most Regions, except the Praha, Středočeský and Vysočina Regions.

In order to find out what indicators are decisive for the conditions of living quality, the principal component analysis has been applied. In 2005, 93 % of the total variance were explained by means of four components, in 2012 then the four components explained 92 % of the total variance. The variables that were most significant in the separate components over the years studied are given in Table 2.

**Table 2.** Principal component analysis outcomes

Component	Year 2005		Year 2012	
	Component weight	Indicator	Component weight	Indicator
I.	0,43	Incomes from the State social support Rate of unemployment	0,45	Incomes from the State social support Rate of unemployment Share of households living below the subsistence level
II.	0,33	Crimi Environment pollution	0,33	Crimi
III.	0,09	Accommodation expenses Share of households living below the subsistence level	0,08	Accommodation expenses Accommodation expenses are a heavy loading
IV.	0,06	Accommodation expenses are a heavy loading	0,07	Environment pollution

Source: Own processing

As it is seen from the Table 2, some changes happened over the years studied. The most significant changes appear in the ranking of the indicator Share of the households living below the subsistence level and in perception of the problem of Environment pollution. The Share of households living below the subsistence level appeared in 2012 in the first Component already, while in 2005 it was in Component III only. This can signal a problem of increasing numbers of socially weak households in some of the Regions. On the contrary, the problem of Environment pollution correlated at most with the Component IV in 2012 (with Component II in 2005). Hence it seems, satisfaction with the state of environment improved in most Regions.

**Table 3.** Groups of Regions with similar situation in the conditions of living, (cluster analysis outcome)

Year 2005	Regions above average	Praha, Středočeský, Jihočeský, Plzeňský, Vysočina,
	Regions about average	Pardubický, Královéhradecký, Středočeský, Zlínský, Liberecký, Olomoucký
	Regions below average	Karlovarský, Ústecký, Moravskoslezský
Rok 2012	Regions above average	Jihočeský, Plzeňský, Vysočina, Praha
	Regions about average	Středočeský, Liberecký, Královéhradecký, Pardubický, Jihomoravský, Zlínský, Olomoucký
	Regions below average	Karlovarský, Ústecký, Moravskoslezský

Source: Own processing

It is obvious from Table 3 that no significant changes occurred in the positions of the Regions. The weakest party in a long-term look is set up of the Karlovarský, Ústecký and Moravskoslezský Regions.

After having performed analyses in the models including the objective or subjective assessment only, we are reaching different outcomes.

In order to carry through a more intuitive comparison, each model obtained an aggregate measure evaluated using the point method, with the aid of which the Regions could be ranked according to the standpoint given. The core of the point method evaluation is the comparison of the actual value with the average of the given measure (the average=1). The total overview is presented in Table 4.

**Table 4.** Order of the Regions according to the aggregate indicators

Region	Total assessment		Objective assessment		Subjective assessment	
	2005	2012	2005	2012	2005	2012
Praha	3	8	1	4	12	10
Středočeský	8	10	4	5	9	11
Jihočeský	2	1	3	2	3	2
Plzeňský	6	2	5	1	7	9
Karlovarský	13	12	12	8	13	13
Ústecký	14	14	14	14	14	14
Liberecký	10	9	7	11	10	6
Královéhradecký	7	5	9	9	5	3
Pardubický	4	7	10	10	2	5
Vysočina	1	3	2	3	1	4
Jihomoravský	5	6	6	6	6	7
Olomoucký	11	11	8	12	8	8
Zlínský	9	4	11	7	4	1
Moravskoslezský	12	13	13	13	11	12

Source: Own processing

We can see from the total comparison that the order of Regions in the total assessment over the years studied shows minor changes only in most of the Regions. An improvement of the situation appears in Zlínský and Plzeňský Regions, the position of Praha and Pardubický Regions deteriorated seriously. When a comparison is done based on the objectively reasoned indicators a part, and then based on those reasoned subjectively, quite a different picture is obtained in most cases. The Ústecký, Karlovarský and Moravskoslezský Regions steadily remain those weakest. The Praha, Středočeský and Plzeňský Regions belong to the Regions with conditions for living above average - as assessed objectively - but they fall through to those below average when the subjective assessment takes place.

Taking into account the differing results of assessment by the objective and the subjective looks and also the better subjective assessment outcomes in the Regions with larger numbers of smaller municipalities, the relationship between the share of respondents living in communities up to 1,000 inhabitants and the rank of the Region has been examined using Spearman coefficient of correlation. The Praha Region was excluded from this examination. In both of the years studied there was a weak correlation between the share of respondents from small municipalities and the rank of the Region when ranked according to the objective viewpoints, while when the subjective assessment was considered, the correlation rose to medium strong and stronger. In 2005 the correlation made it up to 0.73 and in 2012 to 0.64.

## 4 Conclusion

Several basic notions come up from the analyses performed:

- In the current assessment of regional disparities in the conditions of living the strongest voice belongs to those indicators that represent economically and socially weak households (Incomes from the State social support, Rate of unemployment, Share of households living below the subsistence level)
- The crime problems are a comparatively significant factor, too, but this does not hold in all the Regions. This indicator shows a relatively high variation and it is perceived to be a problem rather in the Regions with a high share of inhabitants of cities.
- The discontent with state of the environment (pollution) declined.
- There are no big differences in the assessment of the Regions over the years studied.
- In both of the two years under study a difference appeared in the assessment according to objective indicators as compared with the respondents' subjective assessment.
- The subjective assessment of the conditions of living is significantly better in the Regions with a higher share of inhabitants living in small municipalities (up to 1,000 inhabitants).

A conclusive statement can be offered here at the end of the paper that assessment of the conditions of living or of the population's level of living represents an important task, especially as connected with the even development of lands. It is a difficult task at the same time, since such indicators have to be chosen for the analyses that are in the position to cover the problem fully. Hence it is not possible to be based on the quantitative and objectively obtained measures only, it is necessary to include indicators covering the subjective assessment of the conditions of living, too, since those can offer information important but hardly obtainable otherwise.

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## Pilot analysis of key factors in honey consumption

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**Annotation:** In this year the internal grant project No. 20151030 on FEM CULS Prague has been started. Its aim is identify to consumer's perception of honey quality in connection of his/her purchasing behaviour. Before the main survey of the project a pilot study of consumer behaviour key factors was conducted. The topic of this paper is a presentation of its results. The used method of the pilot study is a questionnaire survey for basic factors honey consumption and consumers' willingness to pay a higher price for honey. Subsequently dependences are determined and tested in SPSS programme. For increasing honey consumption it should be recommended to focus on the youngest age group of people mainly. The main motivation for consumers to pay higher price may be a certificate of quality of honey and origin of honey from the same region where the consumers live in. This certification can bring higher sales with the small costs to beekeepers and higher value of honey for consumers.

**Key words:** Honey, consumption, consumers, dependence, sale, certification.

**JEL classification:** Q13

### 1 Introduction

Pollination services are known to provide substantial benefits to human populations and agriculture in particular (Breeze et al., 2011). Insect pollination is thought to benefit the yields of 75% of globally important crop species and is responsible for an estimated 35% of world crop production (Klein et al., 2007). Economically, the value of insect pollination services to crop agriculture has been estimated at 153 billion euro per annum globally (Gallai et al., 2009). Among the pollinating insects, bees are one of the most important and specialized groups (Danforth et al., 2006).

The predominated group in the Czech Republic is group of hobby beekeepers behaving to 15 hives. This group provides effectively uniform pollination services in the countryside. At the same time it gives the ideal conditions for the production of regional foods and opportunities for regional supply throughout the country as well as. Therefore, the maintaining competitiveness of the beekeeping is crucial factor for the future of agriculture production and the ecological care about landscape. One point of view is health of bees, a quality of beekeepers work and using of some supporting applications (e.g. Google Maps) (Halbich and Vostrovský, 2012). Other point of view is economics of the beekeeping including costs and potential revenues.



One of the factors that adversely affects Czech beekeeping is relatively low consumption of bee products, especially of honey. Honey consists wide range of sugars, minerals and vitamins and their proportions are varying from honey to honey depending on their quality and botanical origins (Saadatmand, 1999). In the Czech Republic, the consumption of honey is between 0.5 - 0.9 kg per capita per year (Ministry of Agriculture, 2014). Although, it is a growing trend, in developed European countries the consumption of honey is three times higher.

In the Czech Republic there are no uniform price levels and there are significant price differences between regions (Smutka et al., 2013), but the honey's price is very similar in regions. The price differences of honey are between direct sale, market sale and sale to repurchase organization. The average market price is slightly increasing in time, e.g. in 2010 it was at 127.70 CZK / kg of honey, in 2013 the price was at 150.00 CZK /kg, the repurchase price was 87 CZK / kg in August 2013 (CUB, 2014).

The beekeepers can use some action for a good opportunity of advertising and new selling possibilities for beekeepers. A beekeeper who fulfils the requirements given by The Standard CUB No.1/1999 is allowed to mark his/her honey by the certificate "Czech honey", which for a consumer means guaranteed high quality of honey (The Standard CUB No.1/1999). The beekeepers can use the competition "Czech honey of year 20xx" or project "honey as it should be", when a beekeeper obtains for its honey a unique number and trademark. The prices for beekeepers to these actions are 980 CZK for Certificate Czech honey, 1120 CZK for competition and 1300 CZK for trademark "honey as it should be". The beekeeper can reduce each of these prices of the subsidy 800 CZK.

So the knowing of honey consumer behaviour respective key factors of honey consumption is one necessary way to change this situation. The economy of honey production has already been researched to a great extent (Wenning 2001; Chaudhary 2009), and likewise, attention has also been paid to consumer behaviour (Wilcock et al., 2004; Hes, 2009; Zhang, 2011); however, to the author's knowledge, there has been no research on honey consumer behaviour in the Czech Republic.

In this year the internal grant project No. 20151030 on FEM CULS Prague has been started. Its aim is identify to consumer's perception of honey quality in connection of his/her purchasing behaviour. Before the main survey of the project a pilot study of consumer behaviour key factors was conducted on one group of honey consumers. The paper targets to identify basic dependence of factors of honey consumption (without a view of sensory aspects) and to obtain answers to following important questions:

1. What is preferred kind of honey? And have consumers enough information about typical colours of honey?
2. Is the honey consumption dependent on the income of household?
3. Is the honey consumption dependent on the other factors: gender, age, residence?
4. Does current price of honey depend on the factors as: gender, age, residence, and household income?
5. Does consumers' willingness to pay a higher price for honey, keep quantity of purchase the same, and depend on gender, age, residence, and household income?

At the end the recommendations for the beekeepers and following research are formulated.

## 2 Materials and Methods

Methodology is based on a questionnaire's survey as a pilot analysis for honey consumer behavior. The questionnaires were distributed within the Czech Republic from the beginning of August 2014 till the end of September. Their return was about 80 - 90 %. The questionnaire was answered by 258 respondents, 195 women and 63 men. All respondents are honey consumers. It was a target group. 69 % of respondents live in cities; remaining 31 % of respondents live permanently in the country. 51.55 % of respondents have university education, and then the most frequent level of education is secondary education with GCSE (36.82 %).

The questionnaire consists of 31 questions. The question "I am not a honey consumer" was the base filter question. The questionnaire contains 16 questions about honey, 8 questions about mead, 1 question about other bee products and 6 questions are identifying questions, which breakdown respondents into some categories according to gender, age, number of children, place of living, level of achieved education and income of household (they are called demographic questions). These questions were put at the end of the questionnaire according to general recommendations for questionnaire designing (Reichel, 2009). All data obtained from the survey are categorical (qualitative), specifically nominal data.

Firstly, individual answers to appropriate question were counted and written in an absolute form or in relative values by using percentages. Next, chart builder as a visual tool was used for a better interpretation of results. The contingency tables (cross tabulations or cross tabs) was used- in contrast to simple frequencies, where only one question was examined, this method allows to find association between two questions. It means to find out if there is dependence between the mentioned two questions (variables). The most used test of independence for contingency tables is Pearson chi-square statistic. The test is based on comparison of empirical (observed) frequencies and expected frequencies in cells of contingency table (Taylor, 2007). In some cases, question could be answered by an "undefined" answer; e.g. "How high is the income of your household?" could be answered by: "I do not want to specify". These respondents were excluded from the corresponding contingency table testing.

Having been proved dependence between two questions, it is suitable to find out how it is strong by using measures (coefficients) of association. The most appropriate coefficient for purposes of this paper is the Cramer's coefficient V, because the value does not depend on dimensions of the contingency table (it means on numbers of categories of each variable). For nominal variables the value of Cramer's coefficient V ranges between  $< 0; 1 >$ , where the value 0 means no association between variables and the value 1 means perfect association between variables (Hendl, 2004). The own processing of returned data was done with using the software SPSS Inc (PASW Statistics 18) and Microsoft Excel.

## 3 Results and Discussion

First of all the preferred kind of honey was identified. The majority, 38.17 % of consumers, do not differentiate the kind of honey. 19.92 % of consumers prefer flower honey, 31.54 % of consumers prefer honeydew honey and the remaining small share of consumers use creamed and mixed honey as a matter of priority.

In the Czech Republic it is usual that the typical colour for flower honey is light and for honeydew honey dark (Dupal, 2004). A question is consumer knowledge about typical colour of honey (as one factor of purchasing decision). So the first hypothesis is that consumers still not have enough information about typical colours of honey. The main idea of this investigation was following: If a consumer prefers e.g. flower honey, he/she should tick the preference of light honey, if he/she knows the connection between kind and colour of honey. Vice versa, the one who prefers honeydew honey should tick the preference of dark honey. Of course, who does not differentiate kind does not differentiate colour of honey, as well.

This relation was tested by with the result Pearson Chi-Square = 0.000 and Cramer's V = 0.481. That means there is an association between kind and colour of honey (even for  $\alpha=0.01$ ), but the association is medium strong and honey consumers know relatively the relation between kind and colour of honey.

Another tool of measurement of consumer's knowledge can be the summary of well connected answers (flower honey-light colour, honeydew honey-dark, I do not differentiate-I do not differentiate), in total, 58.5 % of consumers chosen "the right combination". In conclusion, the first hypothesis was confirmed: consumers still do not have enough information about typical colours of honeys.

Most of consumers ingest between 2.5 kg (55.60 %), almost 30 % of consumers do not ingest more than 1 kg and only 2.49 % of respondents have consumption more than 10 kg. The average value of annual honey consumption within this survey is 3.31 kg per one consumer. It is more than the official value (0.7 kg) (Ministry of Agriculture, 2014).

It is typical that people buy more products or buy higher volume of a product if they have higher income. The second hypothesis is that the honey consumption is dependent on the income of household.

This relation for honey will be measured below in table 1 by Chi-Square test. Due to methodology, consumers, who answered "I do not want to specify my income" were excluded from the testing (so 213 consumers were tested finally). The most frequent (60 consumers) is combination of 16,000 - 30,000 CZK and 2 - 5 kg and then combination of 31,000 - 50,000 CZK and 2- 5 kg (28 cons.)

**Table 1.** Income of household and annual consumption of honey

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.605 <sup>a</sup>	6	0.197
Likelihood Ratio	9.287	6	0.158
Linear-by-Linear Association	0.002	1	0.967
N of Valid Cases	213		

*a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 2.33*

**Sources: own processing, 2014**

According to Pearson Chi-Square = 0.197 it is obvious that the second hypothesis were not confirmed: there is no association between the honey consumption and the income of household - not even for the level of significance  $\alpha = 0.10$ . A possible reason could be that honey is not a typical good with the typical economic behaviour. People with higher income do not buy more quantity of honey. It is important knowledge for buying process planning.

Next three factors were tested according to the third hypothesis: The consumption of honey depends on some other factors – gender, age and permanent residence. The results from the testing are in the table 2 below.

**Table 2.** Other factors and annual consumption of honey

Factor	p-value of Chi-Square	Dependence ( $\alpha=0.05$ )	Dependence ( $\alpha=0.1$ )
Gender	0.590	independent	independent
Age	0.044	dependent (Cramer's $V=0.164$ )	dependent (Cramer's $V=0.164$ )
Permanent residence	0.228	independent	independent

Sources: own processing, 2014

By testing other three factors that could have an association with honey consumption, it has been founded out that honey consumption is not dependent on factor gender and permanent residence.

Age is a factor that influences the honey consumption. So, there is an association between age and honey consumption even on the level of significance  $\alpha = 0.05$ , but the association is low (Cramer's  $V = 0.164$ ). After better examining this phenomenon it was ascertained that young consumers till 30 years of age have the lowest honey consumption. Consumers older than 30 years have averagely similar consumption, which is nearly by 1 kg higher than in the case of the first age group. Thanks to the age composition (the sample includes more young people), it can be given weight to this finding. It should be recommended to focus on the youngest age group to increase its honey consumption. One opinion is, that young do not have "their own" beekeeper and they do not want to buy it in hypermarkets or they don't know or don't need the other possibility using of honey (for baking, as a treatment etc.).

So, honey should become more available for these young people mainly through new channels enabling them to buy it with more information about possibility of honey using.

The next important part of research was identifying factors for buying a honey. The absolute majority (62.66 % of consumers) answered, that the most important factor for buying a honey is the person who sells them the honey. This person means not only a beekeeper as a seller, but it may to mean origin in general (e.g. Czech honey). On the other side, the relatively high number of consumers answered: "I do not know since I will have a seller to help me". It implies that there is a significant number of consumers who require a seller to give additional information about the product. Then the most frequently chosen possibilities were "the sensory properties" (20.33 % of consumers) and "the kind of honey" (12.03 %). 27.8% of consumers said that they should never buy granulated honey. Only 8 consumers (3.32 % of cons.) ticked price of honey as the most priority factor.

The biggest part of consumers pays for honey till 120 CZK. Consumers pay currently for 1 kg of honey in average 108.0 CZK (if 90 CZK is taken as the lower bound).

The price of honey depends on many factors and varies in wide range. The authors wanted to use achieved data and find out if there is a factor that may influence the price of honey in general (without taste, because the taste research is other part of this project). The next hypothesis is that the (current purchase) price of honey is dependent on some other factors (gender, age, permanent residence and income of household. The procedure of testing with contingency tables is the same as was described in the case of examination of dependency

of the kind on colour of honey as well as honey consumption on income of household. Thus, only the results will be mentioned (see Table 3).

Due to methodology, consumers, who answered “I do not want to specify my income” were excluded from the testing as well as consumers, who answered “my friends gives me honey for free” and “I do not know another member of household procures honey” were excluded from this testing (so 149 consumers were tested finally).

**Table 3.** Dependence of current price of honey on

Factor	p-value of Chi-Square	Dependence ( $\alpha=0.05$ )	Dependence ( $\alpha=0.1$ )
Gender	0.700	independent	independent
Age	0.461	independent	independent
Permanent residence	0.522	independent	independent
Income of household	0.196	independent	independent

Sources: own processing, 2014

In the table 3 there are the results of examinations of four factors that could influence the price, for which the consumers buy honey at present. None of them has any statistical relation to the current price of honey.

The next question dealt with consumer's readiness to pay maximally for 1 kg of honey. The majority of consumers lie between 101-130 CZK. So, consumers are prepared to pay for 1 kg of honey in average 120.3 CZK (if 90 CZK is taken as the lower bound). It was discussed how much extra are consumers disposed to pay in comparison to current price? 16.1 % of consumers pay the maximum price for honey at present and they are not ready to pay more. 32.89 % of them are ready to pay 10 CZK more, 26.17 % of consumers 20 CZK more. None of consumers answered that he/she is prepared to pay less than he/she pays currently. The final hypothesis says that the preparedness of consumer to pay more than current purchase price dependent on some other factors (gender, age, permanent residence and income of household).

In the table 4 there are the results of examinations of four factors that could influence the maximum price, for which consumers are ready to buy honey. Gender and permanent residence seem to be factors that influence the preparedness of a consumer to pay a higher price for honey without any change of purchased quantity, but both dependences are weak (low Cramer's V). Women are ready to pay 119.73 CZK and men 122.54 CZK for one kg of honey, if 90 CZK is taken as the lower bound. From view of permanent residence: Consumers living in the country are ready to pay 119.10 CZK and consumers living in cities 121.00 CZK for one kg of honey, if 90 CZK is taken as the lower bound.

**Table 4.** Preparedness of consumer to pay a higher price for honey without any change of purchased quantity on

Factor	p-value of Chi-Square	Dependence ( $\alpha=0.05$ )	Dependence ( $\alpha=0.1$ )
Gender	0.071	independent	dependent (Cramer's V=0.220)
Age	0.149	independent	independent
Permanent residence	0.062	independent	dependent (Cramer's V=0.223)
Income of household	0.594	independent	independent

Sources: own processing, 2014

More than half of consumers (55.60 %) are ready to accept even higher price than the stated maximum price within previous question and are disposed to maintain the same purchased quantity. 22.82 % of consumers would find another supplier, 16.18 % of consumers would decrease purchased quantity and 0.41 % of them (1 consumer) would replace honey by a different sweetener (by a substitute of honey).

#### 4 Conclusion

The paper targets to identify basic dependence of factors of honey consumption without a view of sensory aspects. The answers to pre-formulated questions are following:

Consumers still prefer dark honeydew honey to light flower honey, but many consumers do not differentiate kind or colour of honey.

Age is a factor that influences the honey consumption. So, there is an association between age and honey consumption even on the level of significance  $\alpha = 0.05$ , but the association is low (Cramer's  $V = 0.164$ ). For increasing honey consumption it should be recommended to focus on the youngest age group of people mainly (thanks to higher number of young people in the sample) it can be given higher importance to findings and recommendations regarding this group of age), which should become the target group (through advertising), because they represent a big opportunity for sales of honey. Young people should be habituated to consume honey. The possibilities of using honey should be taught by parents since children's age, by lectures on bees and bee products within elementary or secondary schools.

The lowest acceptable price of 1 kg of honey is 120 CZK. In comparison with the market price 150 CZK / kg in 2013, the quoted price is still very low. The reason is that some small beekeepers sell their honey under 100 CZK / kg, and so 120 CZK / kg seems to be expensive. The repurchase price was 87 CZK / kg in August 2013. This way of selling is very simple, but direct selling can bring more money. Gender and permanent residence seem to be factors that influence the preparedness of a consumer to pay a higher price for honey without any change of purchased quantity, but both dependences are weak (low Cramer's  $V$ ). More than half of consumers are ready to accept even higher price than the stated maximum price within previous question and are disposed to maintain the same purchased quantity. The remaining respondents require some compensation. Antoušková (2014) says, that in general, it is possible to sum up that for most products local people are more likely to know regional certified products and they are more likely to know about the certification in comparison to tourists. Due to this fact, the main motivation for consumers to pay higher price may be a certificate of quality of honey and origin of honey from the same region where the consumers live in.

For comparison, the sale of 350 kg of honey to purchase organization for 79 CZK gains to beekeeper revenues of 27.650 CZK. When the same amount (but certified honey) is selling for 130 CZK, the revenue will be 45.500 CZK. Certification costs Czech honey is (when including subsidies) only 180 CZK.

The recommendation for the following research activity is to find a honey product with optimal trade characteristic combinations for consumer by a multicriterial analysis, because honey is not a typical good with the typical economic behaviour.

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## ICT Influence on Supporting Agribusiness Development

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**Annotation:** Quality of the information system significantly influences the competitiveness of a company. Information and data saved in the information system have become one of the most important corporate assets, especially when used in connection with relevant experience and knowledge. Farmers need to make their decisions on the basis of quality data and information. Primary data are typically recorded while their content is not exploited at all - unless they are further processed and used for analyses, modelling and simulations. Agriculture is a very specific sector - it is therefore very hard to use modules of the management information systems made primarily for other industries. Farm management information systems allow users to perform analyses, simulations and modelling. In the Czech Republic, information and data mining for managerial purposes in the agrarian sector has been on a very low level in the long-term. The survey showed that only 7% of companies use Business Intelligence software while almost 80% of companies struggle with the lack of information which they cannot retrieve from their information system. Moreover, 8% of the companies make their decision intuitively, without having their decisions justified. In order to enhance the support for decision-making processes, a structure suitable for data processing and use (reports) has been designed. Proposing a convenient model that would allow simultaneous access to data from all units of the company should result in a significant competitiveness increase during the entire decision-making process. The managers have to define – based on their knowledge and experience – the data and information to be converted into a consolidated and integrated database for the Business Intelligence.

**Key words:** Farm Management Information System, Business Intelligence, report, knowledge

**JEL classification:** Q13

### 1 Introduction

One of the most prominent factors in nowadays economic environment is the company's ability to process information at the highest possible precision rate. If a company strives to retain or increase its competitive edge, its data and information processing requires a decent use of technological innovations. The significance of farm management information systems is indisputable. Lewis (1998), for example, stated that "innovative tools for computer and database administration have the potential to increase both the quantity and quality of information available for decision-making." Only a few FMIS use Internet data processing technologies and the subsequent added values. In the Czech Republic, an information system of this kind is not currently available. The Zeman company for instance offers basic information system modules for agriculture – e.g. accounting, payroll, livestock, herd turnover, land registration etc. These modules do not enhance neither decision-making nor

economic modelling – they just serve as a data repository with the ability to file tax returns and to prepare various reports required by the government. It is fairly difficult to get the data and information in some form suitable for decision making. Data and information are not integrated and it is problematic to get the data in time series.

The present paper is aimed at verifying or denying the two hypotheses:

**H1** – decision-making software in agricultural enterprises – the survey is expected to assess the percentage of enterprises using Business Intelligence software results in their decision-making processes.

**H2** – influence of both the information acquired and management skills on the quality of the decision-making processes.

A survey based on the hypotheses has been carried out in primary production agricultural enterprises. The hypotheses related to management outputs and outputs enhancing multi-functionality in agriculture were determined on the basis of knowledge and experience of agrarian specialists. The objectives of the research were the following: to create an appropriate environment and a database enabling decision-making simulations in all enterprise units/departments and to create a suitable environment promoting multifunctional activities – processing activities, agro-tourism etc.

The research related to FMIS (Farm Management Information Systems) has been so far focused on decision-making of biological models – e.g. yield forecast (Australian project focused on supporting decision-making processes related to growing wheat – WHEATMAN system) or outdoor field operations – machinery, fertilisers consumption, speed control with a view to the yield planned, soil nutrient content and other technological decisions.

Automated systems development in agriculture has recently gained more attention which led to the fact that research teams got involved in developing rational and adaptable systems based on behavioural approach (Sørensen et al., 2010). Combination of new communication technologies, sensor systems, GPS and GIS boosted the development of new systems for crop growing and harvesting (Slaughter et al., 2008). Robotic applications in agriculture, forestry and horticulture have been developed to carry out different operations – robotic milking, robotic tomato and strawberry harvesting etc.

Precision agriculture is technically and computationally more complex than traditional agriculture. This complexity derives not only from the practical implementation of precision measurements and precision applications but also from work with the information system which is the key element in precision agriculture system.

As far as the conventional FMIS are concerned, the outputs (i.e. reports) usually take the form of documents and spreadsheets. The structure of current outputs (reports) is pre-defined and the farmer receives reports at regular intervals – it means that only the data in the time interval in question vary. The structure of output requirements remains unchanged and is not feasible within current systems. Changing the output structure is not only a long-term process but it is also connected with considerable financial costs. Precision agriculture enables on-line creation of the output structure and is implemented with a much greater level of accuracy in terms of the individual lots, stables, machinery, equipment, employees – based directly on the requirements of managers. “Not just large enterprises need to know their environment and make good decisions. Also, it does not have to be a key change. There are small everyday decisions which require information.” (Molnár 2003) This implies the importance of decision

support software for both large and small enterprises. The opportunities of data, information and knowledge connection in agricultural companies is also investigated by Brožová (2011) and Fountas et al. (2015). This issue has long been involved also Kasumov (2015).

Data and information arise fast in all departments of agricultural enterprises and their volumes are truly enormous. In addition, there is almost no data integration in the farms. Data and information are saved in modules of the individual departments and are mostly used for further processing solely in their departments of origin where they are also saved. As a result, executive workers and managers can hardly obtain all information related to the whole enterprise on one spot. If they require access to complex data, they are forced to look them up in the individual modules and process these outside the information system. Spreadsheets seem to offer a very suitable environment for data processing as most users are able to make use of their functionalities. However, speed and suitability are the main drawback of this method. It is only appropriate as a substitute and temporary solution.

In 2009, the EU funded a project that has brought a new model and a prototype of the new farm management information system. In the study accompanying the project, Sorensen et al. (2010) defined and analysed the system boundaries and also identified relevant FMIS decision-making processes. A related study of Lawson et al. (2010) analyses potential benefits of implementing farm management information systems in Germany, Greece, Denmark and Finland. The study revealed that "more than 40% of surveyed enterprises in Germany, Denmark and Finland were not sure about the usefulness of information systems." (Lawson et al., 2010). However, the authors also concluded that there is a need for further research regarding the applicability of innovative technologies and benefits of the information systems. The FutureFarm research project continues to identify the content of "processes" of the information flow model entities that actually represent the use of information processes. Moreover, it identifies "Information" of the entities representing data elements (Sorensen et al., 2011). Data collection for the sake of farm information systems is also dealt with by e.g. Steinberger et al. (2009). Software architecture for the farm management information systems in precision agriculture is researched by Nikkilä et al. (2010) who specializes in integrating the individual departments of an enterprise and application in management processes. Research planning and management procedures as well as judgment procedures need to be adapted to fit transdisciplinary requirements. The cases demonstrate that the process of connected value development is unique for each project; there is no standard recipe. (Bouma et al. 2011) A mobile application allowing data access in a given time and on spot will be a real contribution according to Simek et al. (2014). The issue of the use of the option of reporting is also addressed in the Silerova et al. (2013). The presence of decision supporting software in companies is necessary nowadays, it directly affects their competitiveness, market position and future expansion. It is very important for agricultural companies too and should not depend on the size of the company (given by acreage, production structure or number of employees) and particularly on its ICT equipment.

## 2 Materials and Methods

The present article was elaborated on the basis of the following scientific methods: analysis, synthesis, induction and deduction. The theoretical part stems from secondary resources, scientific and research papers. Based on the hypotheses, a questionnaire was compiled. It comprised 20 questions - 18 questions were closed and 2 were open. The total of 81 agricultural enterprises were addressed reaching the response rate of 85,19 %

(69 respondents reacted to the questionnaire) The structure of chosen businesses corresponds with the national structure. Out of 81 businesses, 27 have area of more than 2000 ha, 32 have area between 1000 and 2000 ha and 22 businesses have area between 400 and 1000 ha. All respondents have both crop and livestock production, 15 businesses have also other activities – agrotourism, hydraulics manufactory, milk or meat processing, feeds production etc. Subsequently, based on the survey results, a direct enquiry was carried out in 30 enterprises. The questions during the inquiry were based on the long term experience of authors (cooperation with practice) in the areas of agriculture, data, information and knowledge exploitation and primary production management. The outputs of the survey were used to design the FMIS structure.

Despite obvious benefits of the FMIS, research in this area is very rare in the Czech Republic and almost none in the field of management support. There is still no complex information system specializing in crop production, animal production, technical services, finance and management to support decision-making processes of farmers.

### 3 Results and Discussion

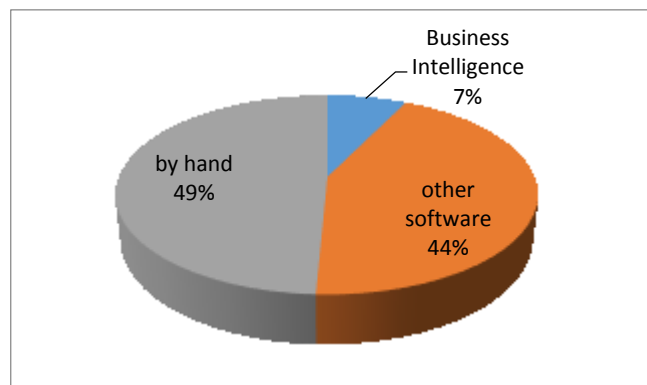
The importance of using the individual modules of information systems at all management levels is still on the rise (operational, tactical and strategic). Management requires processed data and information almost on a daily basis. It would be optimal if each manager was able to work with "his/her" data by himself/herself and independently. If this was the case, the managers could formulate software requests meeting their needs the most. Both very good understanding of the data processed and detailed knowledge of the company operations are a must. Managers at all levels must be able to retrieve comprehensive data in order to model and simulate various situations that may occur. Thanks to high-quality data, they will have an opportunity to make better, more qualified decisions, which affects substantially the competitiveness of their businesses.

Many executive workers on managerial positions require regular submission of reports from "their" reporting departments. This is where various significant problems arise:

1. Report suitability – Managers deal with a wide range of issues affecting the position of the company in a highly competitive market environment. In case of predefined outputs, only the data generated are changed (updated) and, as a consequence, managerial requests are not always directly met.
2. Up-to-date data - Reports are often created over a database supporting tactical and strategic management. At the same time, huge data volumes lead to the creation of different databases into which chosen company data are exported. The requests then arise over those data. Whether the data are up-to-date or not, is affected by many factors – line of business, production turnover rate, volume of the data saved, ... (Kasumov, 2015)

The questionnaire results related to H1 show how agricultural enterprises currently process and use their data to make decisions. Fig. 1 shows that only 7% of companies use the Business Intelligence software, 44% use a different software - Excel (34 %), a database environment (10 %), and 49 % of companies process data from the information systems by hand while their outputs mostly take the form of spreadsheets.

Fig. 1. Methods of Data Processing Management



Source: own

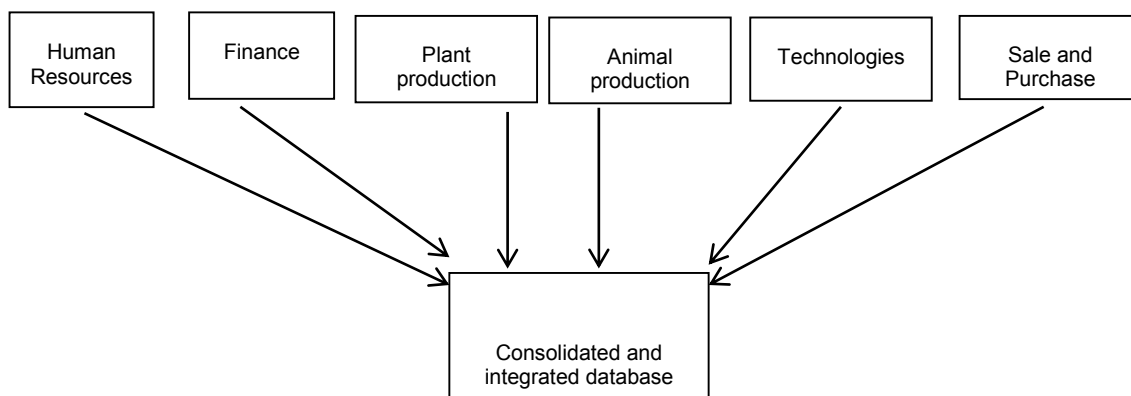
In the direct enquiry, the question related to "using data for decision-making" was also raised in order to clarify and elaborate further on the data shown in Fig. 1. Managers and executive workers still stick to using "pen and paper" since it is the cheapest and the most available option for them. Using Excel spreadsheets and database environment depends on IT skills and knowledge of the individual managers. Their use is also influenced by the possibility to export data from the individual information system modules into Excel or database environment. Low use of the Business Intelligence is affected by several factors - the possibility of integration with the existing modules employed in farms, price, costs and supply.

Hypothesis 2 was pursued in several questions - "Do you use software for performing analyses; is your decision affected by the quality of the software outputs; do you have the opportunity to perform simulations in your software." The answers to all the above-mentioned questions were identical - 79.9% of respondents replied "NO". Positive "YES" answers were recorded in the farms and enterprises who have implemented the Business Intelligence and use database environment. Only 18% carry out analyses in the Excel environment, however, they do not use this environment for simulations. Direct enquiry method was used, emphasising the use of data and information in connection with managerial experience and knowledge and their overall impact on the quality of decision-making processes. It can be stated that decision quality is higher in the companies where data and information saved is systematically used. The respondents primarily appreciate the opportunity to perform simulations, the output quality and in particular the fact that these outputs are up-to-date. Those respondents who cannot use the environment in question perceived lack of information for making well-informed and qualified decisions. Most of their decisions are made intuitively being significantly influenced by their knowledge and experience. 8% of the responses clearly stated that the lack of information had a negative impact on the decisions made at a particular moment. The respondents who do not use the Business Intelligence actually make their decisions only on the basis of atomized data resources and are hereby very often negatively affected by that. The Business Intelligence usage did not differ across the separate groups of agricultural companies based on their size. The usage was influenced by the management's demands on the up-to-dateness and quality of data and the software's ability to carry out simulations.

The results of the survey show that the managers lack data and information to make their decisions in most cases. It may be mentioned that the volume of data and information saved in corporate databases is currently very high but in most cases unavailable to managers. A lot of primary data are not very suitable for performing analyses and simulations. It is essential

to pre-process these data and subsequently create a database suitable e.g. for the Business Intelligence.

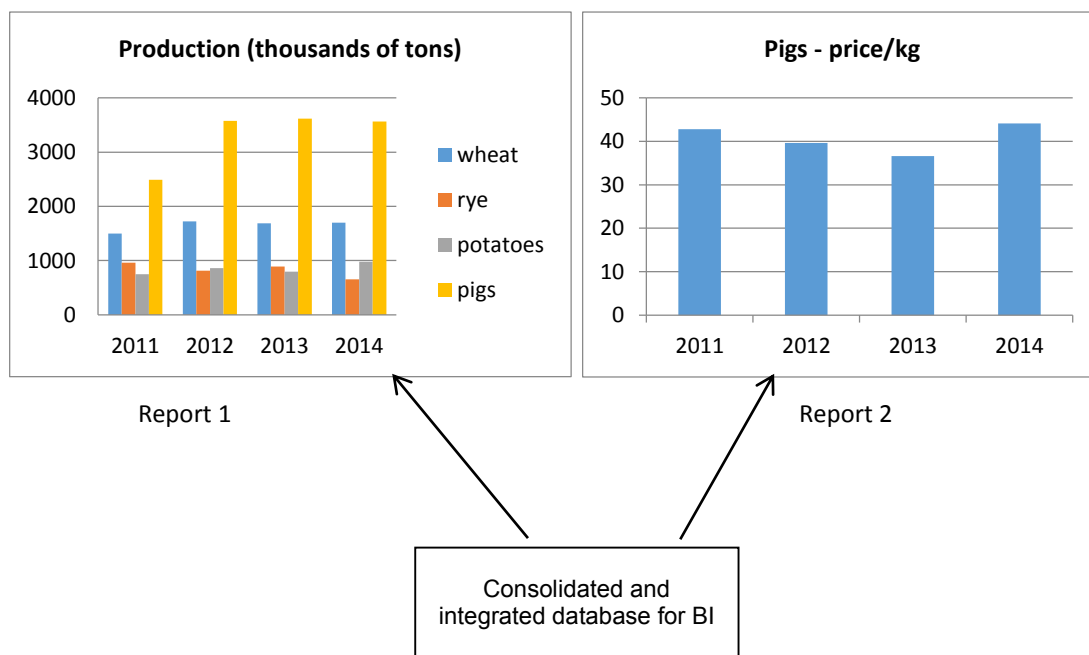
Fig. 2. Structure proposal



Source: own

Qualified, competitive decision-making requires timely up-to-date data from all the departments - production, finance, HR, sales. The proposed structure will enable the creation of an environment that will provide support for the decision-making processes. Personalized outputs (reports) performed on the basis of specific managerial requirements will be a vital element in the whole decision-making process.

Fig. 3. Data used for reports



Source: own

The outputs (reports) represent consolidated data from crop and animal production in Report 1 and integrated data from animal production and finance in Report 2. The main advantage of the database stems from specific data accessibility in line with user requirements and user rights. Models can be created allowing users to make forecasts in crop production, animal

production, business, finance, human resources or company as a whole – internal company data are combined with external data (market price estimates, sales volumes and more) with a view to create the models as effective as possible. In the current highly competitive economic environment, it is important not only to use the latest scientific findings, but also to get actively involved in the processes of their implementation.

It would be optimal if a manager was able to create a report in a given time by himself/herself according to his/her requirements and preferences, and then, based on the up-to-date output, would make an informed decision.

#### **4 Conclusion**

Agriculture is currently becoming a knowledge-driven sector where the knowledge of employees (i.e. data and information acquired) is a key profitability factor. FMIS tools are an integral part of the business and information strategy of a company. Nevertheless, it is not the only opportunity for increasing the business competitiveness. The use of Business Intelligence tools in farms and agricultural enterprises is very low – a mere 7% in the sample. Research in farms focused on the use of FMIS, to that extent, according to our knowledge, has not been performed (research was carried out in holdings whose size ranged from 400 hectares to 3,145 hectares). The results are very difficult to compare with the results of other authors – e.g. Sorensen et al (2010), Nikkilä et al (2010), Lewis (1998). These authors reported that many farmers are still not interested in FMIS because decisions based on intuition, tacit knowledge and routines acquired from previous generations. For farms in the Czech Republic, the significance of FMIS is much higher because given the size of the farms decision-making processes must be more sophisticated.

Managers themselves are negatively affected by the lack of information when making their decisions. Proposing a suitable model that would allow simultaneous access to data from all units/departments of the company should result in a significant competitiveness increase during the entire decision-making process. The proposed model must allow integration of all types of data in the company – various production types, economics, human resources, new technologies, commerce – and connection with external data. That case will enhance the quality of decision support processes. Incorporating precision agriculture tools in the production – sales – employees – finance chain is highly important. Precision farming will fully enhance the company development only if all company units are interconnected. This interconnectivity is possible only when modelling data from all ongoing company operations. Tailored architecture designed for an agricultural enterprise will make this come true.

#### **Acknowledgements**

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## Increase in work efficiency with information sources in areas of agriculture and rural development using UX

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**Annotation:** In recent years the issues of UI (User Interface) and UX (User eXperience) of web applications and software have reached the scale of basic human / ICT (information and communication technology) interaction. This article focuses on determining whether the UX approach is suitable for testing web information sources in the areas of agriculture, forestry, water management, food industry, rural development, tourism etc. This approach was tested using responsive design on Agrarian WWW portal AGRIS for both smartphones and tablets. Users were separated into two groups. The first group consisted of users with previous experience with the desktop version of AGRIS, while the second group of users did not use the site before but had at least general knowledge on how to operate web presentations and applications from mobile devices.

**Key words:** information source, UX, testing, responsive design, mobile device, agrarian sector

**JEL classification:** P25, L86, O32

### 1 Introduction

According to Hassenzahl and Tractinsky (2006), issues of UI (User Interface) and UX (User eXperience) of web applications and software have reached the scale of basic human / ICT (Information and Communication Technology) interaction. Professionals from research and other fields work with the concept of UX every day. Even after many attempts to identify, understand and define UX, it is not clear whether a uniform consensus has been reached. (Lallemand et al, 2015).

One of the perils of UX design is that user can receive unwanted experience. Also the UX approach is missing normative tools to lead designers and developers (Puccilo and Canscini, 2014). Understanding of user preferences is crucial for product designers (Chien et al, 2014) and web application developers. Techniques of UX approach testing vary. For instance there is five-second test, which displays the visual of information rendering of the web, followed by user questioning (Doncaster, 2014). Other techniques involve eye tracking, commonly used for testing usability (Olmsted-Hawala et al, 2014), evaluation of user satisfaction during interaction with digital content (Zahidi et al, 2014), or evaluation of usefulness regarding context and experience factors (MacDonald and Atwood, 2014). In any case, results are dependent on target user group, as proven by many studies. Big differences are for instance between college students and senior citizens (Brajnik and Giachin, 2014).

User experience (UX) as a recently established field of study is still in the phase of identifying its extent and operationalization of own experience (Law et al, 2014). There is no uniform consensus or effective solution method of ergonomic UI and UX on a general level. In specific cases, the situation is better due to existence of many research studies in this area. However, some of those are contradictory to each other. Expert literature often does not pay attention to these issues as much or not at all, especially regarding applications for rural and regional

development, agriculture and related sectors (water management, forestry, food and processing industry etc.). It is certain however, that ergonomically designed web is much more effective for user awareness and the growth of the sector, including tourism, agro-tourism, or congress tourism (Šilerová et al, 2013).

The main objective of the paper is the experimental verification methods UX usability test on the Agrarian WWW portal AGRIS.

## **2 Materials and Methods**

One of the most visited information sources in agrarian sector in Czech Republic is Agrarian WWW portal AGRIS. Its main purpose is to serve as an integrated internet information source for agrarian and countryside related issues (agriculture, food industry, forestry, water management etc.) The targeted user group are management employees of businesses, government administration, local autonomy administration, food consumers, countryside citizens and students. AGRIS portal provides its services since its establishment in 1999. It provides access to existing information sources, creates own content and publishes information for subject that do not possess own satisfactory means of electronic publishing. The main benefit of the portal is increased accessibility to and usability of relevant information in the agrarian area.

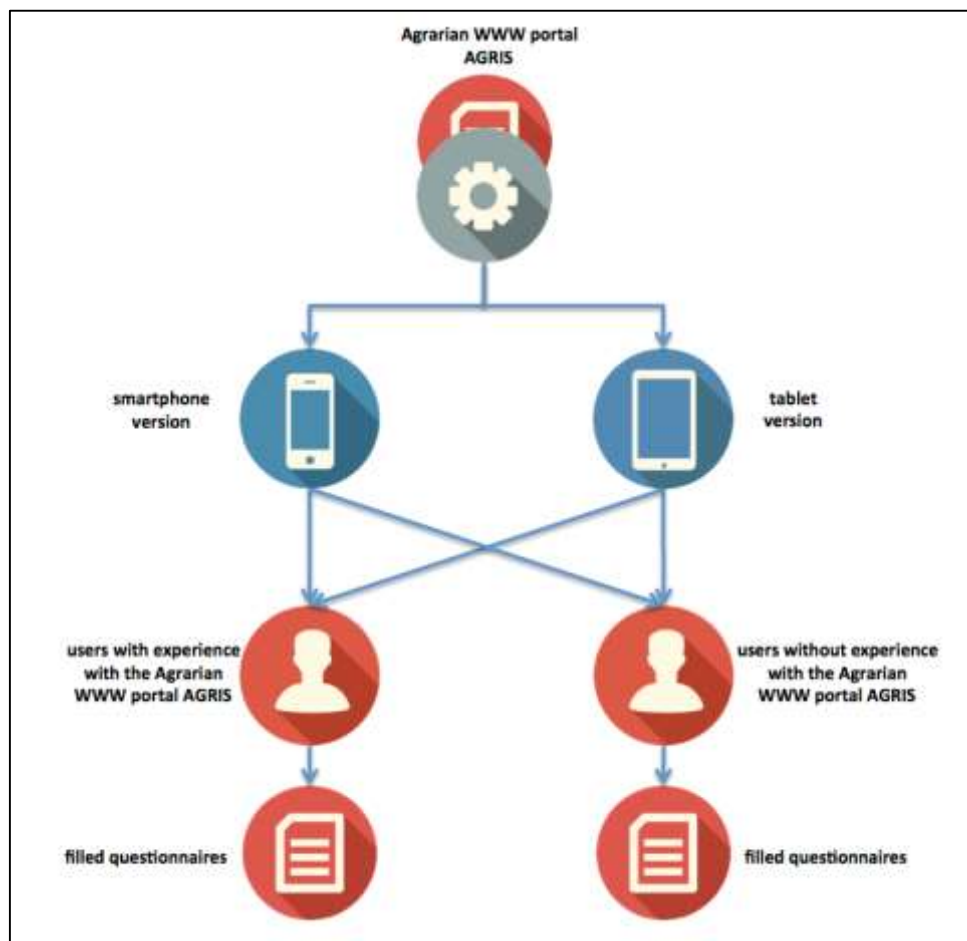
Increased trend of mobile device access can be also registered within agrarian portal AGRIS. Using Google Analytics, it was determined that in 2012 only 3% of visitors used mobile device. In 2014 this overall ratio has risen to 13% of visitors (10% from smartphones, 3% from tablets).

During 2014 the agrarian WWW portal AGRIS was adjusted to allow better access from mobile devices. Basic scientific method of analysis and synthesis was used to propose a solution, which was experimentally tested and evaluated. One of the methods used was implementation of responsive design for mobile phones and tablets. More details about the implementation can be found in Šimek et al (2014). This design was tested using UX approach. Eye tracking, visual five second test and usability test were conducted. This article focuses on the usability test with participants divided into two groups – those with previous experience with agrarian WWW portal AGRIS in its desktop version and users who have not used the portal before, but have at least basic skills operating mobile devices. There were 10 users in each group.

The following hardware were used during the testing:

- Samsung SIII smartphone, Android 4.3 OS, Internet Android browser
- Samsung Galaxy Note 10.1, Android 4.1.2 OS, Internet Android browser

Fig. 1. UX testing process of Agrarian WWW portal AGRIS responsive design.



Source: own processing

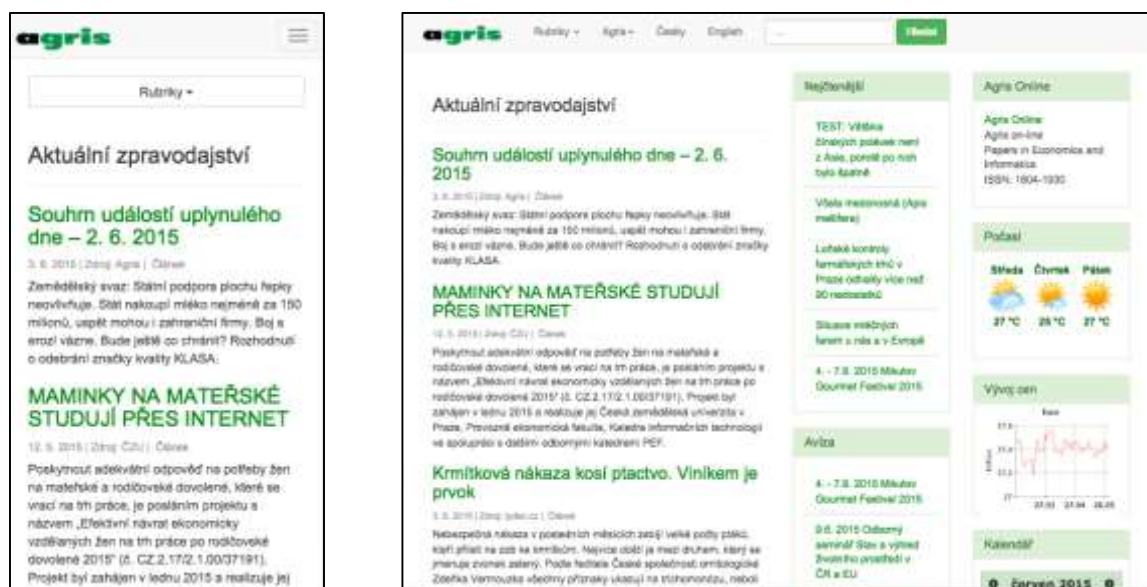
Each user worked with Agrarian WWW portal AGRIS using a mobile device according to given instructions without third party assistance and evaluated their work on a 1 to 5 scale (1 meaning best comfort or agreement to 5 meaning least comfort or disagreement). Each user marked their responses into a questionnaire. The following questions were used:

1. How quickly did you find Recent News section? (1 – very fast, 5 – very slow)
2. How quickly did you find main menu? (1 – very fast, 5 – very slow)
3. How would you rate the navigation system? (1 – well arranged, 5 – chaotic)
4. How would you rate the search system? (1 – very good, 5 – very bad)
5. How would you rate the arrangement of work area? (1 – very good, 5 – very bad)
6. How quickly did you find the Current Price section? (1 – very fast, 5 – very slow)
7. How quickly did you find the Issues section? (1 – very fast, 5 – very slow)
8. Is the Most Read section convenient? (1 – very convenient, 5 – useless)
9. Is the Upcoming Event section convenient? (1 – very convenient, 5 – useless)
10. Is the Calendar convenient? (1 – very convenient, 5 – useless)
11. Are the news and article details readable? (1 – easily readable, 5 – hard to read)
12. Is it easy to return to front page without using the browser back button? (1 – very easy, 5 – very hard)
13. (tablet only) Are the right two columns in article detail convenient? (1 – very convenient, 5 – useless)

### 3 Results and discussion

The first task (finding Recent News section) did not cause any troubles for any participants. Thanks to recent news being on the home page, all the participants rated the first question with mark 1 on both smartphone and tablets.

Fig. 2. Agrarian WWW portal AGRIS for smartphone (left) and tablet (right)



Source: [www.agris.cz](http://www.agris.cz)

Second question involving finding main menu was rated very well also. Average mark given using smartphone was 1.4 for the first group of users (with previous experience with agrarian WWW portal AGRIS), 1.2 for the second user group. When using tablet there were no issues finding the menu and both groups had average rating 1.0.

The navigation system was rated with average 1.6 by the first user group on smartphone, two responded marked this question as 3. The second group of users had lower average rating of 2.1 with two respondents marking it as 3 as well. Using tablet, no major issues were noticed, since the average marks were 1.0 (the first user group) and 1.1 (the second user group).

More problematic was the search system, more specifically on the smartphone version. The first group of users rated the fourth question by average 2.8, one user gave it mark 4 and only one user gave it 2. In the second user group the average rating was 3.4. This was due to the search field being put inside the menu, so respondents reported having issues actually finding the search area. The tablet version had opposite results, because the search field can be immediately seen next to the horizontal navigation. The average rating was 1.0 for the first user group and 1.3 for the second group of users.

Arrangement of work space was rated as 2.0, respectively 2.3 on average for smartphone version as many users disliked the search being somewhat “hidden” in the navigation. For tablet version the average rating was 1.7 in the first users group and 1.8 in the second.

The speed of Current Prices section had average ratings of 2.2 (the first user group) and 2.1 (the second user group) for the smartphone version. Users intuitively find this section by scrolling the display with their fingers. The tablet version had ratings of 1.9 and 2.4. The second group of users rated this question worse mainly because they were unaware

of this section being on the front page, since they were missing the previous experience with Agrarian WWW portal AGRIS.

Similar ratings were recorded with the question regarding the Issues section. Smartphone version averages were 1.9 and 1.7, while tablet version ratings were 1.3 and 2.2. Slightly better rating were given mainly because users already knew where to look in general thanks to previous question.

The convenience of Most Read section for smartphones was rated as 1.9, respectively 1.7 in the second group of users. The tablet version was rated as 1.0 and 1.1. Upcoming Events question had very similar scores of 1.9 and 1.8 for smartphones and 1.0 and 1.5 for tablets.

The question regarding Calendar on smartphones achieved rating of 1.9 in the first user group and 2.1 in the second group of users. For tablets it was rated as 2.0 and 2.3 in average.

Readability of article and news details was rated as 1 on average, except second group tablet version, where it was 1.2. Difficulty of returning to front page without using the browser options was rated as 1.9 by smartphone the first group of respondents, 1.9 by the second user group on smartphone, 1.4 by the first user group tablet respondents and 1.7 by the second group of tablet users. These results indicate that most users are accustomed to the general internet practice that clicking on logo will return them to the front page.

The last question regarding the two right columns on tablets was surprisingly well rated. Users with previous portal experience rated it with 1.6 on average, while in the second user group the average rating was 1.8.

**Table 1.** Average ratings of UX testing process of Agrarian WWW portal AGRIS

Question	The first user group		The second user group	
	Smartphone	Tablet	Smartphone	Tablet
1. How quickly did you find Recent News section?	1	1	1	1
2. How quickly did you find main menu?	1.4	1	1.2	1
3. How would you rate the navigation system?	1.6	1	2.1	1.1
4. How would you rate the search system?	2.8	1	3.4	1.3
5. How would you rate the arrangement of work area?	2	1.7	2.3	1.8
6. How quickly did you find the Current Price section?	2.2	1.9	2.1	2.4
7. How quickly did you find the Issues section?	1.9	1.3	1.7	2.2
8. Is the Most Read section convenient?	1.9	1	1.7	1.1
9. Is the Upcoming Event section convenient?	1.9	1	1.8	1.5
10. Is the Calendar convenient?	1.9	2	2.1	2.3
11. Are the news and article details readable?	1	1	1	1.2
12. Is it easy to return to front page without using the browser back button?	1.9	1.4	1.9	1.7
13. Are the right two columns in article detail convenient?	-	1.6	-	1.8

Source: own processing

These results of experimental evaluation of usability with the UX approach prove, that this approach is suitable for testing design and functionality of web sites, which serve as information source in the areas of agriculture, forestry, water management, food industry, rural development etc. User experience (UX), being only recently established area of study, is still in the early phases of its extent identification and operationalization of own experience

(Law et al, 2014). UX of web applications and software in general has therefore reached the scale of basic human / ICT equipment interaction (Hassenzahl, 2006).

#### 4 Conclusion

The UX approach is suitable for testing usability of web information sources in agrarian sector and related fields. The experiment proved the benefits of UX for the purpose of the Agrarian WWW portal AGRIS that is one of the most visited information sources in the sector in the Czech Republic. Results of the experiment showed that responsive design of the portal is not very flawed, the only major shortage was the "hidden" search button in smartphone version menu. Testing was done using roughly 20 users divided into two groups. The first group contained users with previous experience with desktop version of the agrarian portal, the second group of users have not used the portal before, but had at least some basic knowledge of web application responsive design in general.

The questionnaire was constructed for this particular web information source and attempted to determine the suitability of UX approach on the agrarian WWW portal AGRIS. For more detailed results larger and more in-depth questionnaire would have to be designed. Other possibility would be to specialize any future research on a certain aspect of UX, such as search term formulation, work with price reports, issues, event reports etc.

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# Mobile accessibility of information sources in the areas of agriculture, forestry, water management, food industry and rural development

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**Annotation:** The current society is characterized by ever growing amount of information sources and by diversification of access to these sources from different client devices and platforms. This also applies in areas of agriculture, forestry, water management, food industry and rural development. More and more information is being published using the World Wide Web and users access these sources not only from their personal computers, but also from many different mobile platforms. Administrators of information sources are therefore forced to choose between creating a responsive design for their content, or expensive, but optimized and effective native applications. This article deals with the issue of access from mobile devices based on experimental evaluation of both approaches using agrarian web portal AGRIS. The portal accommodates approximately 30 thousands users each month and is one of the most commonly used information source in areas of agriculture, forestry, water management, food industry and rural development in the Czech Republic.

**Key words:** Information source, agrarian sector, rural development, mobile devices, Android, responsive design.

**JEL classification:** Q13, L86, O32

## 1 Introduction

The current society is characterized by ever growing amount of information sources and by diversification of access to these sources from different client devices and platforms. Information can be automatically machine collected, sorted and processed, but such form does not allow optimal view and access for users. For machine processing, it is possible to utilize various metadata formats and thesauri (Šimek et al, 2013). For user optimized access the situation is more complicated. There are many diverse mobile devices using different platforms that provide access to server based information sources. In April 2015, more than one fifth of users (22.11%) used smartphones or tablets to connect to web pages and applications. In May 2013, it was only 11.16% (NetMarketShare, 2015).

In the case of mobile device access, users should be provided with the option to operate web application in optimized form. In many cases however, the developers and administrators of applications do not provide users with comfortable enough solution. In reality, this leads to situations where information is scattered onto many different pages or screens, which can be very unpleasant for the end user (van der Kolik et al, 2013). Modern web applications should provide users with ergonomic interface for mobile devices.

One of the possible solutions to this issue are responsive design or responsive layout. Responsive design allows optimal display of user interface on screens of mobile devices. It also decreases the necessity of scrolling (Lestari et al, 2014) and is therefore currently the most



used long-term solution for developers, designers and in turn for the end users (Rempel and Bridges, 2013).

Other possible option is to develop native application for individual platforms. Despite using similar or same functions, the development and maintenance costs for separate applications is several times higher than costs for a single application (Chang and Oh, 2015, Xanthopoulos, 2013). This problem can be partially addressed by using cross-platform applications, but those can contain severe limitations and work on lower level of abstraction (Heitkotter et al, 2015). But even when focusing on a single platform such as the most commonly used Android, there can be issues related to different operating system versions, used development tool or the actual end user mobile device. This can lead to swings in the overall application performance (Acosta and Almeida, 2014). Other issues include demographic, geographic and social differences between the end users (Gurtner, 2014).

The above mentioned facts are very important to remember during development and apply in the areas of agriculture, forestry, water management and rural development as well. That is because the general trends of increased usage of World Wide Web based information sources and increasing ratio of users using mobile devices to access these sources can also be registered in these highly specific areas.

The main objective of the paper is to evaluate access ways to agrarian web information sources from mobile devices with experimental verification to the agrarian WWW portal AGRIS with focus on native mobile application on Android platform.

## **2 Materials and Methods**

One of the most visited information sources in agrarian sector in Czech Republic is Agrarian WWW portal AGRIS. Its main purpose is to serve as an integrated internet information source for agrarian and countryside related issues (agriculture, food industry, forestry, water management etc.) The targeted user group are management employees of businesses, government administration, local autonomy administration, food consumers, countryside citizens and students. AGRIS portal provides its services since its establishment in 1999. It provides access to existing information sources, creates own content and publishes information for subject that do not possess own satisfactory means of electronic publishing. The main benefit of the portal is in the increased accessibility and usability of relevant information in the agrarian area.

Increased trend of mobile device access can be also registered within agrarian portal AGRIS. Using Google Analytics, it was determined that in 2012 only 3% of visitors used mobile device. In 2014 this overall ratio has risen to 13% of visitors (10% from smartphones, 3% from tablets).

During 2014 the agrarian WWW portal AGRIS was adjusted to allow better access from mobile devices. Basic scientific method of analysis and synthesis was used to propose a solution, test it experimentally and evaluate the new solution. Firstly, the basic characteristics of average user in the sector, respectively user of AGRIS portal, were examined. It was determined that the average user is very conservative and demands mostly easy and fast access to required information. In the next step, various methods that could provide effective access of the web information source were analyzed. Those were:

- creating a responsive design for web browsers,

- creating a native application for Android platform (which is the most commonly used mobile platform),
- creating multiplatform applications (Šimek et al, 2014b).

These methods were tested using agrarian WWW portal AGRIS followed by their effectivity assessment.

### 3 Results and discussion

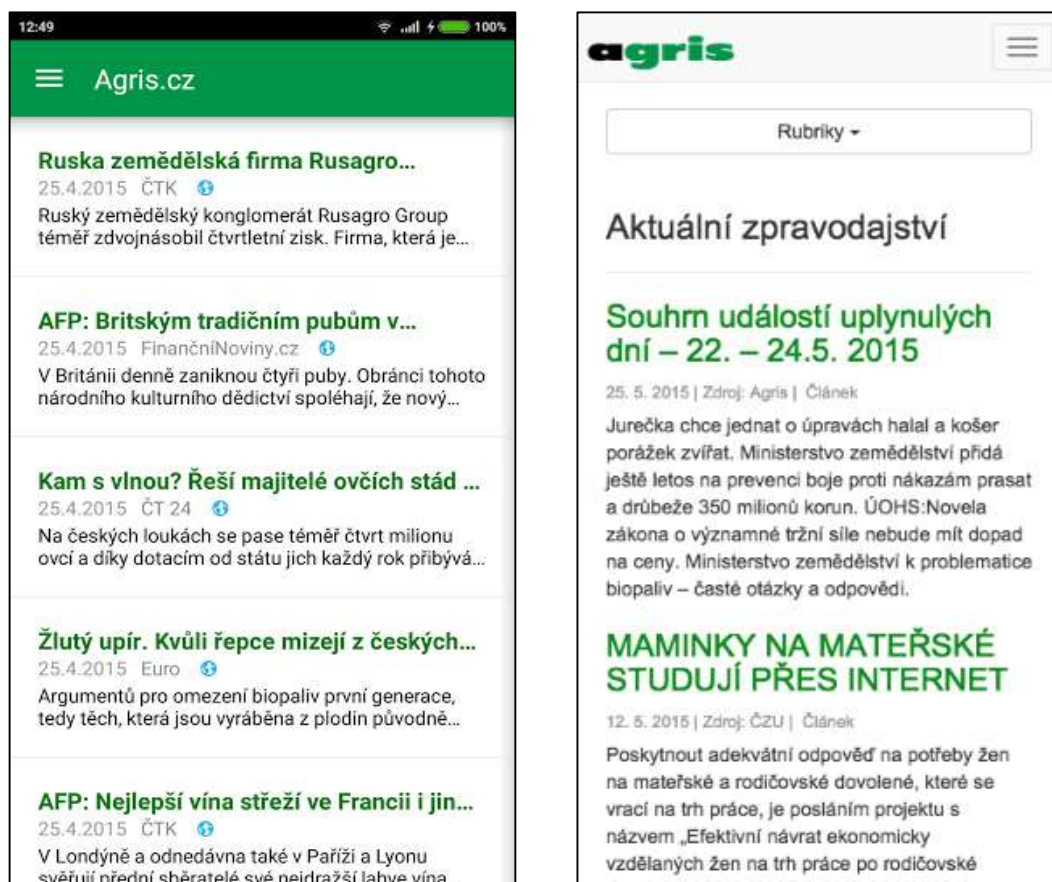
Based on the analysis of average user of web information sources and with the increasing ratio of access from mobile devices in mind, experimental solution involving responsive design was developed for agrarian WWW portal AGRIS. MediaQueries technology was used within Cascading Style Sheets 3 (CCS3) that allows an adaptable display of the portal content output based on end user device parameters. This include information about:

- web browser used by the mobile device,
- size and resolution of the mobile device display,
- screen orientation (portrait vs. landscape).

The whole agrarian web portal is configured so that it is not considered masked by full-text search engine like Google for instance. This prevents the removal of search results. The same content is therefore delivered to all end user browsers including full-text search robots (such as Googlebot-Mobile). The implementation of responsive layout is the easiest way to allow access to agrarian portal from mobile devices. Further, more detailed information about this implementation are depicted by Šimek et al (2014b).

The implementation of native application for agrarian WWW portal AGRIS on Android platform was more complicated. The whole application was designed so that it would as much comfort as possible while being visually similar to responsive design. Requirements for the application were set mainly on the basic principles of functionality, reliability, usability, effectiveness, maintainability and transferability (Vaniček, 2000, Vaniček 2006). A lot of emphasis was given to functionality, since the application must contain functions to accommodate user request when using the application. Reliability of the application must be good enough to maintain a certain level of performance during its use. Usability has to deal with the ability of users to quickly and easily learn how to operate the application and its overall appearance. Effectiveness of the application comprises of its ability to maintain performance with regards to the vast amount of information to be sifted through and displayed. It is also designed to be easily maintained, modified, repaired, upgraded or adapted to changing environment and changing function specification. Transferability is limited to Android platform only, meaning it can be used on different Android operating system versions and different mobile devices, but cannot be used on entirely different OS platform such as iOS or Windows. This problem will be tackled in the future by the experimental development of multiplatform application.

Fig. 1. Illustration of native application for Android platform (left) and responsive design of web application (right) – smartphone output



Source: www.agris.cz

Fig. 2. Illustration of native application for Android platform – tablet output



Source: www.agris.cz

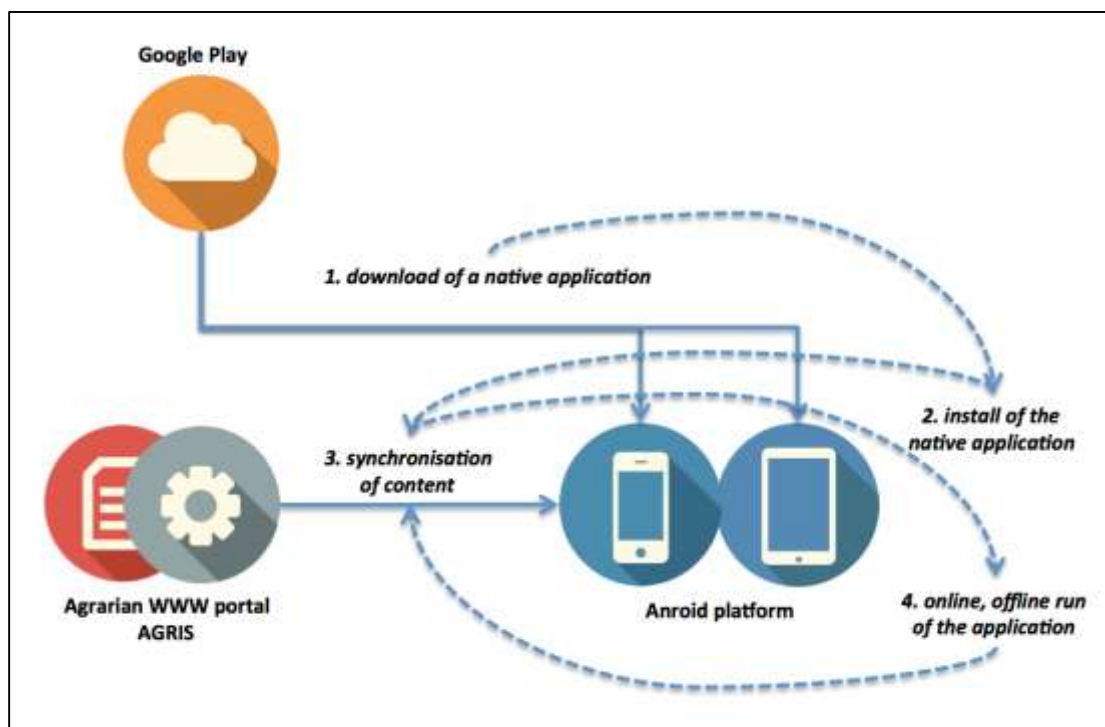
Native application was developed in Android Studio environment, which is based on IntelliJ IDEA and is official IDE for Android platform application development. The application requires Android version 4.0 Ice Cream Sandwich or higher and is optimized for both types of mobile devices (smartphone and tablet). It detects used device and changes resolution and display orientation accordingly (portrait vs. landscape).

The process of using the native application can be divided into four main steps:

1. downloading the application, for instance via Google Play,
2. installing the application into mobile device,
3. synchronization of current content from Agrarian portal AGRIS, and
4. using the application either in online or in offline mode.

The last two step repeat depending on the need and internet connection status.

**Fig. 3.** Basic principles of using native application for accessing Agrarian WWW portal AGRIS



Source: own processing

The development of native applications for individual platforms is very time consuming and costly, as illustrated by Chang and Oh (2015) or Xanthopoulos and Xinogalos (2013). Partial solution for this problem can be using a cross-platform application. Its development is currently in progress and expected time of its completion and testing is summer 2016.

## 4 Conclusion

By designing and developing a native mobile application of Agrarian WWW portal AGRIS for Android platform possibilities for access to information sources in areas of agriculture, forestry, food industry, water management and rural development were practically tested and evaluated. It was a second step towards content display optimization and better control ergonomics on mobile devices (the first step being responsive layout). This provides greater

comfort when using the portal services or retrieving the required information for the growing number of users that prefer access from mobile devices. It increases the reach that AGRIS portal has, by allowing better accessibility and information utilization among mobile platforms.

Users can therefore decide, whether they want to use web browser in their mobile device or if they want to download and install native mobile application (provided they have Android operating system). In both cases, they receive an optimized ergonomic access to an important information source. If they choose native application they can work in offline mode, because the application will download the current content from the portal server and does not need internet connection afterwards. These include current news, price reporting and upcoming events. Upon user request or after connecting once again, the application will update and synchronize. The demands on the Internet connectivity are minimal, since only the current content is being downloaded in text format, so even GPRS which is available alongside the mobile signal will be sufficient.

The next research objective will be to ascertain the effectiveness of multiplatform application or hybrid application development from a single data file source. From developer perspective, the responsive layout on information source web interface is much more feasible. From user perspective the most comfortable solution is native application optimized for his current platform, which includes the ability to work offline. But the development of many native applications is very time consuming and costly and multiplatform applications can fall in the center of these two approaches.

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## Projection of Czech agricultural workers' gender structure

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**Annotation:** Considerable number of researches related to the gender issues in agriculture shows the importance of this topic. Especially in the agriculture of developing countries a various global organizations (FAO, World Bank, UN etc.) highlight the importance of women empowerment, but the knowing the age-and-sex structure of the agricultural workers population is also important in developed countries. The current structure of the population and of the workers in agriculture, fishery and forestry is surveyed by Czech Statistical Office (CZSO) in periodic Census. While, the future population development is a subject of many studies, the research on males and females agricultural gender inequalities still missing. It is due to the obstacles in methodology of projection of particular population group. Therefore, the aim of the paper is to project the age-and-sex structure of agricultural economically active workers and agricultural economically active policymakers and managers in the Czech Republic. The calculations use cohort-component method with certain assumptions. The data from 2011 Census (by CZSO) are used and the calculations for following 35 years (i.e. until 2046) in 5 years interval are done. The development of important statistics arising from the projection shows not only the changes in the proportions of male and female workers (or policymakers and managers as well), but also changes in average ages and female longevity.

**Key words:** gender structure, agricultural workers, agricultural policymakers and managers.

**JEL classification:** J11, J16, Q01

### 1 Introduction

According to Food and Agriculture Organization (FAO), females comprise, on average, 43% of the agricultural labour force in developing countries and thus make significant contributions to the rural economy in those regions. In developed countries, the situation is different. Not only in terms of the female employment in agriculture but also overall decrease of employment in agriculture is visible. The Czech Republic belongs in terms of the share of the agriculture on employment to the developed countries of the EU with the highest decrease of agricultural workers. The highest reduction appeared especially after the revolution in 1989, when in 5 years, the number of agricultural workers declined almost by a half. Regarding the employment of females, Czech Republic belongs to countries with lower share of working females (approximately 30% in comparison with 38% in the EU) (Doucha et al., 2014). Females were also more seriously affected by the decrease of employment in agriculture. In 2004 their share was still 35.1%, but in 2006 to 2008 was already lower than 31%, in 2010 achieved 33.4% (Spěšná et al., 2009). This is in line with findings of Haghghat (2002), who analysing the effect of economic growth on the share of female employment in three sectors in 136 countries, noted that the effect of economic development on the female share of employment in agricultural is negative. Also the character

of the work in agriculture is changing. See e.g. the study of Rendall (2013), who found out that female employment opportunities increase as the available jobs become more intellectually, as opposed to physically demanding. The future development is unknown, but the decrease of the need of non-qualified workers in agriculture (and especially of females) is expected in the Czech Republic. It is related to the still continuing decrease of the volume of animal production, where the jobs are traditionally more occupied by female workers with lower qualification. Regarding the management of the firms and the leadership positions at the authorities, a widely discussed topic are the quotas on the representation of the females on those positions. The EU recently proposed that at least one third of employees in the management should be occupied by females. Therefore, the attention is paid not only to the development of the number of workers, but also to the category of policymakers and managers.

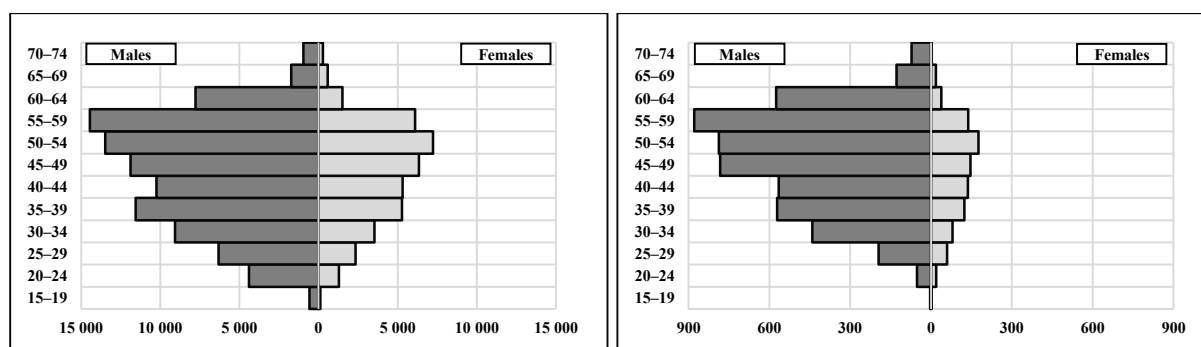
The aim of the paper is to project the age-and-sex structure of agricultural **economically active workers** and agricultural economically active **policymakers and managers** in the Czech Republic. First, used methods of population projection and the assumptions are introduced. Then the results are presented and the impacts are discussed. Last section draws the conclusions for policy makers are made.

## 2 Materials and Methods

Given that the researchers from CZSO construct a fairly accurate population projection in three different scenarios, we calculate on the basis of component method (Keyfitz, 1964) the estimates of the age-and-sex structures of these economically active persons with great precision up to the year 2046 (i.e.  $T = 35$  years long horizon after latest available empirical data). The conditions of our calculations are as follows: (I) selected scenario of the population projection by CZSO is medium variant. This is because the low and high variant is rather referred to as lower and upper bound. (There are studies, which predict that the most probable future development of our population will be low variant; see e.g. Šimpach, Langhamrová, 2014, or Šimpach, 2015, but for the case of agriculture we set our assumptions on the medium variant). (II) The calculation assume the same decline in mortality over time, which is expected by CZSO (i.e. the increase in life expectancy at birth of males (females) from 74.70 (80.82) years in 2011 to 82.30 (87.41) years in 2046 and linear increase in the total fertility rate from the value of 1.43 in 2011 to 1.55 in 2046. Finally, it is important to note that (III) calculations cannot take into account dramatic change in the behaviour of immigration and emigration of these workers and policymakers and managers. (The sum of immigrated persons is the same as the sum of emigrated ones). Census 2011 was processed by the CZSO's methodology (CZSO, 2012), (final census' results of the economically active workers in Czech agriculture, forestry and fishery and economically active policymakers and managers used is displayed in Fig. 1).



**Fig. 1.** Empirical data of economically active workers in the field of agricultural, forestry and fishery in total (left chart) and economically active agriculture policymakers and managers (right chart) by Census 2011.



Source: data CZSO (2012), authors' illustration

Estimation of age-and-sex specific structure of agricultural population is not simple, as several important aspects have to be taken into account. The first is the saturation point because agriculture has a particular employee capacity which will probably not be exceeded in the future. The second is the proportion of females in the agricultural population. The last aspect is the issue of small population when the pure statistical methods cannot be used as it is not possible to apply the law of large numbers (Gardner Jr. and McKenzie, 1985). In this paper we follow the study by Fiala and Langhamrová (2011), who calculated projections of ICT experts in various economic fields. The results of Census 2011 (CZSO, 2012) state the total number of persons in the population ( $S_{x,t}$ ) in 5-year age groups ( $x-x+h-1$ ) at time  $t = 2011$  by sex ( $M$  - male or  $F$  - female), the number of economically active workers in the field of agriculture, forestry and fishery in total, (respectively the number of Czech economically active agricultural policymakers and managers), also in 5-year age groups ( $x-x+h-1$ ) at time  $t = 2011$  by sex, where  $x$  is completed age and  $h$  is the width of age interval 5 years. All the numbers of economically active agricultural workers are considered in the age interval from 15–19 to 70+ years. Census 2011 has higher intervals for the total number of persons in the population ( $S_{x,t}$ ), i.e. 70–74, 75–79 ... 100+, but because the number of economically active agricultural workers in the highest age group is relatively small (see Fig. 1), we consider interval 70+ from the groups of agriculture workers as comparable with the interval 70–74 from ( $S_{x,t}$ ) group. This measure is commonly used in similar analyses and as previously stated Fiala, Langhamrová (2011) or Šimpach, Langhamrová (2014) this will not lead to a significant distortion of the results. Component method of population projection stands on the assumption that the person at the exact age of  $x$  will be with a certain probability next year exactly one year older (Keyfitz, 1964). The exceptional situations are when a person dies, emigrates, or someone else immigrates.

**Table 1.** Males' EA agricultural workers in absolute numbers (EA\_AGRI), males' EA agricultural policymakers and managers in absolute numbers (EA\_AGRI\_P+M) and proportions in % with saturation points.

Age group	S	EA_AGRI	EA_AGRI_P+M	EA_AGRI (%)	EA_AGRI_P+M (%)
15–19	297 860	568	3	0,191177	0,001010
20–24	354 381	4 394	52	1,267627	0,015002
25–29	387 292	6 307	194	1,682845	0,051763
30–34	463 655	9 066	440	1,992006	0,096678
35–39	459 293	11 546	571	2,539502	0,125589
40–44	364 367	10 229	565	2,834547	0,156567
45–49	356 929	11 873	782	3,347723	0,220493
50–54	338 051	13 484	787	3,998754	0,233389
55–59	369 091	14 444	879	3,905399	0,237666
60–64	353 635	7 763	575	2,186274	0,161936
65–69	250 635	1 733	128	0,688764	0,050872
70–74	163 771	967	72	0,589235	0,043873
TOTAL	4 158 960	92 374	5 048	2,221084	0,121376

Source: data CZSO (2012), authors' calculations and illustration

**Table 2.** Females' EA agricultural workers in absolute numbers (EA\_AGRI), females' EA agricultural policymakers and managers in absolute numbers (EA\_AGRI\_P+M) and proportions in % with saturation points.

Age group	S	EA_AGRI	EA_AGRI_P+M	EA_AGRI (%)	EA_AGRI_P+M (%)
15–19	282 322	116	1	0,041153	0,000355
20–24	333 971	1 292	20	0,391212	0,006056
25–29	359 138	2 335	60	0,660977	0,016984
30–34	435 335	3 539	80	0,823880	0,018624
35–39	432 522	5 261	124	1,223949	0,028848
40–44	343 645	5 319	137	1,555923	0,040075
45–49	342 704	6 331	147	1,854472	0,043059
50–54	336 610	7 226	176	2,153024	0,052440
55–59	386 841	6 102	138	1,577698	0,035680
60–64	391 152	1 512	39	0,386089	0,009959
65–69	302 702	569	18	0,188025	0,005948
70–74	220 356	269	3	0,122091	0,001362
TOTAL	4 167 298	39 871	943	0,956759	0,022629

Source: data CZSO (2012), authors' calculations and illustration

According to methodology of Fiala, Langhamrová (2011) it is supposed that each population (economically active workers in the field of agriculture, forestry and fishery (labelled *EA\_AGRI*) and economically active agricultural policymakers and managers (labelled *EA\_AGRI\_P+M*)) has its own saturation point in particular age group which achieves and which also will not exceed in the future. These saturation points, calculated as the proportion of economically active persons in the particular field (*EA\_AGRI* and *EA\_AGRI\_P+M*) to the total population (*S*) by age group are highlighted in the Tab. 1 for males / Tab. 2 for females. At the same time it is assumed that every person works in his / her profession until he / she dies or until he / she reaches the retirement age. (Retirement was set at the middle of the last economically active age interval from Census 2011 results (i. e. 72.5 years) both for males and for females. It is due to the uncertainty about the retirement age settings in 2046 and later – see e.g. study by Krebs and Průša (2013) about solidarity issues in Czech society. Due to the zero migration balance assumption the proportion of economically active male workers in each cohort after the saturation point will remain at the level of 3.999% (*EA\_AGRI* males), 0.238% (*EA\_AGRI\_P+M* males) until he reaches the retirement age and at the level of 2.153% (*EA\_AGRI* females), 0.052% (*EA\_AGRI\_P+M* females) until she reaches the retirement age.

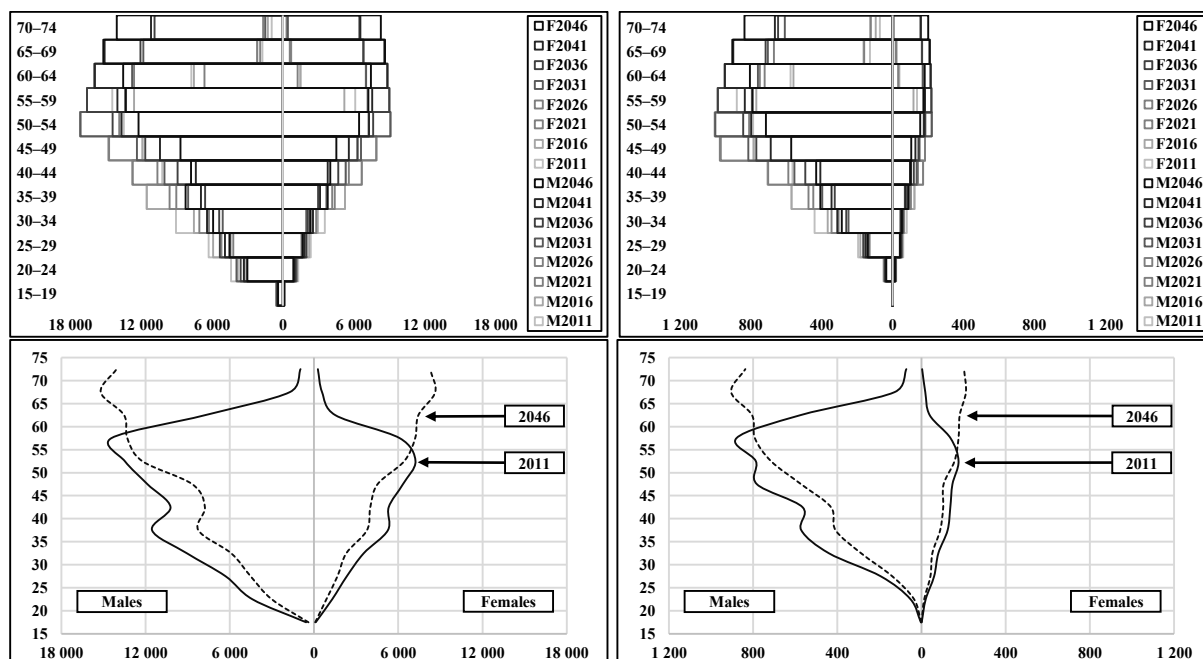
### 3 Results and Discussion

Using cohort component method with above mentioned assumptions we calculate the estimates of the economically active agricultural, forestry and fishery workers in total

and the number of economically active agricultural policymakers and managers on the 1<sup>st</sup> January 2016–2046. The results are presented in multi-tree charts. The lightest shade represents presence, the darkest far future. The results of population projection present Fig. 2. For better illustration of the results there are the current age-and-sex specific population structures of 2011 shown together with the projection of 2046 in bottom charts in the Fig. 2. It is obvious that the future structures will be narrower at its base. This is mainly caused by low total fertility rate of Czech females, which will be below the level of simple population replacement. Consequently less young people will arrive in agricultural sector. Older agricultural workers either stay in their profession until retirement, or change their profession and will be replaced by workers from other sectors, or they die. From Fig. 3 where the total numbers of the economically active workers in the field of agriculture, forestry and fishery and of agricultural policymakers and managers are shown, it is possible to observe that the peak will occur between 2031 and 2036. After 2036 the total numbers will continue to decline, because our population will be regressive with not enough of young people. Regarding the gender structure, the share of the woman on the total number of agricultural workers will be developing in a positive way, *ceteris paribus*. The projection shows that the share of females will increase by the year 2046 on 34.06%. However, it is more given by the decrease of the number of male workers. In absolute terms the number of female workers will be mildly decreasing until 2016 and increasing significantly only until 2036.

Consequently the increase will be modest and there will be even less females in 2046 than in 2041. The number of male workers will be slightly decreasing until 2021, will decrease mildly till 2036, but the decrease is expected onwards. This situation will be favourable for the share of females in the total agricultural workforce. Their share will be the highest in 2036 (34.11%). Of course, the problem of female employment in agriculture is not that urgent in the Czech Republic and other developed countries where the majority of jobs is generated in other sectors of national economy. The situation is different in developing countries. As FAO (2003) states, “the women represent a substantial share of the total agricultural labour force, as individual food producers or as agricultural workers”. According to their data around two-thirds of the female labour force in developing economies is engaged in agricultural work. This is in contrast to the Czech Republic where it is less than one third. However, due to technical advancement, it is not necessary to employ more. The share of the females on the number of policy makers will follow the same trend. In 2011, the females were represented in policymaking and managerial positions only from 15.74%. The share will even decrease by 2016 (15.73%).

**Fig. 2.** Projection of population structure of EA agricultural workers in total (top left) and projection of EA agricultural policymakers and managers up to the year 2046 in 5-years' time intervals (top right). Bottom left and bottom right is highlighted current population structure and the projection in 2046 only.



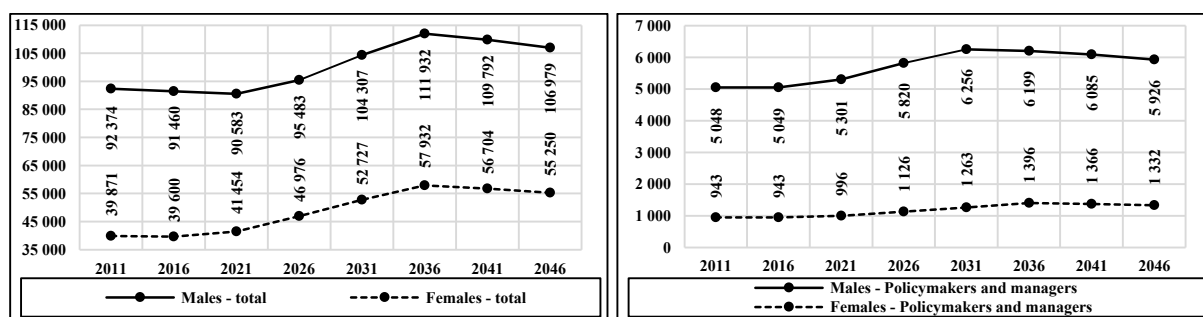
Source: authors' calculations and illustration

This will be caused by the increase of males on those positions. The absolute number of females will remain the same (943). Only after this year, it will start to increase. As the pace of increase of females will be higher than of males, it will cause the increase of the share. The highest share of female policymakers and managers on the total number of the policymakers and managers in agriculture will be the highest in 2036 (18.38%). Until 2046 it will fall to 18.36% as there might be 1 332 female and 5 926 male policymakers and managers. This shows that if the quotas on the managers of firms or authorities were set, the Czech Republic would not be able to fulfil them, nor nowadays nor in the future (if we consider only natural development). Certain policies would have to be put in place to attract more females in managerial and policymaking positions. For example in Italy, the quotas in local elections were set in 1993 and abolished in 1995. They had positive effect as according to the research of Baltrunaite et al. (2014) there was an increase in the quality of elected politicians in terms of the increase of years of education. Presented results raise some serious issues for the discussion. Who will work in the Czech agriculture, forestry and fishery 20 years after and later, and who will manage this sector if the need for the workforce would be the same? Both male and female population of agricultural workers will be older (see Fig. 4, where the results of estimated weighted average ages of males and females are presented). If females – policymakers and managers get older according to the set scenario, it is possible that in the year 2046 the average age of males and females policymakers and managers will be almost equal (this conclusion also stated e.g. Šimpach, Pechrová, 2014 in their study). This is mainly due to the fact that there are currently very few young females in the agricultural sector. Most of female workers are in the middle ages, and therefore the increase of their average age would be dramatic. Besides, financial support scheme is implemented via Rural Development Programme in the framework of Common Agricultural Policy. So-called New Entrant Scheme has already succeeded for example in Ireland “in encouraging younger people

to enter the dairy industry, acting as a more effective reform vehicle than counterpart schemes which aim to motivate older people to exit farming” (McDonald et al.,2014).

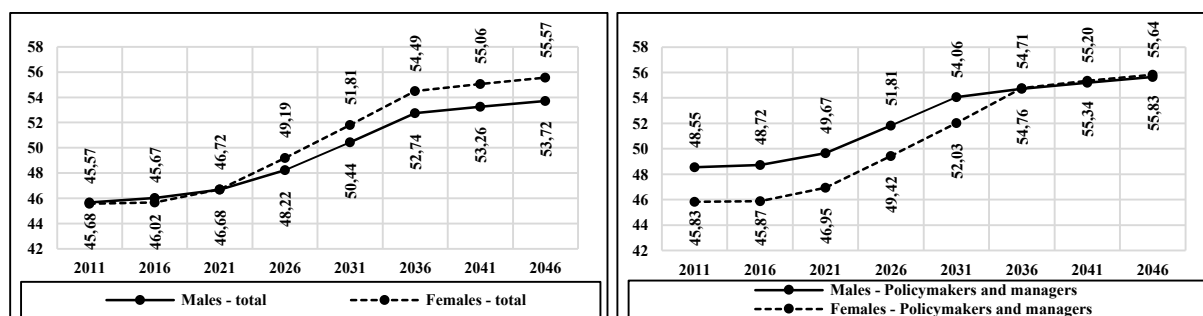
Also the financial incentive implemented in Greece attracted the females into agriculture as head of farm holdings and helped them to pass through unemployment or the lack of alternative employment opportunities (Kazakopoulos and Gidakou, 2003). We have to highlight that the research is strictly based on the ceteris paribus assumptions. It provides the information about the workforce according to the population projections. It does not tackle the issues of the need of jobs in agriculture. With technical advancement and changes in used technologies it is probable that the demand for labour in agriculture will decrease in the future. Also the character of the work will continue to change from physically demanding to more intellectual. This will also affect the demand for male and female workforce. As stated e.g. Zagata et al. (2015) who dealt about problem of the ageing population of farmers: “exact analysis and evaluation of the situation in the Czech Republic is difficult, due to the methods used in the survey.” It is important to note that these difficulties are issues also of other EU countries. Therefore, the challenge for future research is to project the number of needed labour in agricultural, compare it with projected numbers and to draw to answer the question whether the Czech agriculture will have sufficient number of workers in the future (in desirable age structure).

**Fig. 3.** Projection of the total numbers of EA agricultural workers (left) and also the projection of total numbers of EA policymakers and managers up to the year 2046 in 5-years’ time intervals (right).



Source: authors’ calculations and illustration

**Fig. 4.** Projection of the weighted average age of EA agricultural workers (left) and also the projection of the weighted average age of EA policymakers and managers up to the year 2046 in 5-years’ time intervals (right).



Source: authors’ calculations and illustration

## 4 Conclusion

The aim of the paper was to project the age-and-sex structure of agricultural workers and a policymakers and managers in agriculture in the Czech Republic based on the data from 2011 Census. There will be changes in the proportions of male and female workers, but not that dramatic as the share of females on agricultural workforce will not exceed 35% by 2046 and the share of policymakers and managers will stay lower than 19%. Currently the shares are slightly above 30% and almost 16%. The more important are the changes in average ages and female longevity. The results are worrying in terms of an increase in the number of agriculture workers and policymakers and managers in the highest age groups – slimming of the base of the population pyramids (due to low level of Czech total fertility rate) and increasing of the average age of the economically active agriculture workers and policymakers and managers as well. Higher number of older workers in the field of agriculture, forestry and fishery may have implications for the Czech agriculture competitiveness in the future (with assumption that the number of total population is the same as today and with no technological progress).

## Acknowledgements

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# Methodology of usability testing of the next generation of editors for agricultural web portals

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**Annotation:** WYSIWYG (What You See Is What You Get) editors are used in content management systems for inserting and updating web pages content. The editors are optimized for simple tasks such as text modification, pictures or another media addition, etc. The simplicity of these editors can lead to different kinds of problems such as inconsistency of generated HTML code or problems accomplishing more complicated tasks. From the end users point of view, problems in usability are the most serious ones. Users perceive difference in usability, because the editor interface for more complex tasks is not optimized for users without desirable knowledge. The user interface in current editors can appear to a user as unintuitive or having illogical structure of steps to accomplish an advanced task. Usability testing is required in all editor development stages to improve the user experience and usability of the next generation of editors. Expert evaluation and user experience methods were used to choose the optimal methods for testing of the next generation editor used in agricultural online magazines and agricultural web portals. Testing methods were compared according to different criteria. A full methodology for the usability testing for the next generation of editors was created. The methods and participants number for each stage of testing were chosen according to a situation where full usability testing is performed by the smallest possible team with no specialized equipment. The focus was to choose and to modify the selected methods and reduce testing expenses without any impact on the results quality.

**Key words:** user experience, WYSIWYG editors, usability, usability testing, web content management system

**JEL CODE:** D83, L86, Q13

## 1 Introduction

The environment of WWW changed rapidly during past years. New groups of users have access to internet. They have different requirements on how to use web applications (Šimek, 2014). Their behavior and exception has impact on the importance of usability (Rajeshkumar, 2013). Web content management systems (WCMS) accommodated these changes. WCMS enabled users without technological knowledge to create and update content and maintain websites.

WCMS use the WYSIWIG (What You See Is What You Get) editors to provide interface for users. The purpose of these editors is to allow users to create content for a page and change basic page settings (McKeever, 2003). WYSIWIG editors are standardized. The use cases, icons and layout is often similar to WYSIWIG editors available for desktop software (Schleich, 1994). Different icons are used for inserting links, pictures and other specialized objects for web.

The main goal was to create a methodology for usability testing for a new generation of WYSIWIG editors. This new version of editors should improve user experience of users of these editors. The execution of both basic and more advanced tasks should be handled with higher usability without reducing usefulness (Hussein, 2014). Evidence suggest that usability is among the most important factors for user experience improvement (Melo, 2014).



Usability testing will be required in each step of the development of new generation of editors. Each phase of development requires different approach to usability testing. The testing will be provided by one or two people and they will participate in each of stage of testing. The selected methods will be applied to users from the agricultural web portals who use WYSIWYG editors mostly for creating content of pages. They usually understand the agricultural area, but they are missing knowledge from the IT area. More complicated tasks are challenging for them.

## 2 Materials and Methods

The testing will be concentrating on user from agrarian web portals to improve their UX and to minimize the problems in articles they create through these editors. Reason for selecting this group of users is that they usually have limited knowledge of needed technologies and often have problems to accomplished advanced tasks (Geser et al, 2012). To increase their performance with editors can help with competitiveness of the agrarian editors. Selected methods must be possible to use on users the limited or no knowledge of needed technologies.

Methods for testing of user experience and usability were summarized in a table. Only methods with direct participation of users were included in this analysis. Expert evaluation was used for the assessment of the usability testing methods. Table 1 represents the list of methods included in analysis in an alphabetical order.

**Table 4.** List of methods included in analysis

No.	Method	No.	Method
1	A/B testing	11	Focus Groups
2	Cardsorting	12	Group testing
3	<b>Click stream analysis/data analysis</b>	<b>13</b>	<b>Moderated Remote Usability Studies</b>
4	<b>Concept Testing</b>	14	Interviews
5	<b>Customer feedback</b>	15	Participatory Design
6	Desirability studies	16	Phone Interviews
7	Diary/Camera Study	17	Scenarios
8	<b>Email Surveys</b>	<b>18</b>	<b>Immoderate Remote Panel Studies</b>
9	Ethnographic Field Studies	19	Usability lab studies
10	Eyetracking	20	Usability testing

Source: self-authored

The cognitive walkthrough, expert or heuristic evaluation are methods provided by expert on the product or on usability without user collaboration (Valentim, 2014). They were added in the plan of testing at the end.

Testing methods were evaluated depending on number of participants, stage of use, type of contact between participants and tester, way of use of product during the testing, equipment needed and type of collected data. Scales used for the criteria are summed up in the table no. 2.

**Table 5.** Scales for different criterion

Criteria	Scale
Type of contact between participant and tester	One-to-one In group None
Way of user of product during the testing	Natural Scripted Combination Not using
Cost on equipment needed	Low Medium High
Type of collected data	Quantitative Qualitative Both

Source: self-authored

Type of contact between participant and tester was considered during the testing. The cost scale of needed equipment was set to:

- low – no specialized equipment need,
- medium – some equipment is needed or the room with computers for group of participants,
- high – testing is provided in laboratory and highly specialized equipment is needed, for example for eyetracking method.

The methodology was created for different phases of editor development. Spiral model and Waterfall model were used for determination of phases of development from the point view of usability testing. 3 phases were set:

1. Determine requirements and design – phase of preparation, collecting ideas and findings, first attempts to draw GUI of new editors
2. Produce and test – creating prototype and testing
3. Verify – collecting information and requests, recommendation for the next version

### 3 Results and Discussion

**Table 6.** Survey of methods and evaluated criterion

No.	Method	Stage of use	Type of contact between participant and tester	Use of product during the testing	Cost of equipment needed	Type of collected data
1	A/B testing	2	one	natural	low	quantitative
2	Cardsorting	1/2	one	not using	medium	both
3	Click stream analysis/data analysis	3	none	natural	low	quantitative
4	Concept Testing	2/3	one/ group	combination	low	both
5	Customer feedback	3	none	natural	low	qualitative
6	Desirability studies	1	one	combination	low	both
7	Diary/Camera Study	3	none	natural	medium	both
8	Email Surveys	3	none	not using	low	quantitative
9	Ethnographic Field Studies	1/3	one	natural	medium	qualitative
10	Eyetracking	2	one	natural/ scripted	high	both
11	Focus Groups	1/2	group	not using	medium	qualitative
12	Group testing	1/2	group	scripted	medium	qualitative
13	Moderated Remote Usability Studies	2	one	scripted	medium	quantitative
14	Interviews	1/2/3	one	not using	low	qualitative
15	Participatory Design	1/2	one	combination	low	qualitative
16	Phone Interviews	3	one	not using	medium	quantitative
17	Scenarios	1/2/3	one	scripted	low	qualitative
18	Immoderate Remote Panel Studies	3	none	scripted	low	both
19	Usability lab studies	2	one	scripted	high	qualitative
20	Usability testing	1/2/3	one	scripted	low	qualitative

**Source: self-authored**

Analysis of methods showed some problems with the selected criteria. The number of participants is not specified for every method. Recommended number of participants differ according to author. Some methods are source of both types of data - qualitative and quantitative.

The number of participants is set for the A/B testing, Card sorting, Focus groups and usability testing methods. The values are showed in table 4. This count of participants is the minimum recommended number. Statistic methods are used for evaluation of results, so higher amount of data can help to reduce deviation (Barnum, 2010).

**Table 7.** Number of participants

Method	Number of participants
Usability testing	5
Focus Groups	3-12
Cardsorting	15
A/B testing	20

**Source: self-authored**

Some of the methods were rejected as unsuitable for this type of product. Laboratory testing in specialized conditions is not necessary and cost of needed equipment is too high. The eyetracking method can be very useful for UX testing of next generation of WYSIWYG editors, but there is problem with the cost on needed equipment too.

Phone Interviews and E-mail Surveys were refused. The cost of this type of testing is low, but on the other hand, the results are limited and there is no option how to evaluate a nonverbal communication during the usage of the product. Diary/Camera Study is not relevant for this type of product.

Different set of actions should be done during each phase of development and different set of UX or usability testing methods should be used. The list of these actions and methods for each phase is mentioned below.

#### 1. Determine requirements and design

Collecting data and requirements on how to improve the performance of users of WYSIWYG editors is the first phase of a product development. To analyze previous research, to collect data about requirements and ideas for new generation of editors are the basic tasks in this step. Recommendation and first drawings of the layout should follow (O'Flaherty, 2015).

Cognitive walkthrough can bring an insight into the way how users work with these editors and what is the main problem in the learning process.

From the point view of UX testing these methods will be used:

- Usability testing
- Focus groups

Simplified version of usability testing can be used. Two groups of 4-5 users should be used for Usability testing. One group should include users with no or limited knowledge of these editors and advanced users should be in the second group. Testing should be short – 10-15 minutes per person.

All users should participate in a focus group. The goal of the focus group will be to define ways how to improve work with the editor. Participants should have access to an editor during the whole testing (Tullis, Albert, 2013). First version of a layout for new editor would be designed based on the collected data. First phase of testing will be finished.

There is an option that analysis of collected data will result in information that improving is not possible and completely new approach to the situation will be needed. In this case the first phase will end. It would be necessary to take different set of methods and find different way how to create a prototype, for example Participatory design or Focus groups with different group of users can be used.

#### 2. Produce and test

Testing is the most complicated and challenging in this phase. New prototype or upgrade version of the product is presented. More than one version of editor can be created and to choose the best from the offered variants is one of the tasks in this phase. The focus is to find problems, reduce risks and improve usability (Page, 2012).

Methods use in this phase:

- A/B testing
- Usability testing

A/B testing will be used in case that there is more than one version of editor. A/B testing is quantitative approach. At least 30 participants should be included in this part. Desirability studies can be used if the A/B testing is not convincing. Online tools can be used in this step, for example online test with the instructions what the participants should do and time limit visible on screen (Mathis, 2011). Test should be concentrated on the problematic tasks which were revealed in the first phase.

Expert evaluation and more detailed usability testing will follow. Observation and Think-aloud protocol are parts of usability testing method. First it will be concentrated on more specialized task and then on the whole editor. 5 participants for testing is the recommended count. Testing will be performed repeatedly during this phase. The number of participants should be higher for the complete testing to assure that a testing was successful and real users will not discover new problems.

Group testing will be used to optimize time demand on testing.

### 3. Verify

This is the last phase. Users should have final version of editor to their disposal and work with it in their natural environment.

Click stream analysis or data analysis can provide information for the improvement in the future. Field study to see how users work with the editor in their natural environment can help to understand their struggles, if there is any.

## 4 Conclusion

Web content management systems are used by people with no knowledge of web technologies. Users from agricultural area and agribusiness mostly belong in this group. Better editors for creating web pages can help to improve their competitiveness. For this improvement, usability testing is necessary. Optimal relation between expenses of the testing and quality of the test results helps implementing the quality usability testing at a bigger rate.

Complete methodology was created for the testing for editors of the next editor generation. Methods for the each phase of development were chosen according to time consumption and required equipment. Focus groups and Scenarios and Cognitive walkthrough will be used for these tasks from the point view of UX in the first phase of development.

Classical usability testing or group testing and A/B testing will be used in the second phase to optimize the usability and UX of users. The click stream analysis and field study can provide information if there is room for improvement in future.

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## Making monopoly profits and price discrimination on food commodity markets

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**Annotation:** A model of monopoly in the food sector assumes a single firm on the market, which produces and offers a unique (homogeneous) product, for which there are no close substitutes. The firm takes into account only the expected behavior on the demand side (consumers), because there are no competitive firms in the industry. An impossibility of access to a particular market is associated with the so-called barriers of entry into the industry. The barriers then become a source of monopoly power. The fact that a monopoly firm has a certain monopoly power allows it to use a pricing strategy called price discrimination. The essence of price discrimination is to gain consumer surplus and convert it into additional profit for the company without having to take the costs into consideration. Second-degree price discrimination consists of setting different prices for different cumulative quantities of a commodity. By this discrimination a monopoly may obtain a part of the consumer surplus (but not all of it). The aim of this paper is to express a rate of exploitation of consumer surpluses in the second degree price discrimination in relation to selected food products of monopolistic character. This concerns the gain of consumers' buying individual food products compared with buying large (cumulative) packages of the product. The result of the paper will answer a research question: how is second degree price discrimination done in practice? The methodology of scientific research will be based on monitoring the prices of selected food products in retail chains and a comparative analysis of collected data. The survey shows that, thanks to second-degree price discrimination seller receives consumer surplus amounting to 37.41% for the sale of individual piece of the product.

**Key words:** monopoly, price discrimination, consumer surplus, food, price, profit.

**JEL classification:** D42, Q02

### 1 Introduction

The monopoly model in the food industry means that a firm is the sole supplier of a particular homogenous product for which there are no close substitutes. The monopoly of the sole supplier results in the absence of competition. The supply for the whole industry in which there is a monopoly (pure, absolute) is controlled by a single firm (Svoboda and Šrédľ, 2012).

In the food industry, a firm gains a monopoly either by a monopolistic type of market behaviour or by the existence of certain specific conditions in the given industry.

- There is only one supplier producing a certain food product or service in the industry, which implies zero competition in the sector. A monopolist satisfies the entire market demand in the industry. Its supply to the market equals the total market supply in the industry.
- The firm produces a singular (homogenous) food product (or service), for which there is no close substitute (Frank, 1995). This fact results in zero cross price elasticity of demand due to the indispensability of the product in the absence of competition.
- Due to various obstacles, the entrance of new companies to the food industry market is precluded. An obstacle can be, for example, the ownership of a singular natural

source, the amount of invested capital, patents, or state regulations (Řezbová et al, 2014)

Samuelson (2007) states that absolute monopolies are rare nowadays; in reality, there is always the possibility of competition because of the uncertainty of being able to maintain the current state in the future (potential competition) or due to the emergence of a substitute; therefore, purely monopolistic behaviour is not sustainable for a long period, if the firm doesn't have full legislative protection (administrative monopoly).

The question as to why there is only one firm on the given market can be answered by the fact that other companies either don't want to enter or are unable to enter the market. The lack of access to a particular market is connected with so-called barriers to entry into industry, which then become the source of monopoly power. The main ones are:

- The fact that the average cost (AC) of certain firms reaches a minimum value at an output higher than that demanded by the market (as long as the price is higher than the average cost, the firm makes a profit). The existence of a natural monopoly in the current economic situation has become somewhat anachronistic, especially due to the effect of globalized production and the development of new technologies.
- Control of resources necessary for the production of a certain product by one firm. In the food industry this could be, for example, the ownership of a singular resource, such as a mineral water spring, etc. The French company Perrier sells bottled mineral water. The company spends millions of dollars each year to promote the exceptional qualities of this water, which are, the firm claims, the result of a historically unique combination of geological factors that have created this mineral spring. ... For many consumers, there is no satisfactory substitute for Perrier mineral water. The monopolistic position of Perrier in relation to such buyers is the result of exclusive control over input that cannot be easily substituted (Frank, 1995).
- A monopoly of a firm securing the whole market demand may occur "artificially" due to non-market circumstances, most commonly as the result of state intervention in the economy. The state may grant a firm the exclusive right to manufacture a given product, or to sell it in a particular area.
- Legal restrictions in the form of patents, intellectual property rights, etc. A suitable example from the Czech Republic is the protection of the recipe for the original food product, the liqueur Becherovka. In the survey by the tourist guide Lonely Planet, Becherovka Original and Absinthe from the Czech Republic are among the top ten best alcoholic beverages in the world. For Becherovka, the guide states that only two people know its recipe.
- Among the barriers to entry that the firm can use against their potential rivals may be advertising and product differentiation. Advertising contributes to product familiarity and brand loyalty. For example, Pepsi and Coca-Cola spend hundreds of millions of dollars per year on advertising their brands. This makes entry to the market very expensive for potential rivals (Samuelson, 2007). A firm really can move the demand curve to the extent that it is able to convince us that the given product is necessary for our well-being and happiness. Advertising not only increases brand loyalty, it also makes entrance to the market more expensive for new producers. A newly entering producer must buy production facilities as well as advertising (Schiller, 2004).



The aim of this paper is to express the degree of exploitation of consumer surplus by firms in second degree price discrimination in the case of selected food products of a monopolistic character. This concerns the surplus of consumers purchasing individual food products in comparison with the bulk (cumulated) buying of a given product. The result of the paper will be answering a research question: How is second degree price discrimination done in practise? The methodology of scientific research will be based on monitoring prices of selected food products in retail chains and comparative analysis of collected data and its evaluation.

## 2 Materials and Methods

A monopoly is a market structure in which a single seller of a product for which there is no close substitute serves the whole market (Frank, 1995). At a given moment, such a supplier can decide on the price or the quantity of the sold product; but not both at the same time. We can see that the monopolist may either choose the price of the product or let the consumers decide how much they will buy at this price, or decide on the quantity of their product so the consumers can determine what price they are willing to pay for this quantity. The first approach is probably more natural, but the second option seems to be more suitable for the purposes of analysis (Varian, 1995).

Within microeconomic analysis, we generally assume that the firm selects the quantity of production, which enables them to maximize profits, and subsequently, from this optimum output and market demand, the market price is determined. "Of course, both approaches are equivalent as long as they are applied correctly (Varian, 1995).

The general condition of profit maximization is the equality of marginal revenues and marginal costs ( $MR = MC$ ) (Samuelson, 2007). The function of demand and the function of revenues, and therefore also the function of marginal revenues, does not include the influence of market prices and the quantities of market competitors. Thus, these functions differ from the functions of demand, revenue and marginal revenue in monopolistic and oligopolistic competition. While selecting the supply quantity, for profit maximization  $\pi$ :

$$\frac{d\pi}{dq} = \frac{dP}{dq} + P(q) - \frac{dTC}{dq} = MR(q) - MC(q) = 0 \quad (1)$$

Max. $\pi$  will be achieved at quantity of supply  $q$ , at which the value of marginal revenue on the last unit of growth of supply quantity will be equal to the value of the marginal cost for this last unit of supply quantity (the intersection point of marginal revenue and marginal cost) (Mach, 1999). The corresponding market price for this planned quantity  $q$  will be the price  $P(q) > MC(q)$ .

Unlike perfect competition ( $P = MC$ ), the market price at profit maximization of a monopolist firm is always higher than marginal costs ( $P > MC$ ) (Samuelson, 2007). The point of intersection of marginal revenue and marginal costs under monopoly, with corresponding property  $P > MC$ , is called the Cournot point in economic theory.

### 3 Results and Discussion

#### 3.1 Price discrimination by a monopoly

A food firm has various options for increasing their profits resulting from their monopoly:

- Lowering their cost per unit of production, in particular in natural monopoly.
- Increasing the volume of sales by moving the demand curve to the right by attracting potential buyers by advertising.
- Under certain conditions, the option of food price differentiation against various groups of customers.

#### 3.2 Price differentiation used by one firm

The term price differentiation (also price discrimination) is used when the seller has the chance to offer the same (homogenous) food product to various groups of customers for different prices.

The fact that a monopoly has a certain monopolistic power allows them to use this price discrimination in their pricing strategy. When companies have a certain market power, they can increase their profits through price discriminations (Samuelson, 2008). The aim of price discrimination is to gain the consumer surplus and to transform it to additional profit for the firm. The essence of price discrimination is setting different prices for identical products by a firm, without justification of different costs; they may attempt to differentiate their product from the products sold by their competitors to further increase their market power (Varian, 1995). The example of price discrimination is the common practice of dual pricing for local people and foreigners in tourism (e.g. in restaurants, taxis). Some individuals are willing to buy a product for a higher than market price, others will buy only for lower prices (Schiller, 2004). DeGraba (1990) finds price discrimination to dampen the innovation incentives of downstream firms, as a more efficient firm is charged a higher price when the discriminatory pricing rule is allowed, and Yoshida (2000) argues that although an increase in total output is a necessary condition for welfare improvement in the case of third-degree price discrimination in a final goods market, it is a sufficient condition for welfare deterioration in an intermediate goods market.

#### 3.3 Transformation of consumer rent to monopoly profit

The source of increased cost of a monopoly in price differentiation is the option to transform a portion of consumer rent (surplus) into the monopoly's profit. Theoretically, it would be possible to achieve the greatest profit by a division of the market such that each consumer would pay for a product an individual price corresponding to their preferences (marginal utility). In such cases, all of the consumer rent would be transformed to the firm's profit. This is an example of first degree price discrimination.

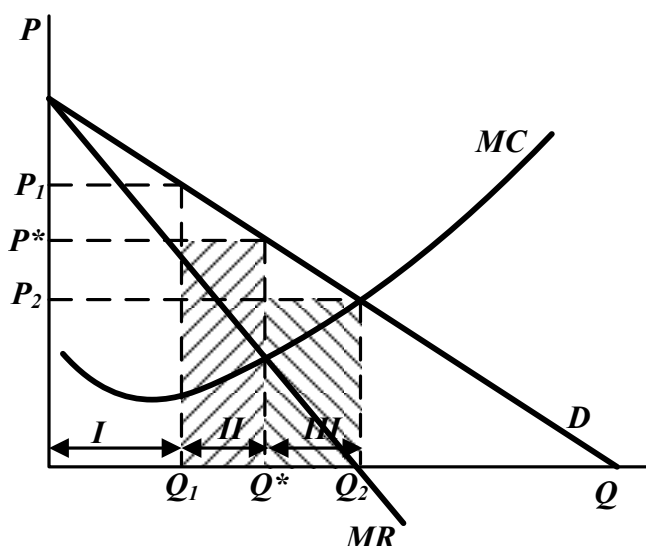
The ability to increase the monopoly profit by market price differentiation occurs when it is possible to divide the market into segments with different price elasticity of demand: to the market with inelastic demand and the market with price elasticity of demand.

Equations, images and tables must be centered. If the equations need to be numbered, use bold numbers in thin brackets on the right side (use invisible tables for alignment, see example below).

### 3.4 Second degree price discrimination

Second degree price discrimination involves setting different prices for different cumulative amounts of the product; this is, therefore, discrimination depending on the quantity sold. Varian (1995) states, that second degree price discrimination is also known as a case of non-linear pricing because it means that the price per unit of output is not constant but depends on the quantity of your purchase. Second degree price discrimination is often associated with information differentiation (Bang and Kim, 2013). The seminal paper, Lewis and Sappington (1994) studies how information provision affects second-degree price discrimination of offering menus of different prices and quantities. So, this form of discrimination is commonly used in public services (Varian, 1995). Since the monopolist determines different prices for various customers depending on various “blocks” of purchased quantities, some authors refer to second degree price discrimination as “Multipart Pricing”.

Fig. 1. Second degree price discrimination



Source: Soukupová et al., 2011

If the monopolistic firm shown in Fig. 1 did not discriminate, they would determine the price  $P^*$  and produce the output  $Q^*$ . Instead, they will divide the produced quantities into “blocks” for which they will set different prices. They set the price of the first block (marked I and representing the quantity  $Q_1$ ) at the level  $P_1$ . By doing so, they will remove a portion of their consumer surplus, which was originally the difference between the price  $P^*$  and the corresponding portion of demand. The consumer surplus has changed to the difference between the higher price  $P_1$  corresponding to a portion of demand. The second block will be sold by the firm for the price  $P^*$  and the third block for the price  $P_2$ . The largest buyer will buy this additional unit because its price is lower, thanks to which he will be better off. The seller will sell this additional unit for a price exceeding the marginal cost, so they will be better off, too (Varian, 1995).

Second degree price discrimination is similar to first degree discrimination in that it serves to drain the consumer surplus from each buyer (Frank, 1995). By second degree price discrimination a monopoly may gain a portion of the consumer surplus (yet not all of it, as in the case of first degree price discrimination) (Soukupová et al., 2011)

Second degree price discrimination can be encountered not only in the well-known examples of the monopolized sectors of water treatment and transportation, electricity production and supply, etc., but also, for example, in the sale of brand name food products of a monopolistic character. For example, by buying a larger pack of four bottles of Coca Cola, the consumer will get one bottle for CZK 20. If they bought the bottles individually, they would pay CZK 35 for each.

### 3.5 Analysis

We will use beverage Coca-Cola as a sample product. Coca-Cola is a typical food product, which is due to the high sugar content very popular worldwide and therefore can be used as an example of price discrimination. Sugar is a very significant component of the global food market, on which it plays an irreplaceable role (Svatoš et al., 2013).

We will compare the price of a bottle of Coca-Cola with the price of one bottle of Coca-Cola in a bulk in the selected store at a particular time. Following two tables show prices of Coca-Cola at different stores at different times.

**Table 1.** Prices of Coca-Cola in bulk (four two-liter bottles) (prices are in CZK)

Chain store	Price per package	Price per liter	Date
Globus	79,90	9,99	1. 10. 2010
Globus	79,90	9,99	22. 10. 2010
Tesco	68,90	8,61	25. 5. 2011
Tesco	89,90	11,24	3. 10. 2012
Tesco	99,90	12,49	11. 12. 2013
Tesco	99,90	12,49	14. 1. 2015
<b>Tesco</b>	<b>94,90</b>	<b>11,86</b>	<b>11. 5. 2015</b>
Lidl	79,90	9,99	25.5.2015

Source: own price survey, 2015

**Table 2.** Prices of Coca-Cola (single two-liter bottle) (prices are in CZK)

Chain store	Price per bottle	Price per litre	Date
Tesco	37,90	18,95	29. 12. 2014
Lidl	37,90	18,95	29. 12. 2014
Billa	34,90	17,45	30. 4. 2015
Lidl	34,90	17,45	11. 5. 2015
<b>Tesco</b>	<b>37,90</b>	<b>18,95</b>	<b>11. 5. 2015</b>
Albert	34,90	17,45	19. 5. 2015
Tesco	34,90	17,45	20. 5. 2015
Billa	34,90	17,45	27. 5. 2015

Source: own price survey, 2015

From both tables we will be interested in recordings made at the same time in the same shop, because only this comparison is authoritative in terms of the research. The comparison of the price of a liter of Coca Cola in bulk (four two-liter bottles) and the price of single bottle (two-liter bottle) done on 11th May 2015 in Tesco shows that the price of one liter of beverage in the case of buying larger packages is by 7.09 CZK lower. The relative price difference is minus 37.41%. The consumer surplus which the company draws in the context of second-degree price discrimination when buying one bottle Coca-Cola versus buying large packs of four bottles in May 2015 was 7.09 CZK per liter of beverage. Thus, the seller receives the consumer surplus totaling 37.41% of the beverage.

American company Coca-Cola is on the market for 129 years. In terms of economic results, in the first quarter 2015 it recorded sales increase for the first time in nine quarters. Revenue rose by 1.3 percent to 10.7 billion USD. Net profit, however, fell by four percent to 1.56 billion USD. Yet it is one of the most famous companies, which represents a monopoly for many customers which consider their product unique (Reuters, 2015).

#### 4 Conclusion

Agriculture or food companies with an absolute monopoly determine their offer of specific food products according to the function of the expected total market demand and the expected profit at the given function of total cost, based on the effects of various combinations of planned levels of market prices and quantities to supply the expected demand, regardless of the existence of possible competition from other companies. Out of these possible planned combinations of quantities of supply and market prices, they select a combination that will ensure the maximization of the total profit of the firm under the given technical production conditions (i.e. at the given production and cost functions). The survey shows that, thanks to second-degree price discrimination seller receives consumer surplus amounting to 37.41% for the sale of individual piece of the product.

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## Measuring Agency Costs in Agriculture

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**Annotation:** The transformation process of Slovak economy started in 1989. As a result of privatisation a lot of firms had been changing their legal form. Before 1989 in agriculture cooperatives were the usual legal form. Nowadays Joint Stock Company and Limited Liability Companies dominate. This paper examines the impact of legal form of agricultural farms on agency costs for a panel of Slovak agricultural farms. We assume that the legal form of a farm determinates the level of the agency costs. There were three measures used: the ratio of operational expanses to annual sales, sales-to-total assets ratio and return on equity. Using MANCOVA and ANCOVA techniques, we find that the legal form of a farm is a relevant determinant of agency costs level. We also conclude that the use of operational expanses to annual sales ratio is recommended only in industries in which its mean value in long run is lower than 1.

**Key words:** Agency costs, legal form, company, cooperative, operational expanses to annual sales ratio, agriculture.

**JEL classification:** G3, L2, M1

### 1 Introduction

The article deals with the relationship of agency costs level and the legal form of the agribusinesses in the Slovak Republic. Agency costs can be defined as the sum of the monitoring expenditures by the principal, the bonding expenditures by the agent and the residual loss (Jensen and Meckling, 1979). To minimize agency costs in a firm is beneficial for stakeholders. The main benefit for the owner in the short run is higher profit distributed and in the long run higher competitiveness of the owned firm. The lower the agency costs, the higher the profitability and the higher the tax revenues for the government. Other stakeholders like employees, suppliers and customers may also benefit from lower agency costs in different ways (in form of higher salaries and better prices). That is reason why to measure agency costs is relevant and any determinant of agency costs` level is very important for stakeholders. The principal-agent theory has been a discussed topic since the early '30s of the 20th century. As stressed (Berle and Means, 1932), when managers hold little equity in the firm and shareholders are too dispersed to enforce value maximization, corporate assets may be deployed to benefit managers rather than shareholders. Very important contribution further developing the theory from the point of view of agency costs origin was made by Jensen and Meckling (Jensen and Meckling, 1979). Their work was further elaborated by many authors (Morck, 1989; Eisenhardt, 1989; Shleifer and Vishny, 1997; Holmstrom and Kaplan, 2003; Becht et al, 2003; Dennis and McConnell, 2003; Hermalin, 2005;

Gillan, 2006; Tirole, 2006; Djankov et al, 2008). All authors conclude that agency problems arise when managers or controlling shareholders have the ability to redirect or consume corporate resources in ways that benefit themselves but which are not in the best interests of the other owners, including minority owners. A responsible management requires of all organization's departments to provide efficient and effective activities (Chebeň, 2012). The keystone of the agency costs theory is the assumption that an increasing number of owners and complexity of owner structure lead to higher agency costs. As the number and types of shareholders increase the incentive for any individual shareholder to incur the costs of monitoring managers decreases because the benefits associated with monitoring are proportional to the shareholder's ownership stake (Shleifer and Vishny, 1997; Holderness, 2009; Belghitar and Clark, 2015). This in turn results in less monitoring than would arise in the case of a single owner.

The agricultural sector in Slovakia was transformed after 1989 when the centralized economy ceased to exist. Before 1989, Slovak agriculture consisted only of cooperatives and state farms with large acreage. After 1989, all farms turned private. Cooperatives were privatized by the issuing cooperative shares and owners became the holders of these shares. The cooperatives in Slovakia have significantly higher number of owners than companies. Companies were established also after 1989 and manage the land of failed cooperatives. This legal form is considered more effective. Therefore we assume that agency costs are determined by the legal form of the company, which is a reflection of its owner's structure. In 2014, more two decades after the change towards the market economy, a substantial part of agricultural land is still farmed by entities with large acreage. Nowadays, cooperatives and companies (Joint Stock Company (JSC.), Limited Liability Company (Ltd.)) are the main legal forms when acreage is considered.

The main objective of the paper is to examine the relationship of legal form of agricultural farms and agency costs for a panel of Slovak agricultural farms. We assume that the legal form of a farm determinates the level of the agency costs. The few studies that have attempted to directly measure agency costs have analysed US and UK firms. For example, (Ang et al, 2000) analysed small unquoted US companies and (Singh and Davidson, 2003) examined quoted US companies. Some authors undertook the first direct study on agency costs in large quoted UK companies (McKnight and Weir, 2009). So far, to our best knowledge, no study dealt with agency costs in the agribusinesses in the transition economies. We analyse the unquoted agricultural farms in Slovakia. The main contribution to the theme of agency costs, apart from the analysis of the agency cost in the transition agriculture, is the verification of assumption that the legal form of a farm determinates the level of its agency costs.

## 2 Materials and Methods

Our analysis is based on a database of primary agricultural production in Slovakia with individual company data including balance sheet and income statement for each farm over the period of 2000 – 2011. The data are collected by the Slovak Ministry of Agriculture and the participation of all companies and cooperatives is obligatory. We split the farms into two basic legal forms: cooperatives (labelled 0) and companies - JSC, Ltd. (labelled 1). These two groups of farms manage a significant part of agricultural land in Slovakia. We analysed a panel consisting of 409 farms; each farm in the panel was economically active during the period 2000 – 2011. To measure agency costs of the farm, we used two alternative efficiency ratios that frequently appear in the accounting and financial economics literature



(Ang et al, 2000; Singh and Davidson, 2003): the expense ratio, which is operating expenses to annual sales AC1 (1) and the asset utilization ratio, which is annual sales divided by total assets AC2 (2). The first ratio is a measure of how effectively the firm's management controls operating costs, including excessive perquisite consumption, and other direct agency costs. The second ratio is a measure of how effectively the firm's management deploys its assets. In contrast to the expense ratio, agency costs are inversely related to the sales-to-asset ratio. The third indicator (not used by Ang et al., 2000) is return on equity ROE, labelled as AC3 (3). The last indicator is a standard measure of the owner's benefit (Klieštík and Valášková; 2013). This indicator can be considered a firm's measure of decision making process efficiency which is influenced by managerial structure and legal form.

$$AC1 = \frac{\text{operational expenses}}{\text{sales}} \quad (1)$$

$$AC2 = \frac{\text{sales}}{\text{total assets}} \quad (2)$$

$$AC3 = \frac{\text{net profit}}{\text{equity}} \quad (3)$$

We use analysis of covariance (ANCOVA) and multivariate analysis of covariance (MANCOVA) to confirm the indicators (AC1, AC2, AC3) are influenced by number of owners and legal form of the farm. MANCOVA is an extension of multivariate analysis of variance (MANOVA). Analysis of covariance (ANCOVA) joints the features of analysis of variance (ANOVA) and multiple regressions. Model of the analysis of covariance (ANCOVA) with one nominal factor and with one covariate takes the form:

$$Y_{ij} = \mu + \alpha_i + \beta(x_{ij} - \bar{x}) + e_{ij} \quad (4)$$

where  $\mu$  is mean,  $\alpha_i$  is a contribution of the  $i^{\text{th}}$  level of factor A and  $e_{ij}$  is a residual. The terms  $\mu, \alpha_i, i = 1, 2, \dots, l$  are the estimated parameters, and  $e_{ij}, i = 1, 2, \dots, l, j = 1, 2, \dots, n_i$  are independent variables with the distributions  $N(0, \sigma^2)$ . If the relationship between X and Y is significant, then the model of analysis of covariance explains most of the variability of the variable Y as a model of analysis of variance. Analysis of covariance tests whether the transformed means of groups (in our case legal form) are different. Means are modified as if the same (average) value of intensive/quantitative factor (in our case number of owners) were in all groups (Hendl, 2004).

### 3 Results and Discussion

As a basic characteristic of our sample we used the mean values of three selected indicators (AC1, AC2 and AC3). The results are presented in tables 1, 2 and 3. The values of indicator AC1 serving as direct measure of agency costs (Ang et al, 2000; Singh and Davidson, 2003; McKnight and Weir, 2009) seem to be more favourable to cooperatives. The mean value for total sample varies between 1.535 and 2.015. However, these values are for vast majority of industries simply not acceptable (for example, the AC1 values for firms analysed by Ang et al. (2000) are well within interval 0.3 – 0.7), because value higher than 1 means, that the firm generates loss. But we have to take into consideration that the evaluated sector is agriculture. In agriculture subsidies play an important role and therefore the agricultural farm does not have to cover all the operational expenses by sales (Pokrivčák et al, 2005). The reason why cooperatives seem to be more effective according to this ratio is the fact (based on previous research) that companies earn higher subsidies while cooperatives generate higher sales. This statement can lead to wrong presumption that the companies are

more effective only due to higher rate of subsidies. From tables 1 and 2 it is obvious that it is not correct. In every year the companies` mean values of AC2 and AC3 are higher than the cooperatives` ones. The results of indicator AC2 present that to generate sales companies need to employ less assets in comparison with cooperatives. The difference in mean value of AC2 is significant in this case. However, the difference is shrinking. This is due to the increasing support in form of Common Agricultural Policy subsidies. The amount of subsidies received is not linked to the market production and results in lower efficiency (see the tendency in AC1 indicator). The last indicator we used (AC3) measures ROE – the benefit of the owner. Generally, we can conclude the higher the return on equity the lower the agency costs (assumed we evaluate firms in the same industry). The values of AC3 show that companies generate ROE 10% higher than cooperatives in every observed period. This is partially affected by the transformation process, meaning that there is still higher equity in cooperatives in comparison with companies. But the fact is that companies as a legal form should be preferred by the owners.

**Table 1.** Mean values for indicator AC1

	AC1_2000 Mean	AC1_2003 Mean	AC1_2007 Mean	AC1_2011 Mean
Total	1.649	1.535	1.781	2.015
cooperative	1.580	1.519	1.744	1.988
company	1.767	1.562	1.847	2.063

Source: own calculation based on data from the Information Letters of the MoARD SR, 2015

**Table 2.** Mean values for indicator AC2

	AC2_2000 Mean	AC2_2003 Mean	AC2_2007 Mean	AC2_2011 Mean
Total	0.597	0.623	0.523	0.521
cooperative	0.441	0.493	0.448	0.461
company	0.865	0.848	0.653	0.624

Source: own calculation based on data from the Information Letters of the MoARD SR, 2015

**Table 3.** Mean values for indicator AC3

	AC3_2000 Mean	AC3_2003 Mean	AC3_2007 Mean	AC3_2011 Mean
total	0.046	-0.034	0.065	0.050
cooperative	-0.003	-0.096	0.017	0.011
company	0.131	0.072	0.147	0.119

Source: own calculation based on data from the Information Letters of the MoARD SR, 2015

In the next step we confirm the indicators are influenced by number of owners and legal form of the farm. We used MANCOVA (legal form was coded as a binary variable (cooperatives 0, companies 1) and the number of owners was a continuous variable). MANCOVA tested the hypothesis that there is no statistically significant difference in vector of indicators AC1, AC2, AC3 for years 2000, 2003, 2007 a 2011 based on the legal form when number of owners considered. We rejected the hypothesis at the 1 % significance level (see table 4). We confirmed that relation between covariate of number of owners and the vector of dependent variables is statistically significant at the 5 % significance level. Based on the MANCOVA results we analysed the influence of legal form on indicators separately in each year. We used analysis of covariance, ANCOVA. The results confirmed the significant difference based on the legal form in indicators AC2 and AC3 (see table 5). However, based on the ANCOVA results we conclude that the indicator AC1 has limitations in measuring agency costs in agricultural enterprises. As descriptive statistics suggested and ANCOVA confirmed there is no statistically

significant difference between cooperatives and companies in AC1. This is due to the fact, that in agriculture the farm rises cash not only on the market in form of sales, but a significant part is linked to subsidies. Slovakia as a member state of the EU benefits from the Common Agricultural Policy and the subsidies are over 30% from the annual sales (Tóth et al, 2010). The indicator AC1 is the ratio of operative expenses (that covers not only market production in agriculture) and annual sales (which are not the one and only source of cash in agriculture). Therefore to use of indicator AC1 as a measure for agency costs in agriculture the impact of subsidies should be considered. The legal form is a direct determinant of agency costs (table 4).

**Table 4.** MANCOVA results

	Test	Value	F	Effect df	Error df	P
Intercept	Wilks	0.0735	488.442	12	465	0.000*
	Pillai's	0.9265	488.442	12	465	0.000*
	Hotellng	12.605	488.442	12	465	0.000*
	Roy's	12.605	488.442	12	465	0.000*
num_own	Wilks	0.95282	1.9186	12	465	0.030*
	Pillai's	0.04718	1.9186	12	465	0.030*
	Hotellng	0.04951	1.9186	12	465	0.030*
	Roy's	0.04951	1.9186	12	465	0.030*
leg_form	Wilks	0.82215	8.3827	12	465	0.000*
	Pillai's	0.17785	8.3827	12	465	0.000*
	Hotellng	0.21633	8.3827	12	465	0.000*
	Roy's	0.21633	8.3827	12	465	0.000*

Note: \* indicates statistical significance

**Source: own calculation based on data from the Information Letters of the MoARD SR, 2015**

**Table 5.** ANCOVA results

P	2000			2003			2007			2011		
	AC1	AC2	AC3	AC1	AC2	AC3	AC1	AC2	AC3	AC1	AC2	AC3
leg_form	0.16	0.00*	0.00*	0.91	0.00*	0.00*	0.78	0.00*	0.00*	0.60	0.00*	0.03*

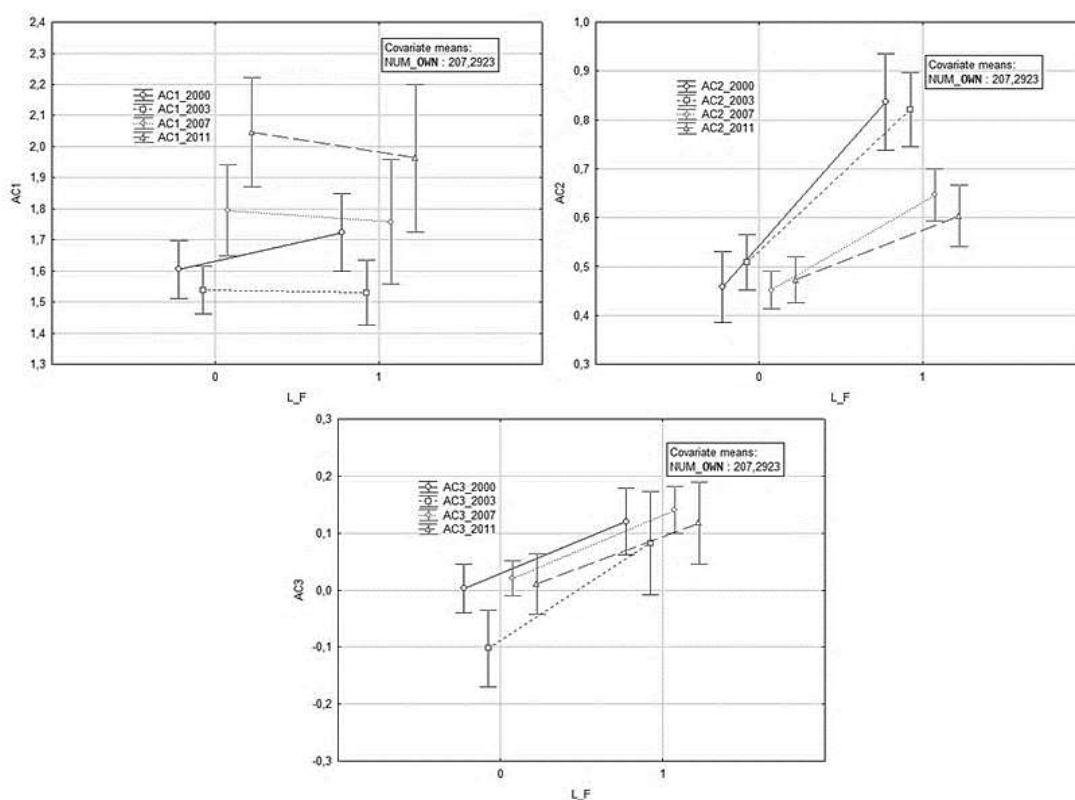
Note: \* indicates statistical significance

**Source: own calculation based on data from the Information Letters of the MoARD SR, 2015**

To be able to focus solely on the legal form we had to eliminate the influence of number of owners. It was necessary because of a big difference in the average number of owners in Slovak agricultural farms (average number of owners in companies is much lower compared to cooperatives; see table 1). We simulated the situation with the same number of owners for each legal form. It was done by the adjusting the sums of the squares of indicator value deviations (for mathematical explanation see methodology). The results are presented in figure 2. The figure shows the mean values with the 95% confidence level of the indicators AC1, AC2, AC3 for the situation the number of owners is the same. Although we eliminated the influence of the number of owners, the indicator AC1 did not show clear results. The values changed in favour of companies in all years with exception of the year 2000. This said, there was no statistical significance of the differences in mean values of indicator AC1 of two legal forms. The remaining indicators (AC2, AC3) after the elimination of the influence of number of owners remained unchanged in the results. They confirmed the statistical significance of difference in mean values between cooperatives and companies. The mean values remained almost unchanged in AC2 and AC3. We conclude that sales to assets ratio (AC2) and

ROE (AC3) in Slovak agriculture are different in cooperatives and companies. From the owner's point of view to generate higher profit, company should be the preferred legal form. The higher profit in companies is achieved with lower assets employed (see mean values for AC2 and AC3). Therefore company as a legal form can be recommended in Slovak agriculture. The literature (Ang et al, 2000; Singh, Davidson 2003; McKnight and Weir, 2009) recommends AC1 (operational expenses to annual sales ratio) as a measure of direct agency costs. The relevance of AC1 in industries strongly affected by public funding (subsidies) is limited when subsidies (or any other form of financial support) are not included. In such industries the ability to generate profit and the resulting agency costs do not depend solely on market revenues in form of sales. Therefore, if operational expenses to sales ratio (AC1) does not include all revenues (as it was the case of the firms analysed by Ang and others) it does not show clear results. This is definitely confirmed for Slovak agriculture by AC1 results in Fig 1. We suppose that the same limitations stand for other sectors with public influence as well.

**Fig. 1.** The mean values with 95% confidence level of the indicators AC1, AC2, AC3 (panel data)



Source: own processing

Note: 0=cooperatives; 1=companies

## 4 Conclusion

The alignment between interests of owners and managers supports the competitiveness of individual firm which results in a higher competitiveness of a country in an open economy. On the microeconomic level this alignment is characterized by lower agency costs. In this paper we focused on agricultural sector which is considered to be industry with generally low efficiency. Nevertheless the agricultural farms can also be divided into two groups regarding agency costs. The one with higher agency costs and the one with lower agency costs. We analysed whether this distinction is connected to legal form of the farm. Based on results

of our research we conclude that companies` (JSC, Ltd.) agency costs are lower and they create higher return for the owners. Another benefit of this legal form is that to generate higher return companies need to employ lower assets. Therefore we recommend this legal form as preferable over cooperatives. Further research should be focused on confirming if this statement is valid for another industry, as well.

The literature suggests several indicators to measure agency costs. We tested two of them. The first one was the operational expenses to sales ratio which measures the direct agency costs. The second one was sales to assets ratio which is usually used as a measure of indirect agency costs. The results show that the use of the first indicator in industries influenced by public support is limited. Any public funding needs to be included into the calculation. The ratio compares expenses to sales which stand for the market revenues only. But in the industry like agriculture a part of the yearly revenues is in form of subsidies which are not generated by market. The indicator is incomplete in this case because the numerator of the ratio covers all operational expenses of the firm but the denominator only a part of its revenues. It results in situation that the ratio is higher than 1 in the long term. We recommend to use this ratio in its basic form only in industries in which its mean value in long term is lower than 1.

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## Measuring Risk in Agriculture: The case of Slovakia

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**Annotation:** Farmers are faced with variety of risks that originate from different sources. These risks are very rarely completely independent from each other, particularly when measured in terms of their impact on the income variability. Concern on increasing farm income volatility in the EU has induced wide range of research in this area. Only a few studies paid attention to the issue of risk in agriculture in Slovakia, therefore we decided to focus our research on this area. The main objective of the paper is to estimate the development of market risk and return of Slovak farms in the period of years 2000 – 2013. The data set of the analysis consists of information from financial statements obtained from the Ministry of Agriculture and Rural development of SR. The paper uses the alternative Markowitz portfolio theory approach, by replacing the stock return with return on equity (ROE), to estimate the riskiness of unquoted agricultural farms. For calculation are used 5-years moving averages, in order to avoid trend of data. The portfolios are created for two legal forms in Slovak agriculture: cooperatives and companies (JSC., Ltd.), as well as for two types of production orientations: crop farms and animal farms. The results show that the companies (Ltd, JSC) are more effective legal form with higher level of return and lower risk. Therefore, it is expected that the amount of low profitable cooperatives will continue to decrease in the future in the favour of companies. From the point of production orientation, the crop farms record higher return and also higher risk in comparison to the animal farms. It agrees with the general opinion that the crop production is riskier, because of its dependence on climate and shorter production cycle than the animal production.

**Key words:** Agriculture, risk, return, legal form, production orientation, Markowitz portfolio theory.

**JEL classification:** Q13, Q14, Q18

### 1 Introduction

Risk generally refers to deviation of the evaluated indicator, and its level depends on the volatility over a certain period. Risk in agriculture has been a matter of worldwide concern since 1933, when the concept of risk analysis had been introduced (Hardaker et al, 2004). Agriculture is a sector facing particularly large risks, resulting mainly from natural factors outside the control of farmers. The resulting variations in farm output, combined with a relatively low price responsiveness of supply and demand, also cause agricultural markets to be rather volatile (Tangermann, 2011). The sources of risks, that are relevant in agriculture have different characteristics, and can be classified in very different ways (Huirne et al, 2000; Holzman and Jorgensen, 2001). Sources of risk of Slovak agriculture include biological nature of production, dependency on climatic conditions, seasonality, animal and plant health, price instability, policy regulations, and range of macroeconomic factors (Serenčėš et al, 2010; Váryová et al, 2012).

The agricultural sector in Slovakia was transformed after 1989, when the centralized economy ceased to exist. Before 1989, Slovak agriculture consisted only of cooperatives and state farms with large acreage, without existence of private companies. Since that time, the number

of private companies (Joint Stock Company (JSC.), Limited Liability Company (Ltd.)) has been gradually increasing, because this type of legal form is considered to be more effective. (Pokrivčák et al, 2005). The next milestone for the Slovak agricultural development has been the Common agricultural policy (CAP) assessment in 2004. New political regulations, requirements and single payment system led to the number of substantial changes that have been ultimately impacting economic development in this sector. The crop production has been year to year on the increase (except of year 2009), while the animal production has been generally decreasing. Therefore, we decided to examine the riskiness and profitability of Slovak farms, according to their legal form and production orientation.

There have been several approaches of measuring agricultural risk, resulting from different focus of authors. Some of them oriented on agricultural risk of individual farms, others took into account the whole aggregate level (El Benni and Finger, 2013; Špička and Vilhelm, 2013, Just and Pope, 2003). Because farms can be thought as assets within an overall portfolio, agricultural producers also paid attention to the concept of diversification and portfolio theory. In the Markowitz portfolio theory, total risk is standardly measured by the mean-variance model and standard deviation of stock return (Markowitz, 1952). But, not all businesses provide the ability to raise their capital in the form of stocks. These businesses represent unquoted companies, to which the majority of agricultural companies belong. The stocks, considered in the original model, represent the equity securities, and the return on stock reflects simply the return on equity invested into the business. Therefore, it might be assumed that to be able to measure the risk of unquoted companies, the deviation of return on equity could be considered, as well. To be able to focus on other than security market, the alternative of Markowitz theory approach, the Simple index model, was created (Sharpe, 1963). In SIM the input variables used in the analysis are the accounting fundamentals of companies. The SIM approach was applied in the number of studies, such as usage of gross and net returns (Gempesaw et al, 1988), farm equity returns (Baginski and Wahlen, 2003), book to market ratios (Fama and French 1995) or cash flow variability (Cohen et al, 2009). It empowers our assumption to measure the market risk of unquoted farms, using the return on equity ratio, ROE.

The Markowitz approach or Single index model, has been applied to the number of studies, however many of them did not have aggregate character. They mainly focused on the certain part of agriculture production, for example, Peterson and Leuthold (1987) used the portfolio approach to examine the cattle feeding problem, Sanchirico et al (2005) use portfolio theory to develop optimal management of fisheries, Gempesaw et al. (1988) applied the model to Delaware farm sector or in the more recent study Libbin et al (2004) applied the Markowitz portfolio model directly to a series of New Mexico farms. Many other studies could be mentioned, because the range of applications is really wide. Similarly, we decided to focus our study on examining market risk and return of Slovak agricultural sector and its development over the time. All farms operating in Slovakia were included into several portfolios, according to the legal form (cooperatives/companies) and production orientation (crop/animal). The main objective of the paper is to estimate the development of market risk and return of Slovak unquoted agricultural farms over the period 2000 – 2013, using volatility of ROE. This paper is the extension of our previous study (Tóth et al, 2014).



## 2 Materials and Methods

The data used for the analysis were obtained from the database of Ministry of Agriculture and Rural Development of the Slovak Republic, over the period 2000 - 2013. Data were selected according to the farm legal form, to the subsets of the agricultural cooperatives and capital companies - Joint Stock Company (JSC) and Limited Liability Companies (Ltd.), and according to the production orientation to the subsets of crop farms and animal farms. The selecting criterion for production orientation was the percentage share of revenues from crop production (or revenues from animal production) to the overall revenues from own products and services. When the farm generated more than 50% of revenues from crops production, it was determined to be crop farm. Analogically, the selection was done for animal farms. To avoid the deterioration of results and trend in data, the 5-years moving averages were used. It divided our overall observed time horizon into 10 periods (2000-2004, 2001-2005, 2002-2006, 2003-2007, 2004-2008, 2005-2009, 2006-2010, 2007-2011, 2008-2012, 2009-2013). Moreover, from the dataset the following farms were excluded: farms that started or quitted during each observed 5 year period, farms with negative equity (liabilities exceeding total assets) and farms with return on equity (ROE) exceeding +/- 100% (average profit or loss exceeds equity) over the observed period. The number of farms used for calculation in each 5-year period are described in the table 1.

The modified Markowitz portfolio theory approach was used to estimates the total risk of five portfolios consisting of all agricultural farms, capital companies, cooperatives, crop farm and animal farms. We assumed that the return of the investor is based on the profit of the company and the equity invested. Therefore, we considered return on equity ROE (Eq. 1) to be equivalent to the return on stocks, generally used in the case of quoted companies. Measuring volatility of return in the Markowitz portfolio theory is based on the average return over the observed period for each investment. We calculated the average return on equity EROE<sub>i</sub> (Eq. 2) for each individual farm.

$$ROE_i = \frac{\text{Earnings After Taxes}}{\text{Shareholders Equity}} \quad (1)$$

$$EROE_i = \sum_{i=1}^t ROE_i \cdot d_i \quad (2)$$

Where ROE<sub>i</sub> is return on equity of farm "i", d<sub>i</sub> is a weight of ROE<sub>i</sub> over the observed period (5 years, d<sub>i</sub> = 0.20), t is number of years in observed period, i, j are individual farms. The individual risk of each farm (σ<sub>i</sub>) is calculated using the standard deviation.

$$\sigma_i = \sqrt{\sum_{i=1}^t (ROE_i - EROE_i)^2 \cdot d_i} \quad (3)$$

Where σ<sub>i</sub> is standard deviation of the individual return on equity (individual farm risk), ROE<sub>i</sub> is individual return on equity, EROE<sub>i</sub> is average individual return on equity.

The portfolio risk (σ<sub>p</sub>) is determined by three variables weight of the individual investment in portfolio (w<sub>i</sub>), standard deviation of the individual investment - individual risk (σ<sub>i</sub>), and covariance, relation between the ROE<sub>i</sub> and ROE<sub>j</sub> (σ<sub>ij</sub>). To take into account market portfolio of all agriculture farms, the weight w<sub>i</sub> of each farm is determined by farm market share, which is the share of the farm`s equity on the total equity of all farms. The covariance represents the relationship between returns on equity of farms (Eq 4) and Σ covariance matrix (Eq. 5).

$$\sigma_{ij} = \frac{1}{n} \sum_{i=1}^n (ROE_i - EROE_i)(ROE_j - EROE_j) \quad (4)$$

$$\Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} & \dots & \sigma_{1k} \\ \sigma_{21} & \sigma_{22} & \sigma_{23} & \dots & \sigma_{2k} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} & \dots & \sigma_{3k} \\ \dots & \dots & \dots & \dots & \dots \\ \sigma_{k1} & \sigma_{k2} & \sigma_{k3} & \dots & \sigma_{kk} \end{bmatrix} \quad (5)$$

The portfolio risk is then measured according to eq. 6

$$\sigma_p = \sqrt{\sum_{i=1}^n w_i^2 \cdot \sigma_i^2 + \sum_{i=1}^n \sum_{j=1}^n w_i \cdot w_j \cdot \sigma_{ij}} \quad (6)$$

Where  $w_i$  is an individual weight of i-farm (farm's equity) in a portfolio (total equity of all farms) and  $n$  is number of farms.

The expected return on equity of portfolio is estimated by the multiplication of  $k \times 1$  vector of individual weights of portfolio ( $w$ ) and  $k \times 1$  vector of corresponding individual expected returns on equity (the sum of multiplication of each farm's expected ROE and its share in the market portfolio).

$$EROE_p = \sum_{i=1}^n EROE_i \cdot w_i \quad (7)$$

Where  $EROE_p$  is expected portfolio return on equity and  $EROE_i$  is the average return on equity of individual farm.

### 3 Results and Discussion

For the analysis were used all agricultural farms operating at least 5 consecutive years, that includes 785 farms each year on average. All the farms are divided based on their legal form (cooperatives and companies) and production orientation (crop and animal farms). From the structure of samples in each period is obvious, that the number of cooperatives is continually decreasing, while the amount of companies is on the increase. The same trend can be seen in the case of production orientation, with the increasing amount of crop farms and decreasing animal farms (Tab.1). It means that the structure of the Slovak agriculture has been gradually changing in the favour of companies (JSC, Ltd) focusing on crop production.

The portfolio return is measured by individual ROE and the weight of each farm in each portfolio. Generally, it is claimed that the higher the return, the better for the investor. We can remark that overall profitability in the Slovak agricultural sector is at the low level. The results show that from the point of the legal form, the companies (JSC, Ltd.) are more profitable than the cooperatives. The differences between them are on average 5.55 % each period of years (Tab. 1, Fig. 1). The companies are considered to be more effective, which results from the fact that the companies are a new legal form driven by the private capital, with lower number of owners. They are more profit oriented, with the focus on the increase of the owners' wealth, and greater motivation of management (lower agency costs). In the case of portfolios created by the cooperatives, the result is the loss in all periods except of the period 5 (2004-2008). Therefore, we expect that the low profitable cooperatives will continue to cease to exist in in the favour of companies.

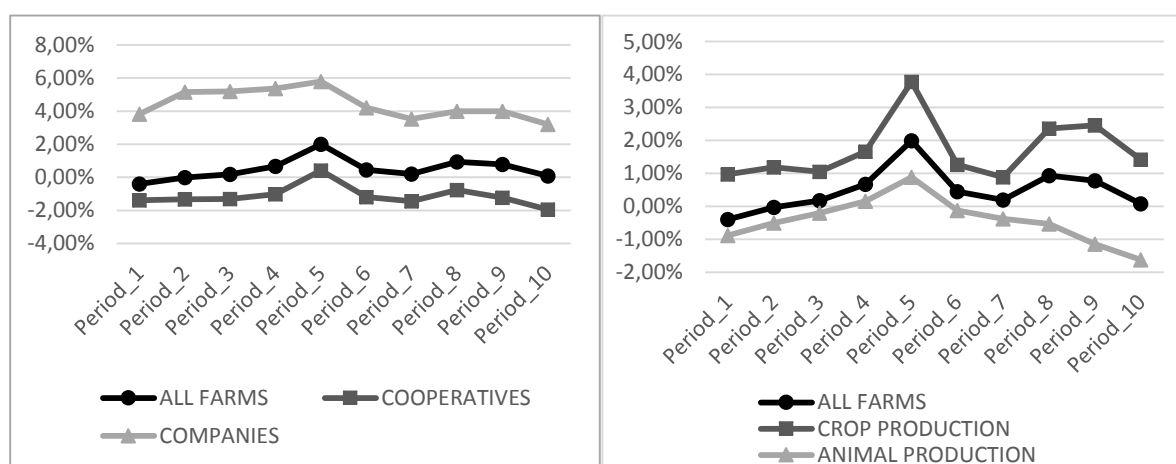
**Table 1.** Risk and return of portfolios of all farms, cooperatives, companies, crop farms and animal farms

	Period	1	2	3	4	5	6	7	8	9	10
All farms	Return	-0.40	-0.02	0.18	0.67	1.99	0.45	0.20	0.93	0.78	0.08
	Risk	2.61	2.64	2.26	1.91	1.00	3.61	3.41	3.40	2.99	2.62
	Farms	686	715	735	791	826	828	802	802	823	841
Cooperatives	Return	-1.38	-1.32	-1.31	-1.03	0.42	-1.20	-1.44	-0.77	-1.24	-1.96
	Risk	2.83	2.76	2.45	2.43	0.89	3.53	3.46	3.59	3.26	3.06
	Farms	465	458	451	443	443	431	411	405	407	400
Companies	Return	3.83	5.15	5.19	5.38	5.80	4.20	3.52	3.99	3.99	3.19
	Risk	2.10	2.43	2.04	1.23	2.03	4.03	3.49	3.26	2.77	2.14
	Farms	221	257	284	348	383	397	391	397	416	441
Crop farms	Return	0.97	1.18	1.05	1.66	3.78	1.26	0.88	2.36	2.46	1.42
	Risk	3.64	3.75	3.27	3.10	2.00	4.75	4.51	4.84	4.48	4.27
	Farms	245	271	288	338	389	413	422	446	465	487
Animal farms	Return	-0.88	-0.50	-0.20	0.15	0.88	-0.13	-0.38	-0.53	-1.14	-1.62
	Risk	2.28	2.22	1.85	1.30	0.53	2.83	2.64	2.38	1.94	0.94
	Farms	441	444	447	453	437	415	380	356	358	354

Source: own processing

From the comparison of crop and animal farms is obvious that the differences of return in individual period are smaller. Production is very closely related, and therefore their development trends are similar as well. However, the return of crop farms is in each period positive, while the animal farms are suffering loss. The exception is the period 5 (2004-2008). It is subjected to the “before crisis year” 2008, when not only the agricultural production was very favourable, but also the prices of agricultural commodities reached their maximum.

**Fig 1.** Return of portfolios of all farms, cooperatives, companies, crop farms and animal farms

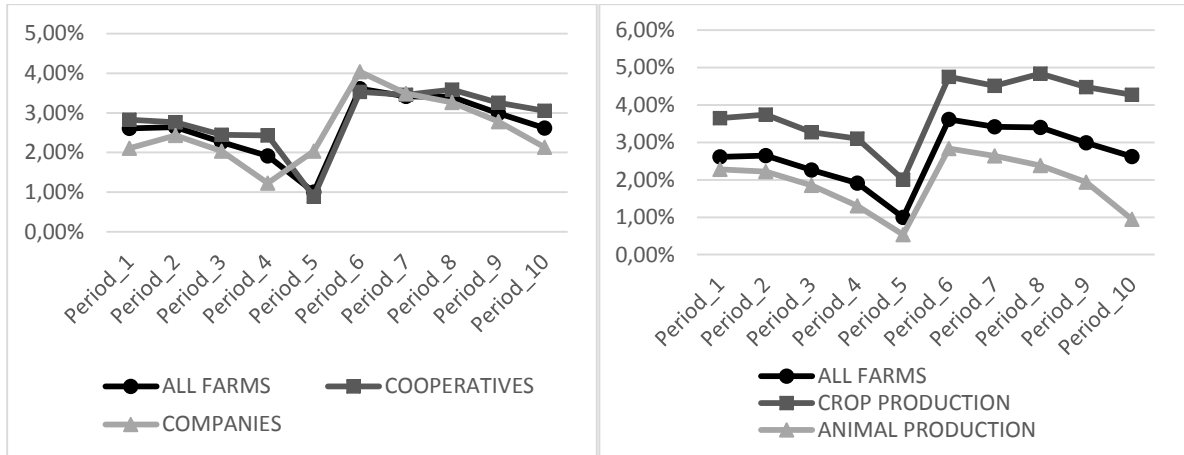


Source: own processing

Risk of portfolios was estimated using portfolio theory approach, with the measured volatility of ROE. This measure gives us an aggregate view on risk of all farms. By adding all the farms existing over the observed periods with the appropriate weight to a portfolio, we simulated the situation, that the investor would buy all the farms in agriculture for the price equal to their total equity. In figure 2 we can see the results in each period. The risk of all farms varied between 1 to 3.61% of ROE. When we divided all farms according to the legal form, the companies reached higher return with lower level of risk. It means, the companies are doing business with lower ROE volatility when compared to cooperatives, but the differences are only small. However, important is to realize that the cooperative generate loss

with relatively similar level of risk in each period. In the case of crop and animal farms is the difference in riskiness more visible. It results from the production character and the fact that crop production is more dependent on the climate and the amount of rainfall received during the cropping season (Hardaker et al, 2004). The animal production is considered to be long-run, therefore it is more stable in comparison to the crop planting, which has usually 1-year production cycle.

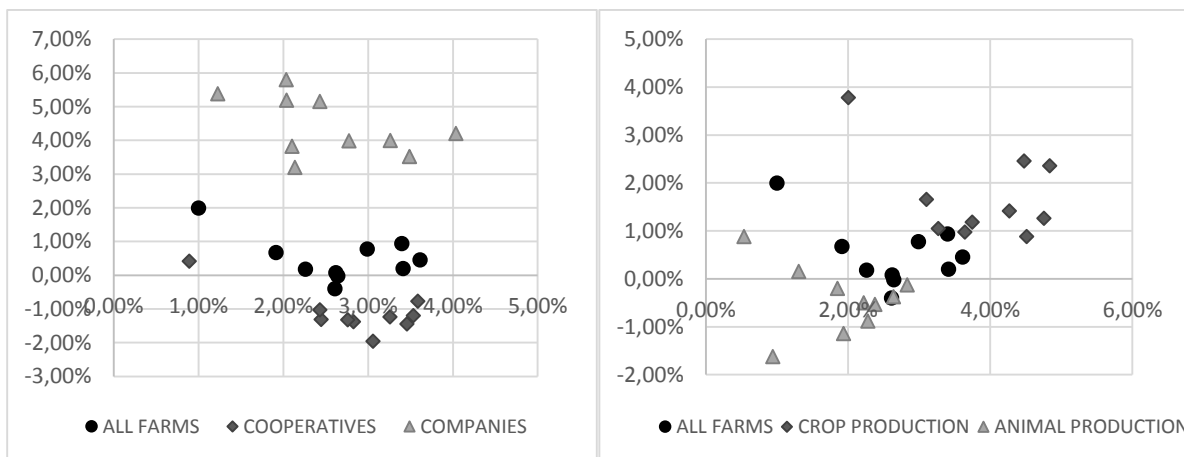
**Fig 2.** Risk of portfolios of all farms, cooperatives, companies, crop farms and animal farms



Source: own processing

In all cases there is a significant change in riskiness between period 5 and 6. It is reasoned by the deviation in the year 2009, when the majority of farms generated loss. Not only the 2009 was the crisis year, so the prices of agricultural commodities were pushed down, but also the climate conditions were unfavourable and the production suffered by drought. These facts caused the increased volatility of returns and production.

**Fig. 3.** Risk vs. Return



Source: own processing

The relationship between risk and return for each portfolio (Fig.3.) is principally important for investors. In the theory, the higher return requires higher risk. In the situation of equal risks the investment with higher return should be preferred and conversely, when returns are equal investor should prefer lower risk. This statement leads us to conclusion, that the agriculture producers should prefer the legal form company (JSC, Ltd.) with the crop production orientation.

## 4 Conclusion

The risk in the European agriculture is decreased by Common Agriculture Policy in form of subsidies and regulations. The difficulty to measure the risk of agriculture companies results from their unquoted character. The majority of farms in agriculture are unquoted. It means by the assessment of market return and risk we have to rely on financial statements. In this case one of the negatives is the fact that these statements are used for tax purposes, and can be adjusted in sense of tax.

In the paper we measured the development of risk and return of Slovak unquoted agricultural farms over the period 2000 – 2013, using the alternative Markowitz portfolio theory with volatility of ROE. Not only all the existing farms in ten 5-years periods were examined, we focused specifically on two legal forms (companies and cooperatives) and two production orientations (crop and animal farms). It can be concluded that the percentage share of cooperatives has been year to year on decrease, in the favour of companies (JSC, Ltd.). This trend is reasonable, because the companies are considered to be more effective legal form, with lower number of owners and preferred profit orientation. The companies generated in each period higher return for relatively similar level of risk, as in the case of cooperatives. From the point of production orientation, the crop farms recorded higher return, and also higher risk in comparison to the animal farms. It agrees with the general opinion that the crop production is riskier, because of its dependence on climate, and shorter production cycle than the animal production. Similarly, there has been a gradual increase of the amount of crop oriented farms and decrease of the animal farms. One of the reasons of this development is also the CAP single payments system that makes the Slovak farms planting on relatively large acreage more favourable. We expect that in the future the structure of Slovak agriculture will change in the way of increasing percentage share of crop oriented private companies.

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# Current state of the art of ICT and information needs among Czech farms in the context of agribusiness

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**Annotation:** This paper aims to evaluate the current state of the art of Information and Communication Technologies (ICT) and information needs and their impacts on farms in the context of agribusiness in the Czech Republic. There is a strong necessity to improve economic performance of farms in the Czech Republic. Moreover, the need for introduction of new ICT in farming and farm management has rapidly increased nowadays. ICT is also one of the key enablers for agribusiness. In farming, ICT directly supports operational agricultural activities and it can also serve as an interactive and flexible tool for monitoring the progress of the farm economic performance. The analysis of current state of ICT and information needs among Czech farms was based on questionnaire survey. We obtained 165 correctly filled answers from agricultural producers. Survey results are presented with descriptive statistics, frequency tables and correlation analysis at the given level of significance  $\alpha=0.05$ . The results show that with 95 % probability: 1) The level of information needs is related to current state of the art of ICT, new technologies and DSS at the farm, 2) Czech farms on average use advanced ICT and information systems, and 3) The farmer's decision making is not strongly facilitated through ICT.

**Key words:** Information and communication technologies, agriculture, agribusiness, evaluation of state, survey, Czech Republic.

**JEL classification:** L86, D83, Q19

## 1 Introduction

Farms do not reach full production potential and technical efficiency according to previous studies (Čechura, 2014), (Čechura, 2010), (Čechura, 2009), (Pechrová and Vlašicová, 2013), (Kroupová, 2010). There is a strong necessity to improve economic performance of farms in the Czech Republic. Moreover, the need for introduction of new Information and Communication Technologies (ICT) in farming and farm management has rapidly increased nowadays. ICT is also one of the key enablers for agribusiness. In farming, ICT directly supports operational agricultural activities and it can also serve as an interactive and flexible tool for monitoring the progress of the farm economic performance. The study (Lawson et al, 2011) presented the descriptive results of the survey responses that explore the perception of advanced information systems among four European countries: i.e. Denmark, Finland, Germany and Greece. The paper (Ulman et al, 2013) briefly describes the current use of e-government services in the Czech Republic with focus on use of e-services in agriculture. Our previous studies (Tyrychtr et al, 2015), (Kubata et al, 2014) evaluated use of business informatics in agricultural enterprises in the Czech Republic. However, in all mentioned surveys, the relation between information needs and the state of ICT was omitted. This paper aims to evaluate the current state of the art of ICT and information needs and their impacts on farms in the context of agribusiness in the Czech Republic.

## 2 Materials and Methods

The analysis of current state of ICT and information needs among Czech farms was based on questionnaire survey conducted by the Department of Information Technologies and by the Department of Software Engineering at the Faculty of Economics and Management at Czech University of Life Sciences Prague in 2015. There were over 1000 respondents asked to fill the survey by e-mail or via online form at <http://dotaznik.czu.cz>.

We obtained 165 correctly filled answers from agricultural producers that 94 % out of them were maintaining land up to 500 hectares. Highest relative frequency was in the category 100 – 499 hectares. Only 4 % of subjects operate at more than 500 hectares of land. The main subject of this survey was group of privately run farms with mid-sized land. 92 % of observed farms employed less than 9 people. The most frequent were enterprises with less than 3 people (with frequency 123). Only 1 % of subjects employed more than 250 people. Other findings are such as 82 % of farms were in crop production, 66 % in animal production and 14 % in other types of production.

The basic exploratory analysis brought that the sample set was mainly consisting of small and middle-sized agricultural enterprises focusing on plant and animal production on land up to 499 hectares and with up to 9 employees.

The research questions are addressed through analysis of empirical data. There was a survey among agricultural entrepreneurs from various regions in the Czech Republic conducted in the beginning of 2015 that provided relevant data sample. Survey results are presented with descriptive statistics, frequency tables and regression analysis at the given level of significance  $\alpha=0.05$ .

To identify relationships between the level of information needs in the agribusiness and informatics in farms (ICT), new technologies or Decision Support Systems (DSS) we set following working hypotheses (Table 1).

**Table 1.** Working hypotheses about dependencies between ICT and selected factors.

Factors	Hypothesis
ICT and information needs	H1: There is a statistically significant dependency between the level of information needs and the level of the ICT.
New technologies and information needs	H2: There is a statistically significant dependency between the level of information needs and the level of the new technologies.
DSS and information needs	H3: There is a statistically significant dependency between the level of information needs and the level of the DSS.

Source: self-authored

The presence of dependency between qualitative characteristics was verified by means of Pearson's and M-V chi-square tests (Lancaster and Seneta, 2005). The Pearson's  $\chi^2$  statistic is calculated based on the formula presented in Equation (1).

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}, \text{ where} \quad (1)$$

$\chi^2$  = Pearson's cumulative test statistic, which asymptotically approaches a  $\chi^2$  distribution;

$O_i$  = an observed frequency;

$E_i$  = an expected (theoretical) frequency, asserted by the null hypothesis;



$n$  = the number of cells in the table.

All associative tables must accomplish the condition that the size of sample set is higher than 40 ( $n > 40$ ). We tested the null hypothesis that assumes statistical independence between examined qualitative characteristics. To measure the strength of relationship Phi test (for 2 x 2 tables) and Cramér V&C (for larger than 2 x 2 tables) were used.

In case of a 2 x 2 contingency table with cells  $a, b, c, d$ , Phi coefficient is calculated according formula (Sheskin, 2003), (Sun et al, 2007):

$$\varphi = \frac{ad-bc}{\sqrt{(a+b)(c+d)(a+c)(b+d)}} \text{ or } \phi^2 = \frac{\chi^2}{n}, \text{ where} \quad (2)$$

$n$  = is the total number of observations.

Statistica 12 software was used to produce exact results of statistical analysis of associative tables.

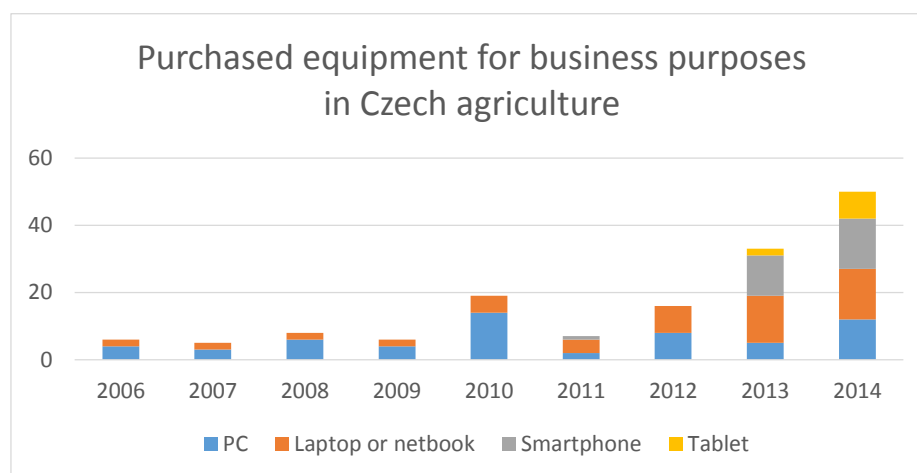
### 3 Results and Discussion

Basic statistical characteristic of the group of respondents and analysis of associative tables are described further. Firstly, the results of the evaluation of ICT are described as an important factor for development of agribusiness informatics in farms. Secondly, there is the analysis of the state of ICT and the verification of statistical hypothesis (Table 1).

#### 3.1 Agribusiness Informatics Evaluation

The current state of agribusiness informatics was evaluated in terms of hardware and software equipment of farms and overall impact of informatics on their activities was assessed. As to the investments to IT, we proved that there are no obstacles for farmers. Most of expenditures on hardware are now directed to mobile technologies (see Figure 1). There is a positive rating of the level of information technologies in farms.

Fig. 1. Structure of hardware purchases in the period 2006 - 2014.



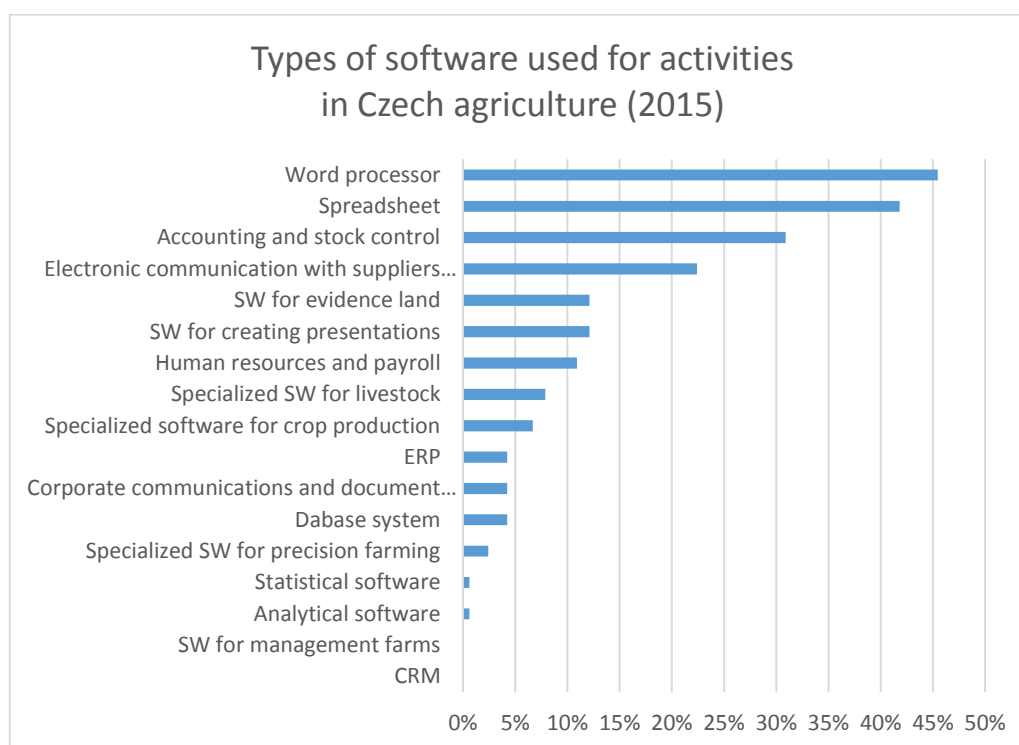
Source: self-authored

Further important finding of the analysis is that business informatics is perceived as a necessary technology solution for realization of business goals in 60 % of cases (75 respondents), while in 18 % (22 respondents) finds it having major impact on the realization of business goals and merely 22 % (27 respondents) thinks that business

informatics has no effect on the realization of business goals. It is relevant to further examine and identify barriers to effective use of BI concepts and applications.

In the next part of survey, the type of used software equipment in observed agricultural enterprises was inspected (see Figure 2). The most frequently used software was Word processor (45%), spreadsheet (42%), accounting and stock control (31%). Interesting facts are that farmers use even further specialized information systems and software such as human resources and payroll management (11%), electronic communication with suppliers (22%), specialized software for crop production (7%) and software for animal production (8%). The exploratory analysis shows that enterprise resource planning (4%) and software for precision agriculture are rare (2%), which is similar to database management systems (4%) and statistical software (1%). None of the respondents uses customer relationship management (CRM) and farm management systems. Based on the results provided above the software equipment of Czech farmers is average.

Fig. 2. Types of software used for activities among small Czech farmers.



Source: self-authored

### 3.2 ICT Current State Analysis

Survey results showed that only 4 respondents (2.42%) used some type of ICT application on an excellent level (see Table 2). Such a rate among Czech farms is negligible. The most stated level of ICT in farms is 'average' (39%) and 'very good' (15%). Based on the results provided the level of ICT in Czech farms is average.

**Table 2.** Frequency of the level of ICT in farms.

Category	Frequency	Cumulative frequency	Relative frequency	Cumulative (rel.frequency)
Do not know	3	3	1,81818	1,8182
None	4	7	2,42424	4,2424
Below average	22	29	13,33333	17,5758
Average	64	93	38,78788	56,3636
Very good	25	118	15,15152	71,5152
Excellent	4	122	2,42424	73,9394
ChD	43	165	26,06061	100,0000

Source: self-authored

Next part of the survey shows that farmers encounter in conducting its activities with serious problems (see Table 3). The most claimed levels of information needs in farms are 'certainly yes' (35%) and 'rather yes' (24%). Conversely, only 4 respondents (2 %) had certainly no serious problems.

**Table 3.** Frequency of the level of information needs in farms.

Category	Frequency	Cumulative frequency	Relative frequency	Cumulative (rel.frequency)
Do not know	4	4	2,42424	2,4242
Certainly not	4	8	2,42424	4,8485
Rather not	37	45	22,42424	27,2727
Rather yes	40	85	24,24242	51,5152
Certainly yes	57	142	34,54545	86,0606
ChD	23	165	13,93939	100,0000

Source: self-authored

Results of the survey also show that farmers use MS Excel for decision-making. The most frequent level of DSS in farms is 'average' (use Excel), (32%) and 'none' (make decisions on their own), (20%). None of the respondents evaluated the level of use of decision support systems as 'excellent'.

**Table 4.** Frequency of the level of DSS in farms.

Category	Frequency	Cumulative frequency	Relative frequency	Cumulative (rel.frequency)
Do not know	7	7	4,24242	4,2424
None	33	40	20,00000	24,2424
Below average	12	52	7,27273	31,5152
Average	54	106	32,72727	64,2424
Very good	19	125	11,51515	75,7576
Excellent	0	125	0	75,7576
ChD	40	165	24,24242	100,0000

Source: self-authored

To test working hypotheses H1, the existence of dependence between agricultural information needs and the level of ICT were examined. The existence of dependence among

qualitative variables is verified by means of chi-square test (sample size is higher than 40). Null hypothesis was that there is statistical independency between examined qualitative variables. As first, the dependency between level of information needs and level of ICT in farms was tested. Results with chi-square test criteria and correlation characteristics are summarized in Table 5. The calculated level of significance  $p$  is lower than  $\alpha = 0.05$  for both types of chi-square test. The null hypothesis is rejected at the given level of significance. We accept the alternative hypothesis that speaks of a statistically significant dependency. There is significant dependency between level of information needs and level of ICT in farms.

**Table 5.** Table of the statistics for the evaluation of dependency.

	ICT(6) x Information needs(5)		
	chi-square	df	p
<b>Pearson's chi-square</b>	32.70655	df=20	p=.03633
<b>M-V chi-square</b>	31.60692	df=20	p=.04767
<b>Phi</b>	.5177706		
<b>Contingency coefficient</b>	.4597937		
<b>Cramér. V</b>	.2588853		

Source: self-authored

Further statistical calculations for verification of all hypotheses are presented in Table 6. There are lowest values of  $p$  values according the Pearson's chi-square or M-V chi-square test in the table. The correlation index  $r$  is evaluated in the remaining three rows of the Table 5. There is statistical dependence between the observed characters determine like direct (due to the positive values of the calculated coefficients), and average dependency (due to the absolute value of the calculated correlation characteristics close to 0.5 value).

**Table 6.** Statistically significant dependencies among factors and information needs, p-value and r-value.

Hypothesis/No. of factor	p-value	r-value
H1: ICT and information needs	0.036	0.518
H2: New technologies and information needs	0.06	0.495
H3: DSS and information needs	0.019	0.491

Source: self-authored

It was observed that with 95 % probability there is significant dependency between level information needs of farm and the use of ICT. We can conclude that level of serious problems agricultural activities have significant influence on fact whether or not farms use ICT, new technologies and other expert and analytical systems.

## 4 Conclusion

The study shows that superior management of information processing and communication, advanced use of business information systems together with well-identified information needs can strengthen production potential and technical efficiency of farms due to the direct support to managerial, analytical, planning, and decision-making activities of managers and agricultural specialists. As to the investments to IT, there is a positive rating of the level of information technologies in agribusiness. Most of expenditures on hardware are now directed to mobile technologies. The most frequently used software was Word processor, spreadsheet, accounting and stock control. Interesting facts are that farmers use even further

specialized information systems and software for crop production and software for animal production. The exploratory analysis showed that the software equipment of Czech farmers is average. Further important finding of the study is that business informatics is perceived as a necessary technology solution for realization of agribusiness goals. Next part of the study showed that farmers encounter in conducting its activities with serious problems. There is a high level of information needs. Survey results showed that only 2.42% used some type of ICT application on an excellent level. Results of the survey also showed that farmers use mostly MS Excel for decision-making. The results of ICT current state analysis show that with 95 % probability: 1) The level of information needs is related to the current state of the art of ICT, new technologies and DSS at the farm, 2) Czech farms on average use advanced ICT and information systems, and 3) the farmer's decision making is not strongly facilitated through ICT.

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## Promoting regional foods as a factor for sustainable development

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**Annotation:** The paper is a part of a below mentioned project and its aim is to propose activities and practical outputs which could support regional foods and products in promotion and sustainability of development in different regions. Regional foods or products not only promote regions; they also create new work places, they are significant potentials in the development of tourist industry (in particular gastro-tourism) and, last but not least, they give local citizens a sense of belonging to a region. The research is focused on the awareness of selected region citizens about regional foods in relation to quality, origin, trademark, price and impact on sustainable development in the promotion of the region. Taking into account regional development actors' view, the paper analyses whether the producers of regional foods experienced changes in economic profitability after receiving the mark and what significance the regional food mark has on the development of promotion in the region. Based on wider research questions, a general hypothesis and several work hypotheses were stated. The field survey was carried out with the help of a quantitative approach using techniques of questioning. The collated data were analysed using mathematical-statistic methods. The role of a quantitative survey using semi-standardised interviews with producers of awarded regional foods was to find out benefits and contribution of regional foods to the development of entrepreneurial activity both from a perspective of regional development and tourism. The elicited findings were analysed and discussed to draw conclusions.

**Key words:** Promotion, region, regional food, regional product, sustainability of regional development, tourism.

**JEL classification:** Z 18

### 1 Introduction

For consumers the regional food denotation should represent the synonym of quality, freshness and regional origin, for particular local producers an efficient marketing tool for communication with potential customers. In order to maintain sustainable development at the level of regional economies it is necessary to use all internal potential of individual regions with respect to human capital, tangible and intangible wealth as well as natural resources. Regional policy has two basic concepts, traditional and modern (Wokoun, Malinovský, Damborský, Blažek et al., 2008). The traditional regional policy means decrease in regional differences. In contrast, the modern regional policy deals with problems related to the process of fast restructuring and supporting innovation.

Every region is unique. The combination of such aspects results in a unique partnership which brings competitiveness as well as self-sufficiency and existence. To preserve sustainable development at the level of regional economies it is important to make use of all internal capital of individual regions from the point of view of human capital, traditions, tangible and intangible wealth and resources. Each region has something unique. The combination of such aspects creates a unique partnership which can bring competitiveness as well as self-sufficiency and existence to a region. Being independent of neighbouring economies can become a great advantage. The impact on access to capital is crucial for the enhancement of small- and medium-sized farm viability while supporting regional food and farmers (Hardesty et al., 2014). The regional food is also defined as food, which is grown and produced in a region (Canavari, 2009). The goal of the regional food is to develop small- and medium-sized businesses focusing on production using local raw materials. It also takes into account the interest in quality food. Designated regional foods are provided legal protection by the European legislation (Parrott et al., 2002).

Marketing support of domestic production has advantages especially for Czech producers. Thanks to a greater interest in their goods, food and agricultural small- and medium-sized businesses are developing in the regions, and competitiveness together with employment in the regions is growing. This is reflected in a total economic performance of a region, or the state. There are also other reasons for the preference of Czech regional foods. They are usually healthier and tastier thanks to shorter distribution ways and have a better nutrition value and clear origin. What is more, by purchasing regional foods, consumers support local, regional businesses. Local products play an important role in strategies of local food networks and open new ways for a transformative development based on alternative values such as regional development, solidarity and identity (Forney and Häberli, 2014: 36-55). Regional agriculture-food networks can very positively influence economic, environmental, social and cultural life in rural areas. In the case study of a selected region in the Eastern Germany, the authors (Burandt, Lang, Schrader, Thiem, 2013: 153-176) confirm that such regional networks can support the marketing of regional products in regional sustainable development. Similar conclusions were achieved by the authors (Davidson, Suddick, Rice, Prokopy, 2015: 305-311) of the paper dealing with rural sustainability as the connection of technology and economy with social and natural factors. The regional networks, such as agricultural alliances, play an important role in the competitiveness of regional food and products (Anokhina and Seredina, 2014).

Local and regional food is more and more increasingly used in tourism as an integral part of the way how to attract tourists and enrich their experiences during their visit but also how to feed them. Binek (2008) defines the sustainable tourism at present as an important concept used in recreational activities as well as in soft forms of ecotourism. A dynamic increase in the sustainable tourism has lately been observed in ecotourism. Musil (2010) defines the sustainable development of tourism as fulfilling the needs of tourists and host regions as well as taking into account an increase in these possibilities into the future. Swarbrooke (1998) defines sustainable tourist industry as such tourist industry, which fulfils the needs of the tourists, and tourist industry without threatening the ability of future generations to satisfy their own needs. On the one hand the tourist industry is a contribution, on the other it has a negative impact on surrounding fields of human society. According to Pásková and Zelenka (2002), the sustainable tourist industry plays an important role in the preservation and enforcement of the potential of cultural and natural heritage. Some



destinations are beginning to understand that there is a great potential for culinary tourism and that food can be offered as a product providing the sustainable development.

Local dishes and foods present distinct wealth for tourist destinations and can play an important role in increasing a number of visitors. At the same time they stimulate growth in other economic fields and also present sustainable jobs for their manufacturers and producers. A close relationship between food and tradition in a region presents the support of cultural heritage through regional foods. Connecting local foods with traditions in a region has a potential to create more sustainable tourism with higher returns.

Gastronomic tourism is a special form of tourism where the main impulse for travelling is discovering local gastronomies and culinary indulgencies. Gastro-tourism can be divided into the area of visiting specialized gastronomic events and fair-trades and the area of very consumption, cooking and tasting, connected with familiarising the tourist with local gastronomic traditions and habits (Kotíková, 2013: 82). While such journeys to discover local gastronomies do not necessarily have to be aimed at gourmets; authentic encounter with dishes both in street stalls or local small restaurants in villages is also accounted for.

Through dishes tourists can discover local culture, encounter not only the people but also their eating habits and traditions. In case of the Czech regions we can observe the ability of the individual regions to differentiate one from the other by their regional foods and traditions, while such diversity is attractive for tourists. On the field of gastronomic tourism the Czech Republic (CZ) has promising conditions for its development. Traditional regions are well-known for the production of beer and wine; however, even other regions have strong prerequisites for their development thanks to their traditional specialities and foods. Nowadays in the CZ such traditions have been preserved in some regions to a greater extent while in others they have died out due to population migration or war. Through transfer from one generation to another, typical basic recipes have been preserved in most regions. Local foods have become an integral part of regional characteristics. An inevitable part of the characteristics are local foods. Regional foods are characterised by the place of their production, in case of agricultural products by the place of their growth. Just as each region is represented by its particular field of industry or agriculture, it is also characterised by its typical dishes and foods. Growing agricultural products is most influenced by climate and the location of a region. The production is then influenced by a long-term tradition in a region and other factors such as the transfer of know-how from one generation to another.

With the help of a questionnaire survey, the quantitative survey was focused on the attitudes and opinions of consumers of regional foods in connection with tourism in the South Bohemian Region. For the purposes of processing the field survey, research questions and hypotheses were established verifying the correlation between the education of respondents and the purchase of regional food. Research questions: The highest number of respondents learnt about Regional Food from the press. More than half of the respondents know at least one Regional Food or one RF producer of the South Bohemian Region. Culinary tourism within the territory of the South Bohemian Region is not commonly sought out among those surveyed. Respondents prefer another form of spending free time in the region. The established hypotheses for verification of the correlation of qualitative characteristics: Does a correlation exist between the knowledge of Regional Food and its purchase? Does a correlation exist between the highest achieved education and satisfaction of respondents with the offer of RF on the market?

## 2 Materials and Methods

A field survey was prepared on theoretical bases. With the help of a questionnaire survey, the quantitative survey was focused on the attitudes and opinions of consumers of regional foods in connection with tourism in the South Bohemian Region. A standardised questionnaire was used for field collection of the necessary data. The collected data was analysed on the basis of simple basic mathematical and statistical methods. Qualitative investigation using semi-structured interviews was conducted with producers of award-winning regional foods in terms of finding the benefits of regional foods to develop their business activity even from the perspective of regional development in the context of the development of tourism.

The concept of regional development is characteristic for the growth of socio-economic and environmental development. Furthermore, it focuses on the competitiveness of specific areas with the aim to improve the population's standard of living. Several institutions contribute to support regional development, thus we can say that regional development is a cross-cutting and multi-disciplinary area.

A total of 200 respondents were addressed, 28 refused to participate in the survey. Thus a total of 172 responses were collected. In terms of sex, the questionnaire survey results revealed that women (115) prevail over men (57). This finding may be affected generally by the fact that women go grocery shopping more often than men. The age structure of the respondents varied in the survey. Most respondents were aged 30-40 years old (representing 59 respondents), followed by the second largest group of respondents aged 41-59 years old (54 respondents). The third group consisted of respondents aged 18-29 years old (41 respondents). The last and smallest group of people were over 60 years of age (18 persons). According to education, respondents were represented in the sociological research as follows: 35 respondents have basic education i.e. 20.4%, 54 respondents have secondary education with GCE i.e., 31.4% of respondents. 41 respondents stated that they have secondary education with a vocational certificate, i.e. 23.8%. 42 respondents reported that university education is their highest level of education attained, which represents 24.4% of the total number of returned questionnaires. The economic activity of respondents was in the following representation: see following table: working (114), maternity/parental leave (21), retired (14), student (10), unemployed (9), and other (4).

## 3 Results and Discussion

The most frequently mentioned criterion in the selection of food is the price, followed by quality and origin. The questionnaire was designed in order to evaluate the respondent's awareness of regional foods (RF) and the relationship to tourism in Southern Bohemia. Respondents most frequently associate RF and regional food with regional origin and local production. The second most frequent representation in the responses was the support of local entrepreneurs, producers. The third answer was award-winning quality food and the last answer was distinction from other regions, and their specificity. The dominant source from which the respondents learned of the existence of regional food was the press. The next most frequent response was directly from the seller, where the information was provided directly by the seller. This was confirmed by research question no. 1. Even local advertising media place great importance on promoting the region by trying to get the existence of original food of their region into the subconscious of respondents. The most common response of respondents regarding where they encountered regional food was

in the supermarket. Second place was dominated by farmers' markets and hypermarkets ranked third. The favourable result of question no. 12 confirmed research question no. 2 that the respondents are aware of the manufacturers of award-winning Regional Food or regional food in general. Due to the limited capacity of the extent of the contribution, the calculation will be provided only for the first tested hypothesis. Even the testing for the second hypothesis defined can be calculated similarly. Does a correlation exist between the knowledge of Regional Food and its purchase? To determine whether there is a correlation between knowledge of RF and its purchase the  $\chi^2$  test for non-correlation will be used (1). The scope of the set is greater than 40 i.e. the scope of the tested set is 172 respondents (Tab.1).  $H_0$  No correlation exists between the stated characters, i.e. there is no correlation between the knowledge of RF and its purchase.  $H_1$  No correlation exists between the stated characters, i.e. there is no correlation between the knowledge of RF and its purchase (2).

**Table 1** Association Table

Knowledge of RF	Purchase of RF		Total
	Yes	No	
Yes	133	22	155
No	7	10	17
Total	140	32	172

Source: own field survey

$$\chi^2 = \frac{n(ad - bc)^2}{(a + b)(a + c)(b + d)(c + d)} = \frac{172(1330 - 154)^2}{17 \times 140 \times 32 \times 172} = 18,16 \quad (1)$$

The tables state the critical value of  $\chi_{20.05}^2 = 3.841$   $\chi^2 > \chi_{20.05}^2$   $18.16 > 3.841$   $H_0$  is rejected and the alternative hypothesis  $H_1$  is accepted

To determine the correlation we will use the coefficient of association

$$|V| = \sqrt{\frac{\chi^2}{n}} = \sqrt{\frac{18,16}{172}} = 0.32 \quad (2)$$

Correlation between variables is direct and moderately correlated.

Does a correlation exist between the highest achieved education and satisfaction of respondents with the offer of RP on the market? To test this hypothesis, it is important to take into account that this verification will cover only 140 respondents, as 32 respondents stated that they do not purchase RP and therefore are excluded from this monitoring.  $H_0$  No statistically significant correlation exists between the satisfaction with the offer of RP on the market and highest achieved education.  $H_1$  Does a correlation exist between the highest achieved education and satisfaction of respondents with the offer of RP on the market? A statistically significant correlation exists that could be described as slight or moderate between the satisfaction with the offer of RF on the market and highest achieved education.

Regional food "South Bohemian - Tastes Nice" is aimed at the promotion of products of the South Bohemian Region. Local producers are trying to preserve the original traditional recipes and processing of local raw ingredients that can be easily described as culinary heritage. Just the location of their plants in the South Bohemian Region is a sign that these producers are also South Bohemian employers. In the future, the addressed producers will continue to strive to be successful in winning different awards and to preserve the competitiveness of South Bohemian food and other food products, while mainly keeping them traditional and regional. Keeping this vision, however, brings with it various difficulties concerning the origin of food. The raw ingredients used in the production of a product should only come from the region and even be processed here. This criterion may also pose considerable difficulties for certain manufacturers in the future.

Small rural areas with rising unemployment are not promising areas for young people, who are leaving to work in other places, thus leading to an outflow of labour from the region. The entire region is trying to promote traditional small-scale, family farms and rural tourism. The promotion of regional products is a form of increasing the attractiveness of the region. Products originating from local production, on the one hand, promote the region, and on the other, offer tourists and visitors something really typical of the given region.

#### **4 Conclusion**

Tourism also improves the standard of living of the population, since the taxes of business entities are also used for local infrastructure and services. Tourism helps to create and maintain a sense of belonging to the local natural, cultural and even culinary heritage. Tourism is a very dynamically developing sector, in which it is necessary to offer tourists and visitors only those products, which will be of interest. Various cultural and other events are held with the aim of boosting domestic tourism. Often the production itself is an experience for tourists and visitors. Tasting excursions to plants are also a tourist attraction. Business activities not only in the production of local products, but also other areas of trade and services are a profit generator for the given region. Only a prosperous region can better serve its residents and non-residents. Greater satisfaction of needs thus leads to regional development in the economic, cultural, social spheres and others. Mostly, it is also about cross-border cooperation between regions, leading to an exchange of information between regions even beyond the scope of regional development.

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# Information Tools of Cost Controlling in Entities of Agricultural Primary Produce in Slovakia

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**Annotation:** The actual problem of primary agricultural production is represented by the continued growth in costs and the high proportion of overhead costs in total production cost structure. The significant attention must be paid to economic cost management, currently presented by cost controlling. Information support of cost controlling constitutes accounting, calculations and budgeting of costs. The main goal of the paper is to review the utilization level of these basic information tools in cost controlling in entities of agricultural primary produce in Slovakia. We derived from the analysis of intra-organizational environment of selected file of entities of agricultural primary produce. Questionnaire survey was used for the purpose of acquiring the initial data. The basic file is presented by entities of agricultural primary produce classified by the legal form. The representativeness of selected file classified by legal form was tested and confirmed by Chi-square goodness of fit test. The existence of dependence between qualitative features identified in questionnaire survey was tested by means of Chi-square contingency test. The survey found out that agricultural entities apply principles of cost controlling covering intra-organizational accounting, budgets and cost calculations, but with a lot of weaknesses mentioned in the paper. Recommendation for improvement and higher quality of information support of cost controlling in agricultural entities in Slovakia have been provided.

**Key words:** accounting, agriculture, budget, calculation, controlling, costs, information.

**JEL classification:** M41, Q12

## 1 Introduction

Agriculture has a special status in the national economy due to its social function and the conditions in which the production process is performed. Tóth et al (2014) state that agriculture is a sector with low profitability. Revenues from agricultural produce are mostly out of the farmer's control. Yields, especially in the crop produce, are substantially affected by weather (Steklá and Gryčová, 2014; Foltínová and Špička, 2014). Output prices are determined by the market, because agricultural entities in the Slovak republic operate in the market with the monopolistic competition, with a minimal ability to increase prices (Kita et al, 2012).

Adaptation to the market thus enables particularly product quality and the level of production costs. Companies after Slovakia's accession to the European Union entered an environment that is characterized by considerable competitive pressure. The competitive environment is forcing management to regulate costs in business and to find new ways of reducing them, while respecting business interests. Homolka and Bubeníková (2013) state that a significance of cost monitoring is unquestionable because costs in the form of various indicators show demandingness of production and thereby in some extent also a presumption of competitiveness of products.

Companies should continuously plan costs and evaluate the deviations of the actual costs from the plan. The business information system must be at such level that allows the management

to use accurate information on any farm costs, causes of the cost formation and cost structure for individual outputs. The availability of such information is essential for the effective financial and operational management. Controlling is one of the ways how to manage costs quickly and effectively (Foltínová and Špička, 2014).

Controlling presents a current topic. Much attention is turned to controlling, both in theoretical cognition as well as in business practice. In the literature controlling definition from different perspectives can be recognized (Stiegler and Hofmeister, 2001; Eschenbach, 2004; Král, 2010). Below are listed some of them.

„Controlling is a system of rules that helps achieving business objectives, preventing discrepancies and early turn on the red light when a danger requiring appropriate measures appears“ (Mann and Mayer, 1992). Vollmuth (1998) understands controlling as "cybernetic system which role is to manage and find the shortest path towards the achievement of profit."

„Controlling is a tool with the task to coordinate the planning, control and to ensure the information data bases in order to improve business results. Controlling is responsible for collecting the information, their processing and structuring for the needs of the entity's management decision making“(Horváth, 2011).

Despite the growing importance and the application of controlling in the entity's management its definition is not clearly identified. Most of the authors come to the so-called coordination definition of controlling, i. e. its core is the coordination of major management subsystems such as planning, organizing, control and so on.

„Cost controlling is a partial method of controlling focused primarily on the overhead costs. Cost controlling includes all measures, analyses and tools which consist in the purposive creation of cost structures. Cost controlling focuses on the cost structure, the roots of costs and the cost flexibility with an emphasis on the future“ (Foltínová and Špička, 2014).

The role of cost controlling is to increase the transparency of cost creation in all areas of the entity, to improve the planning and decision-making based on adequate information on costs and capacity utilization and as well constantly to improve company cost calculation system (Foltínová et al, 2011). Information support of cost controlling constitutes accounting, calculations and budgeting of costs (Kontsevaya, 2014; Chodasová, 2007).

The article's task is to review the level of utilizing the basic information tools of cost controlling in entities of agricultural primary produce in Slovakia.

## 2 Materials and Methods

We derived from the analysis of intra-organizational environment of selected file of entities of agricultural primary produce in the process of assessment of utilized basic information tools of cost controlling. Questionnaire survey was used for the purpose of acquiring the initial data. It was realized by means of structured questionnaire in period 2012 - 2013. The basic file is presented by entities of agricultural primary produce classified by the legal form. 250 entities were selected from the basic file by a random selection while we focused on agricultural cooperatives, companies with limited liability and joint ventures. The representativeness of selected file classified by legal form was tested and confirmed by Chi-square goodness of fit test. Therefore the representative selected file enabled to generalize results of selected file to basic file. The existence of dependence between qualitative features identified in questionnaire survey was tested by means of Chi-square contingency test.

The article follows the preceding authors' work which assessed the development and the structure of own costs in the entities of agricultural primary production in Slovakia. Factual materials from information database of Research Institute of Agricultural and Food Economics (RIAFE) in Bratislava were used for the purpose of development analysis of production costs in crop and livestock produce. RIAFE deals with the selected files of business agricultural entities by means of mathematical – statistical methods in order to secure the representativeness of data. The period of years 2008 – 2012 was assessed. Base indexes were used for the expression of cost development in time.

Based on the acquired data from the analysis the authors found the constant increase in costs and growing proportion of overheads at own costs in the entities of agricultural primary production. One of the main causes of increasing costs of entities in agricultural primary produce is a continuous rise in prices of production inputs, especially fuel prices, fertilizers, seeds, chemical preservatives, electricity and gas. The costs and their development may also be influenced by company management which with its inadequate approach allows the creation of diverse non-productive costs leading to a redundant increase in costs. Pursuant to the achieved results it is clear that the significant attention shall be turned to the economic management of costs. Currently, the basic economic method of cost management presents a cost controlling.

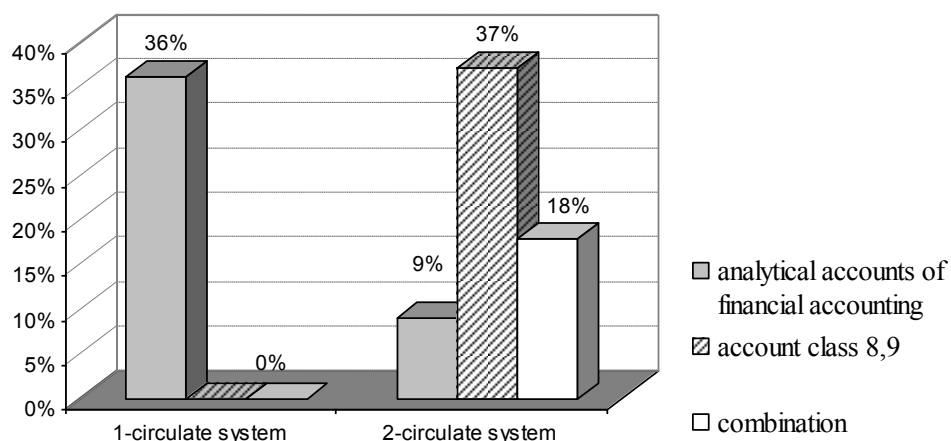
### **3 Results and Discussion**

Based on the acquired results it ensued that the principles of cost controlling are applied in agriculture entities, covering the area of intra-organizational accounting, budgets and costs calculations. Information obtained from these basic tools of cost controlling is used in the management and decision-making.

The basic task of the accounting system in an entity is to provide a true and fair view on all economic facts, as mandated by Act No. 431/2002 Coll. on Accounting, as amended. Accounting presents the relevant source of information essential for the decision making of management on each its levels. Two levels of accounting classification are recognized, namely financial accounting and intra-organizational accounting. The outputs of both financial and intra-organizational accounting which character is set by an entity itself are utilized for the need for the cost controlling. It is considered to be satisfactory, the accounting that meets all the requirements prescribed by law. This level of accounting in entities often does not meet the needs of controlling or management. Therefore it is necessary to ensure that the accounting really provides a true and fair view of the company and served as a base and sufficient information tool for cost controlling and the managers of entities. This requirement must ensure that accounting as a whole. What is not met by the financial accounting; it must be developed further in the intra-organizational accounting.



Fig. 1. System and variant of intra-organizational accounting



Source: own processing

The survey showed that intra-organizational accounting is applied by 73% of analysed entities, while double circuit accounting system is kept by means of separate accounting classes 8 – 9 Intra-organizational accounting. We recommend its early implementation to entities without intra-organizational accounting system since the outputs of intra-organizational accounting are important for several reasons:

- providing of information for the valuation of own production in crop and livestock produce, the valuation of intra-organizational services and works, the procurement of fixed assets acquired by own investment activity and their putting into use;
- providing of review about status and movements of inventory in financial accounting;
- providing of information for the creation of final calculations of production costs;
- information utilization for need of control in intra-organizational departments and entity as a whole.

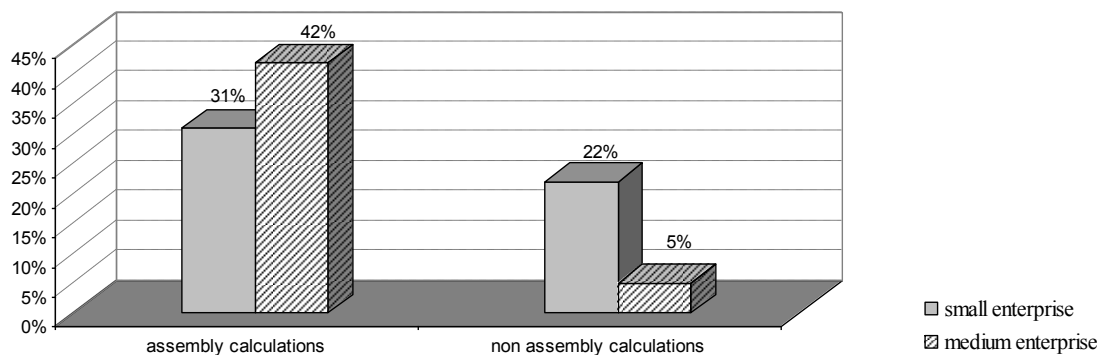
The following discrepancies of company accounting systems have been determined. They occur in entities and are required to be eliminated:

- missing, respectively insufficient accruals – pre paid expenses of individual periods cause inaccurate cost recognition and consequently the profit or loss in the current accounting period;
- missing, respectively insufficient distinction of tax and accounting depreciation – the majority of entities does not differentiate between tax and accounting depreciation for the sake of simplicity. There is a risk that the actual amount of physical and moral wear and tear does not correspond to the amount of depreciation and amortization in accounting. This fact consequently distorts the actual production costs in calculations and the amount of profit or loss;
- insufficient distinction of costs according to the place of creation/origin (intra-organizational departments/cost centres) - if an entity is unable to determine exactly which centres are consuming what sources it is impossible to identify effective and non-effective cost centres;

- missing, respectively insufficient cost distinction according to their output relations – the incorrect data about production costs are presented as results of incorrect allocation of costs to particular outputs.

Data needed for the preparation of cost calculations are drawn from intra-organizational accounting.

**Fig. 2.** Compilation of calculations based on the size of entities categories



**Source:** own processing

The survey found that 27% of entities presented by small entities with the number of employees less than 50 persons do not compile cost calculations. Chi-square contingency test confirmed weak dependence between entity size and compiling of calculations. The entities with less number of workers adapt their possibilities to staff, information sources, and time severity of selected calculation method. These entities typically utilize a competitive and demand-oriented pricing, since the complex calculations regarding the entity size and position within the market environment would be unjustified. Calculations shall already be a truism in medium and large entities.

The entities that do not pay attention to the calculations of own costs are recommended to compile the calculation because of the fact that the calculation of own costs in agriculture is arising directly from the Act No. 431/2002 on Accounting as amended. This Act prescribes the binding manner for the measurement of own production, namely in own costs of production which consist of direct costs and the part of indirect costs (overheads) belonging to a concrete production. None of agricultural entity can exist without the calculation of own costs because for the measurement of own production the intra-organizational prices arising from the calculations of own costs must be set.

Final calculations are compiled only by 46% from the entire sample. 27% of entities compile except for final calculations as well as preliminary calculations. Insufficient attention turned to preliminary calculations might be predicated by specifics of agricultural produce. Despite this fact entities should compile preliminary calculations for short periods, thereby reducing uncertainty. Preliminary calculations have their place as well in adjacent and associated produce, which is characteristic except for crop and livestock produce in agricultural entities. Entities compiling preliminary calculations are recommended to perform final calculations quarterly, respectively monthly in order to eliminate negative discrepancies found out as a result of final and preliminary calculations comparison during the financial year.

The assessment of questionnaire survey showed that agricultural entities compile calculations pursuant a unified calculation formula recommended by Research Institute of Agricultural and Food Economics (RIAFE). This methodology of calculation compilation was mentioned by all respondents compiling calculations. Methodology is mandatory only for companies included in the sample file of RIAFE providing information about actually obtained costs of crop and livestock produce and other economic data to assess the effectiveness of production. The before mentioned methodology might be used by all agricultural entities after adjusting to specific conditions.

The advantage of calculations compiled in accordance with classical calculation formula recommended by RIAFE is their simplicity, low laboriousness and low deployment costs. However, their disadvantage is an inability to allocate overheads to outputs correctly. Overheads are distributed to outputs which are not combined with overheads. Inadequate distribution bases are used. One of the reasons for incorrect cost allocations is the fact that currently calculations are compiled by software. The manner of calculation compilations is defined in system and does not take into consideration specific conditions of a company. We agree with the opinion of Dvořáková (2012), according to her, disadvantages of classical calculations might be eliminated by non-traditional methods of calculation compilation e. g. ABC method and calculation of variable costs.

Budgets are as well an information tool of cost controlling. However cost budgeting presents the weakness of agricultural entities. Cost budgets are compiled only by 62% of entities from the sample. Budgeting should be combined with planning. The content of plans and budgets (frequently identified with each other) is not set up precisely in entities. It is evitable to define the scope of planning and budgeting clearly by the management while both activities are essential tools of cost management. They influence results of intra-organizational departments and company as a whole. The meaning of budgets relies on the determination of overheads which are subsequently used for preliminary calculations and are calculated to individual outputs. Even 90% of companies compiling cost budgets distribute overheads by the estimation based on their development in the last periods. The reason is a biological character of agricultural produce and as well a strong dependence on climatic conditions. The rest of companies distribute overheads by means of norms and limits of overheads. Similarly as for preliminary calculations, agricultural entities should focus on short-term budgeting for which the level of uncertainty is lower.

It is essential to make cost evidence divided by various aspects for effective cost management. Based on the results of questionnaire survey it was found that all sample companies track costs according to nature for which the structure is prescribed by the framework chart of accounts for entrepreneurs bookkeeping in double entry accounting. For the need of cost calculation compilation 73% of entities utilize except for cost classification according to nature as well calculation cost classification. This classification and evidence structure is not suitable for decision-making of management and therefore it is also necessary to apply other cost classification. We recommend cost classification to variable and fixed costs which is significant for intra-organizational management. The structure of variable costs within Slovak agriculture is defined by RIAFE as well. The Institute deals with variable costs. Such a classification provides a possibility of international comparison of achieved results. Variable cost structure defined by RIAFE is compatible with the methodology of the European Union. At the same time, such a breakdown of costs should be the basis for the application of modern methods of calculation compilation, for example calculation of variable costs.

## 4 Conclusion

Constant increase in costs and high overhead share in the structure of total production costs are considered as actual issues of agricultural produce. In order to find a solution to this problem the application of economic cost management, currently presented by cost controlling, might be helpful. In this context a questionnaire survey was compiled, with the aim to assess the level of applied cost controlling and as well utilization of its basic information sources in the selected sample of agricultural entities.

The results show that intra-organizational accounting is applied by 73% of analysed entities. The small entities with number of employees less than 50 persons do not compile cost calculations. Insufficient attention is turned to preliminary calculations. It might be predicated by specifics of agricultural production. Agricultural entities compile calculations pursuant a unified calculation formula recommended by Research Institute of Agricultural and Food Economics. Cost budgeting presents the weakness of agricultural entities. Cost budgets are compiled only by 62% of entities from the sample. All sample companies track costs according to nature for which the structure is prescribed by the framework chart of accounts for entrepreneurs bookkeeping in double entry accounting.

The survey found out that agricultural entities apply principles of cost controlling covering intra-organizational accounting, budgets and cost calculations, but with a lot of weaknesses mentioned in the paper. Recommendation for improvement and higher quality of information support of cost controlling in agricultural entities in Slovakia have been provided.

One of the authors' recommendations is the utilization of non-traditional methods of calculation compilation which are able to eliminate the discrepancies of calculations based on the classical calculation formula recommended by RIAFE. Method ABC (Activity Based Costing) enables the more concrete calculation of overheads. The calculation of variable costs requiring the evidence of costs divided into fixed and a variable cost is sufficient for the short-term management and decision making. The issue of non-traditional methods of calculation compilations in agriculture of the Slovak republic is not so discussed. Therefore, the intention of the authors is to address their scientific work to the possibilities of using non-traditional methods of calculation compilation in the agricultural entities in the future.

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## Determinants of crop productivity in Nigeria in the era of agribusiness

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**Annotation:** Agriculture is the most significant sector of the Nigeria economy. The sector serves as the major employer of labour, source of income for smallholder farmers, non-oil foreign exchange earner, and food security. Therefore, the integration of agriculture with other sectors of the economy in the country in the present era of agribusiness is necessary. This contribution assesses some determinants of crop production in Nigeria, using OLS regression and Granger causality approaches. The OLS suggest that fertilizer consumption, cultivated land, loans and producer price index have a relationship with crop productivity in Nigeria. In the same fashion, the estimated results from the Granger causality/Block exogeneity Wald test based on a Vector Autoregressive (VAR) model provides a bidirectional relationship running from fertilizer consumption to crop production. A unidirectional causality is confirmed between cultivated land and crop productivity in Nigeria. The results also signify a unidirectional causality between the farm gate price and agricultural fertilizer applications. The Nigerian government should create an enabling environment and provide or guaranteeing affordable loans to producers, continue to subsidize fertilizer and ensure that it is distributed to farmers at the right time. Farm expansion should be encouraged for full utilization of the abundant agricultural area for maximum and sustainable production, food security and market in the present era of agribusiness.

**Key words:** fertilizer consumption, cultivated land, Granger causality

**JEL Classification:** Q10, Q15, Q18, Q29

### 1 Introduction

Nigeria is endowed with abundant food and agricultural resources which are yet to be fully developed for household consumption, industrial and commercial purposes. As a consequence, the country has been a net importer of food since 1974. Prior to the extraction of crude oil in Nigeria in the 1960s, the country was dependent solely on the agricultural sector of the economy for domestic consumption and foreign earnings (Olajide, Akinlabi and Tijan, 2012; Verter and Bečvářová, 2014a). Between 1900 and 1960, the Nigeria's economic growth was mostly dominated by the performance agricultural products (Eicher, 1967). However, this sector of the economy has taken a backseat since 1970s when the country started producing oil on a large scale. Despite the chronic neglect of agriculture for oil, the country's economy is still dominated by agriculture, contributing over 35% to the real gross domestic product (GDP). Undoubtedly, even though the petroleum accounts for over 80% of the country's total value of export products, agriculture is still the mainstay of the economy. Agriculture is still the largest employer of labour and a source of food security for the majority of the rural dwellers in the country (Verter and Bečvářová, 2014a).

Given the importance of agriculture to the country's economic growth, a sustained and accelerated development of agricultural production for food security and trade are crucial to economic growth and development. However, the development of agriculture and agribusiness in Nigeria is slow as compared with the total number of producers and others

in agricultural related activities. Even though Nigeria accounts for a significant proportion of the global output of cassava, yams, sorghum, cocoa, cashew and shea nuts, and millet, agro-processing and agribusiness is still scanty (UNIDO, CBN and BOI, 2010; Yusuf, 2014). The spatial distribution of agricultural related business in both raw production and processing indicated that many crops are grown in regions; however, no distinction was made between the individual categories of processing (UNIDO, CBN and BOI, 2010). Although Nigeria accounted for 65% of total tomato outputs in West Africa, ironically, the country is now the largest importer of tomato paste in the sub-region. Sadly, available data from FAO (2015) shows that between 2005 and 2013, the net index of agricultural production in Africa was slightly higher than Nigeria. This suggests that agricultural performance in Nigeria is below the African average.

The underdevelopment of the sector has had grave implications for food security and the socioeconomic development in Nigeria. Arguably, producers still faced with many challenges from production to post-harvest. The challenges of agricultural performance in Nigeria are partially attributed to the low level of farm mechanization, access to finance and market, the small size of farm, inputs, producer prices, and storage conditions. Furthermore, the lop-sidedness of government policies on agriculture coupled with a lack of political will have constrained agricultural performance in the country (Verter and Bečvářová, 2014b).

Some researchers have empirically determined factors that drive agricultural productivity in Nigeria and elsewhere in the world. For instance, Oyekale (2007) investigates some factors that influence agricultural land expansion in Nigeria. Using Johansen co-integration and error correction model (ECM), the Johansen test suggests that there exist a long-run equilibrium relationships among the variables in the model. The ECM findings indicate that the dynamic unrestricted short-run parameters of permanent cropland growth rates, an index of agricultural production, inhabitants, and land have a significant impact on agricultural land expansion in the country. In the same fashion, Ayinde, Adewumi and Omotosho (2009); Ammani, Alamu and Kudi (2010); Verter and Bečvářová, (2014b) also find a positive relationship between area harvested and crop production in Nigeria.

Similarly, Brownson, Ini-mfon and Etim (2012) investigate the drivers of cash crop output volatility in Nigeria for the period between 1961 and 2010. Using an ECM model, the results indicate that the inflation rate, harvested area, and commercial loans have effects on the volatility of agricultural performance in the country. Kareem et al (2013) determine some drivers of agricultural productivity in Nigeria. Using OLS and Granger causality approaches, they find out that bank loans to agriculture, foreign direct investment, interest rate and food import value have a positive relationship with agricultural productivity in the country. The result of the Granger causality test also shows that agricultural performance Granger cause commercial loans. On the contrary, some studies (Iganiga and Unemhilin, 2011; Verter and Bečvářová, 2015) find an inverse relationship between commercial loans and agricultural performance in Nigeria. Arguably, most loans to agriculture are not channelled to agricultural related activities. More so, most smallholder farmers do not have access to these loans.

Data available from FAO (2015) shows that in 2012, agricultural area (arable), 72 million hectares (79.1%) out of Nigeria's total land area of 91 million hectares. However, only 41.7 million hectares were classified as Arable land and Permanent crops, out of which 35 million hectares is arable while 6.7 million hectares are for permanent crops. Even though cultivated area as a percentage of the total agricultural area increased from 51% in 1961 to 58% in 2013,

the country is yet to utilise fully the available agricultural land for maximum production. This to some extent show that Nigeria has been producing below expectation. This may be among the reasons why the country has been the net importer of food since 1974. Studies by UNIDO (2012); AGRA (2014) show that agribusiness is yet to make significant progress in Nigeria and many other African countries such as Burkina Faso, Ethiopia, and Ghana.

The present dwindling oil prices on the world market has necessitated Nigerian government to tighten its belt to diversify the economy by promoting and stimulating crop production and agribusiness development across the regions in the country. This initiative may yield the desired results if the factors that are either militating against or enhancing agricultural performance are identified and addressed. This paper an attempt to investigate the impacts of some variables such as fertilizer use, cultivated area, loans and farm gate price on crop production in Nigeria.

## 2 Materials and Methods

Secondary data were mainly used in this contribution. For the empirical analysis, annual time series data spanning the period between 1987 and 2012 were obtained from reliable institutions. The periods were chosen because they appear to explain the changes of the variables of interest. Specifically, statistical data on the total crops produced, fertilizer, cultivated land and producer price index were obtained from the Food and Agriculture Organization (FAO) of the United Nations. Data on commercial loans to agriculture was obtained from the Central Bank of Nigeria (CBN), annual statistical bulletins.

In order to determine the factors of agricultural (crop) production in Nigeria, crop production is captured as a dependent variable, whereas, fertilizer, land used for agriculture, loans, and producer price index are being used as explanatory variables in this study. All the data in the models are processed using two econometric software-Gretl and EViews 8. The econometric model is specified as follows:

$$QCP = F(FC, ACL, AL, PPI) \quad (1)$$

Thus, model 1 is then mathematically defined to include log and error term as follows:

$$\ln QCP = \beta_0 + \beta_1 \ln FC + \beta_2 \ln ACL + \beta_3 \ln AL + \beta_4 \ln PPI + \varepsilon \quad (2)$$

Where;

InQCP denotes the natural log of the annual quantity of crop produced in Nigeria, measured in tonnes. InFC stands for the natural log of fertilizer consumption, measured in tonnes. Fertilizer application on farms is among the paramount factors of agricultural production. InACL is the natural log of agricultural cultivated land, measured in hectares (ha). The land is another primary factor of agricultural production. InAL is the natural log of commercial loans to agriculture (in Nigerian Naira), captured for capital. It is the amount of guaranteed loan received by farmers under the agricultural credit guarantee scheme fund (ACGSF) to producers of agricultural products. InPPI denotes the natural log of the producer price index, captured for an annual change of farm gate price prices. It is the annual changes in prices received by farmers for primary agricultural commodities as collected at the first point of sale.  $\varepsilon$  is the error term,  $\beta_0$  denotes constant while  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$  are coefficients of each variable in the model. All the explanatory variables in the model are expected to have a positive effect on crop production in Nigeria.



The vector autoregression (VAR) is normally used for forecasting systems of interrelated multivariate time series data and for analysing the dynamic impact of random disturbances on the system of variables. The mathematical representation of a VAR is:

$$y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + \beta x_t + \varepsilon_t \quad (3)$$

Where;

$y_t$  is a  $k$  vector of endogenous variables,  $x_t$  is a  $d$  vector of exogenous variables, while  $A_1, \dots, A_p$  and  $B$  are matrices of coefficients to be estimated in the model, and  $\varepsilon_t$  is vector of unobservable or white noise.

The Granger (1969) approach to the question of whether  $x$  causes  $y$  is to see how much of the current  $y$  could be explained by previous values of  $y$  and then to see whether adding lagged values of  $x$  could improve the explanation. The mathematical representation of a Granger causality is:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \dots + \alpha_l y_{t-l} + \beta_1 x_{t-1} + \dots + \beta_l x_{t-l} + \varepsilon_t \quad (4)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \dots + \alpha_l x_{t-l} + \beta_1 y_{t-1} + \dots + \beta_l y_{t-l} + \mu_t \quad (5)$$

for all possible pairs of  $(x, y)$  time series in the group in the Granger equation. The Wald statistics for the joint hypothesis is:

$$\beta_1 = \beta_2 = \dots = \beta_l = 0 \quad (6)$$

for each equation. The null hypothesis is that  $x$  does *not* Granger-cause  $y$  in the first regression and that  $y$  does *not* Granger-cause in the second regression.

### 3 Results and Discussion

#### 3.1 Test Checklist

Given that time series data are subject to spurious regression findings; a stationary test was carried out prior to estimating some econometric approaches. Specifically, Augmented Dickey- Fuller (ADF) unit root test was run. All the variables in the model were not stationary at their level but have become stationary after the first difference (see Appendix A). The ordinary least squares (OLS) regression (see Table 2) and Granger causality (see Table 3) tests were run after unit root test was carried out. Diagnostic checklist for the OLS regression was carried, and all the classical assumptions were fulfilled (see Appendix B). Prior to Granger causality test, unrestricted VAR model was carried out. Based on the information criteria, the optimal lag length of two was chosen (see Appendix C) to run both the VAR and Granger causality approaches.

#### 3.2 OLS Regression Estimation

As presented in Table 2, the estimated results show that the Adjusted  $R^2$  of 67% accounted for the variability in the response variable in the model. Also, F. statistics in the model signifies that all the explanatory variables jointly influence agricultural performance in Nigeria, statistically significant at the 0.01 level. Similarly, the OLS estimation result suggests a robust positive relationship between fertilizer consumption (FC) and crop production (QCP) in Nigeria, statistically significant at the 1% level. This signifies that *ceteris paribus*, a 1%

percent increase in the application of fertilizer on farms, crop outputs in the country may increase by 0.1%. This result also corresponds to works by Ayinde, Adewumi and Omotosho (2009); Ammani, Alamu and Kudi (2010); Verter and Bečvářová, (2014b). Given that soil has lost its nutrient or manure for maximum yield or output, fertilizer is among the essential agricultural inputs and significant contributors to rising crop production. The application of fertilizer on farms may well improve yields and total output of agriculture in the country. Even though Nigeria has proven 180.5 trillion cubic feet of natural gas reserves in 2015, and 9th in the world, coupled with the large quantity of phosphate rock deposits, local fertilizer production is still insufficient. In the same fashion, the result further indicates that cultivated land (ACL) has a strong connection with crop production in Nigeria, statistically significant at the 0.01 level. This signifies that *ceteris paribus*, a 1% percent increase in farm expansion may well bring a corresponding agricultural output by 1.2% in the country. This result corresponds to the works by Oyekale (2007) who also find a positive relationship between agricultural production and land expansion in Nigeria.

**Table 2.** Some determinants of crop production in Nigeria 1987-2012 (T = 26)

Dependent variable: lnQAP				
Variable	Coefficient	Std. Error	Test-statistic	p.value
const	0.0420	0.0095	4.4375	0.0002***
lnFC	0.0859	0.0167	5.1562	0.0004***
lnACL	1.2105	0.2737	4.4226	0.0002***
lnAL	-0.0532	0.0204	-2.6056	0.0165**
lnPPI	0.0216	0.0118	1.8227	0.0826*
R-squared	0.7214	Adjusted R <sup>2</sup>	0.6684	
F(4, 21)	13.5970	P-value (F)	0.0000	
Durbin-Watson	1.6560			

Note: The asterisks (\*, \*\*, \*\*\*) denote statistical significance at 0.1, 0.05, and 0.01 levels respectively

Source: own processing

Contrary to prior expectation, the results indicate an inverse relationship between commercial loans to agriculture (AL) and crop performance in Nigeria, statistically significant at the 5% level. The result is in consonance with the works of Verter and Bečvářová (2015) who also find a negative connection between commercial loans and yam production in Nigeria. They argue that the majority of the smallholder farmers in the country are poor, and they do not have collateral security to secure the loans provided by those institutions. As a consequence, only a few farmers have access to loans to boost their farm-related activities. Consequently, commercial loans to producers seem not to induce crop productivity in the country. Migap and Audu (2012); Verter and Bečvářová (2014b) stress that lack of adequate provision for agricultural loans from the financial institutions to producers has constrained a sustainable cultivation and outputs in Nigeria. The results, however, show a weak relationship between the producer price index (PPI) and crop production in Nigeria (see Table 2).

### 3.3 Granger Causality Test

Granger (1969) causality test is employed using a lag length of two in a VAR environment (see Appendix C). Table 3 shows the results from the Granger causality technique. The result suggests there is a bidirectional causality running from fertilizer consumption to crop

production in Nigeria. The findings also provide a unidirectional causality from cultivated land to crop production.

A unidirectional causality is confirmed between commercial loans and crop performance in Nigeria. This result corresponds to the works by Kareem et al. (2013) who also confirm a unidirectional causality running from the cultivated land to crop production in Nigeria. In the same direction, the results also confirm a unidirectional relationship from producer price index to fertilizer consumption. The results further suggest that fertilizer use, farm size, loans and producer price index jointly Granger- cause crop performance in Nigeria. Similarly, the result signifies that crop production, cultivated land, commercial loans and the producer price index jointly Granger- cause fertilizer consumption in the country (see Table 3).

**Table 3.** VAR Granger Causality/ Block Exogeneity Wald Test (2 lags)

Equation	Excluded	$\chi^2$	df	Prob > $\chi^2$	Decision
lnQCP	lnFC	7.0413	2	0.0296**	Reject $H_0$
	lnACL	15.1574	2	0.0005***	Reject $H_0$
	lnAL	5.5821	2	0.0614*	Reject $H_0$
	lnPPI	4.4169	2	0.1099	Fail to reject
	ALL	20.4329	8	0.0088**	Reject $H_0$
lnFC	lnQCP	12.1316	2	0.0023***	Reject $H_0$
	lnACL	2.9671	2	0.2268	Fail to reject $H_0$
	lnAL	1.7062	2	0.4261	Fail to reject $H_0$
	lnPPI	6.6316	2	0.0363**	Reject $H_0$
	ALL	36.5312	8	0.000***	Reject $H_0$
lnACL	lnQCP	3.1536	2	0.2066	Fail to reject $H_0$
	lnFC	0.6546	2	0.7209	Fail to reject $H_0$
	lnAL	0.2755	2	0.8713	Fail to reject $H_0$
	lnPPI	1.8712	2	0.3924	Fail to reject $H_0$
	All	7.9316	8	0.4402	Fail to reject $H_0$
lnAL	lnQCP	0.5733	2	0.7508	Fail to reject $H_0$
	lnFC	3.5529	2	0.1692	Fail to reject $H_0$
	lnACL	0.4196	2	0.8107	Fail to reject $H_0$
	lnPPI	0.4556	2	0.7963	Fail to reject $H_0$
	ALL	8.6273	8	0.3747	Fail to reject $H_0$
lnPPI	lnQCP	0.9570	2	0.6197	Fail to reject $H_0$
	lnFC	1.2956	2	0.5232	Fail to reject $H_0$
	lnACL	0.9157	2	0.6327	Fail to reject $H_0$
	lnAL	2.5343	2	0.2816	Fail to reject $H_0$
	ALL	4.4775	8	0.8117	Fail to reject $H_0$

Note: \*\*\*, \*\* and \* indicate the rejection of the null hypothesis at 0.01, 0.05 and 0.10 significance level respectively

Source: own processing

## 4 Conclusion

Agriculture is the most important sector of the Nigeria economy. The sector serves as the major employer of labour, source of income for smallholder farmers, major non-oil foreign exchange earner, and food security. Given that agriculture is the mainstay of the country's economy, this contribution determines the effect of fertilizer consumption, loans, cultivated land and producer price index on crop production in Nigeria for the period 1987-2012. Using OLS and Granger's causality based on a VAR environment, the OLS regression results indicate that fertilizer consumption, cultivated land, producer price index and commercial loans to agriculture have a significant relationship with crop productivity

in Nigeria. In the same fashion, the Granger causality analysis also provides a bidirectional relationship running from fertilizer consumption to the crop production. A unidirectional causality is confirmed between cultivated land and crop performance in Nigeria. The results also signify a unidirectional causality between producer price index and fertilizer applications.

The Nigerian government should create an enabling environment and provide or guarantee affordable loans to producers, continue to subsidize fertilizer and ensure that it is distributed to farmers at the right time. Farm expansion should be encouraged for full utilization of her abundant agricultural area for maximum production, food security and market in the present era of agribusiness.

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## Appendix:

**Appendix A.** ADF test for unit root (constant only)

Variables	ADF at level	ADF at first difference
lnQCP	-2.8546	-6.3450***
lnFC	-2.1476	-5.3003***
lnACL	-1.5957	-4.3555***
lnAL	-0.1755	-5.1973***
lnPPI	-2.8389	-4.6864***

**Appendix B.** Diagnostic test

Test	Test- statistic	P. value
Ramsey's RESET	3.2833	0.0596
White's test for heteroskedasticity	14.0556	0.4456
Breusch-Pagan test for heteroskedasticity	1.7622	0.7794
Test for normality of residual	1.3390	0.5120
Breusch-Godfrey test for first-order autocorrelation	0.6306	0.4364
Ljung-Box Q' test for first-order autocorrelation	0.8210	0.336
Test for ARCH of order 1	0.8441	0.3582

**Appendix C.** VAR lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	42.6134	NA	3.00e-08*	-3.1344	-2.8890*	-3.0693*
1	54.8257	18.3185	9.18e-08	-2.0688	-0.5962	-1.6781
2	92.6794	41.0082*	4.31e-08	-3.1399*	-0.4402	-2.4237

Note: \* indicates lag order selected by the criterion

## Possibilities of Talent Development in the Czech Republic

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**Annotation:** Regarding current trend in organisations to retain quality and knowledge employees who would be able to provide high performance in long-term and support organisational competitive advantage, more and more organisations orient themselves on continual employee development and talent management. To reveal current situation in mentioned area, primary research on employee development in agriculture and forestry was driven. The aim of the paper is to describe and identify approaches to talent management and development in selected organisations in the Czech Republic and to analyse those approaches to evaluate the situation and formulate suggestions. The data were collected in 101 organisations operating in rural economy by CAWI and CATI method. The sample selection took into account the size of the organisation. Only respondents from upper or top management were answering the questionnaire. One respondent per organisation was questioned. The primary data were evaluated using the tools of descriptive statistics, analysis of correlation, and also, dependence among qualitative characteristics was tested for verification of the obtained data and their further analyses (multidimensional statistics). The results show orientation of surveyed organisations on development and education; 64% of respondents are being regularly developed on their job position and 12% are being developed for their future position or position on which they aspire. Total 54% of surveyed employees aspire on higher position (managerial or specialist). The impulse to development is mostly own ambition of each employee (58%). Only 12% of surveyed respondents are neither developed by themselves nor by organisation at all. The outputs of the survey were statistically tested on selected level of significance. 50 per cent of surveyed organisations in agribusiness are focused on development of their employees. They use either talent management, personnel planning or performance management. The results allow prediction of further development activities in the Czech Republic.

**Key words:** development, talent management, agriculture, forestry, employee.

**JEL classification:** M12, M53, M54, Q12

### 1 Introduction

According to Berger and Berger (2004), experts in the field of human resource management, are of the opinion that in contemporary companies talent management represents a fundamental and absolutely key element that is able to affect positively the long-term survival of the organisation. Lockwood (2006) adds that at the beginning compensation and benefits may attract employees but as the time goes, the top management must start focusing on the development and retention of talented employees.

According to Larsen (2012), talent is hard to copy, substitute or even imitate. Fishman (1998) draws attention to the fact that the permanent increase in organisations' demand for talented

individuals is logically accompanied by a decrease in their offer. This is confirmed also by a study by Srivastava and Bhatnagar (2010) the results of which show that the demand for talented and qualified persons greatly exceeds available resources. The war for highly talented employees thus reached a global level (Frank and Taylor, 2004) and is crucial for all sectors of economy, including agriculture and forestry. Therefore research was made in organisations operating in agriculture and forestry to reveal current situation and approaches of Czech agriculture and forestry organisations and to find possibilities of talent development in this area.

The aim of the paper is to describe and identify approaches to talent management and development in selected organisations in the Czech Republic and to analyse those approaches to evaluate the situation and formulate suggestions.

The first part of the article presents introduction and theoretical background of the paper originating mainly from scientific journals. The chapter Materials and Methods presents data source, information concerning the survey made in agribusiness and describe analyses used to evaluate the data. Next chapter Results and Discussion includes an analysis and synthesis of the survey targeted at talent management and employees development in agriculture companies in the Czech Republic. A comparison of results and draft recommendations are included in the Conclusion.

### **1.1 Theoretical Background**

According to Armstrong (2007), the task of talent management is to find the talented people who will satisfy the demand for talent either already today or in future. Furthermore, the author emphasises the need to realize that one day these talented people will become the core resource for the company on which the competitive ability of the entire company will be based. Lockwood (2006), Rottwell (2005), Tarique and Schuler (2010), and Ashton and Morton (2005) agree to that and according to them, efficient talent management represents one of the most important strategic powers.

The creation and development of so called "talent pool" is one of the fundamental pillars of talent management. Collings and Mellahi (2009) and Rydvaldová and Junová (2011, p. 89) use this term to identify the employees who feature a high potential and deliver above-average performance at their current positions and may be appointed by the company to hold key positions in future. It is possible to say that the company is extremely interested in the development and long-term retention of the employees belonging to the talent pool (Jackson, Schuler and Werner, 2011, p. 132).

Schramm (2006) understands retention of talented employees as a strategic opportunity to maintain efficient and competitive labour. In this connection it is equally important to specify the reasons due to which employees leave companies. Kaliprasad (2006) characterises those reasons as an unsuitable situation as to both tangible (compensation, benefits) and intangible elements such as relationships, the balance between work and personal life, career growth opportunities, trust or the job content itself where the employee believes that those aspects of his/her job may be at a higher level in another organisation.

Branham (2009, page 17) and Buchtová (2002) state that as much as 90 % of managers incorrectly believe that the primary reason for departure of employees is the financial remuneration or a better work offer but in fact 80-90% of employees leave companies due to



various internal factors. Moreover, those factors can be often influenced by the company management. Vronský (2012) includes among those other factors also an offer of better working conditions, dissatisfaction with the overall level of work, and personal reasons. Branham (2004) has already elaborated these issues more specifically and defined the following fluctuation reasons: already mentioned dissatisfactory working conditions, bad relationships with co-workers or superiors, a lack of opportunities to develop talent, absence of the feeling that the job is important for the entire organisation, or lack of recognition and acknowledgment.

Sousa-Poza and Hennenberg (2004) have worked with slightly different categories of departure reasons within their research, i.e. demographic (sex, age, marital status, education), working (working time, membership with trade unions, income amount, benefits, trainings, size of the company), and subjective (satisfaction, security, promotion, labour market opportunities, the company's pride).

## 2 Materials and Methods

The article has been based on evaluation of results of primary research. The sample of organisations in agriculture and forestry was carried out in the Czech Republic as a random selection of organisations. The sample group contains 101 Czech organisations operating in agriculture or forestry. The overall questionnaire return was 14.8%, i.e. 101 organisations completed and returned the questionnaire. The Czech organisations involved were mainly small-sized (60.4%); 32.7% were mid-sized and large organisations (with more than 250 employees) made up 6.9%. A total of 680 randomly selected Czech organisations from all regions of Czech Republic were contacted.

The data was collected using the method of an electronic questionnaire that automatically recorded and pre-categorised respondents' answers (CAWI method – 85 respondents) and telephonic interview (CATI method – 16 respondents). The sample selection took into account the size of the organisation (small organisations of up to 50 employees, medium-sized organisations employing between 51 and 249 people and large organisations with more than 250 employees). Only respondents from upper or top management were answering the questionnaire. Only one respondent per organisation was questioned. The questioning took part in the beginning of year 2015 (January – March).

The respondents' answers were classified according to identification questions that constituted the first section of the questionnaire. The measurement in the survey was derived from closed questions with one or several possible answers that had been selected based on the study of literature, documents and other related surveys. Also semantic differential was applied; this permitted to identify nuances in respondents' attitudes throughout the questionnaire. The range of respondents' reactions to target statements and their attitudes to the given matter was restricted by offering a set of statements. The extremes of the five-point scale represented bipolar concepts of the evaluation dimension. Using a scale of 0 to 4, respondents expressed their inclination towards one of the pre-set extreme statements or, provided it was not possible to favor either of the sides, selected a zero, neutral value. The scale permitted not only to specify respondents' attitudes but also to indicate their intensity.

All the primary data were evaluated using the tools of descriptive statistics (relative frequency, the analysis of correlation, association). Also, dependence among qualitative characteristics

was tested for verification of the obtained data and their further analyses (Pecáková, 2011). To evaluate the data, the SPSS 22 statistical software and MS Excel were used.

During the research the procedures followed were in accordance with the ethical standards and national law.

### **3 Results and Discussion**

The section on results present the outcomes of the quantitative analysis of the agricultural and forestry organisations. The discussion contains a comparison of the results with regard to the issues in question and discusses the future development of talent management in this specific industry.

The survey addressed individual statements based on theoretical perspectives of work. Questions were designed to indicate level of agreement or disagreement of respondents. They also had the opportunity not to answer in the event that the given statement was not relevant to their organization.

Based on the results of the survey, 50 per cent of surveyed organisations in agribusiness are focused on development of their employees. The outputs also show orientation of surveyed organisations on development and education; 64% of respondents are being regularly developed on their job position and 12% are being developed for their future position or position on which they aspire. Total 54% of surveyed employees aspire on higher position (managerial or specialist). The impulse to development is mostly own ambition of each employee (58%). Only 12% of surveyed respondents are neither developed by themselves nor by organisation at all.

The specific results are summarised in Table 1.

According to the results it can be summarised that most of the organisations addressed (61.3%) incline to the opinion that talent management has an extraordinary importance for their organisation (45.5% agree; 15.8% strongly agree). The representatives of these organisations were less equivocal in their responses to whether talent management forms an integral part of their organisation. A total of 37.6% organisations agreed and an almost equal number (32.7%) of organisations did not agree. On the basis of the results it can be stated that representatives of the agricultural and forestry organisations addressed agree with the statement that leadership advocates a unified approach to managing talent, that they have defined strategies for talent management, and that these are a component of the strategic goals of the organisation. Within the given organisations senior executives (59.4%) contribute most to work with talent and external consultants (9.9%) the least.

**Table 1.** Relative frequencies of responses

Statements	Abbreviation	Totally agree	Mostly agree	Mostly disagree	Totally disagree
Talent management has extraordinary importance.	A	6,9 %	16,8 %	45,5 %	15,8 %
Talent management is an important part of the organisation's mission.	B	5,0 %	32,7 %	37,6 %	9,9 %
Top management has a unified approach to talent management.	C	12,9 %	20,8 %	35,6 %	9,9 %
We have a clearly defined talent management strategy.	D	23,8 %	23,8 %	29,7 %	5,0 %
The talent management strategy is integrated with the strategic goals of the organisation.	E	18,8 %	19,8 %	31,7 %	4,0 %
We have a list of key talent essential for our organisation.	F	31,7 %	20,8 %	18,8 %	7,9 %
We look for talent in each of our employees.	G	7,9 %	19,8 %	46,5 %	16,8 %
Talented individuals have an interest in working in our organisation.	H	2,0 %	12,9 %	46,5 %	17,8 %
We know how many talented employees we will need in the future.	I	14,9 %	25,7 %	30,7 %	6,9 %
Talent management is integrated with our system of employee compensation.	J	21,8 %	18,8 %	32,7 %	7,9 %
We develop talent on the basis of formulated plans.	K	26,7 %	32,7 %	15,8 %	4,0 %
We have enough financial resources to support the development of talented employees.	L	20,8 %	36,6 %	21,8 %	5,0 %
We have been successful at retaining talented employees.	M	8,9 %	24,8 %	39,6 %	8,9 %
We manage to satisfy the requirements of talented employees.	N	11,9 %	24,8 %	33,7 %	7,9 %
Talented individuals leave our organisation to seek new opportunities.	O	17,8 %	38,6 %	11,9 %	4,0 %

Source: own survey

The results were later analysed by Persons correlation coefficient. The questions were designed to allow testing of hypotheses and correlations. The resultant correlation table is presented below (Table 2). Middle and strong correlations are marked bold. Abbreviations are explained in Table 1.

As it is possible to see in the Table 2, correlations show that organisations with focus on talents have also unified approach to talent management and clearly defined talent management strategy which is integrated with the strategic goals of the organisation.

Correlation analysis also revealed that when top management of an organisation is interested in talent management, the organisation is also attractive for talented individuals to work in such organisation, because talent management is integrated with the system of employee compensation. Talented employees are also recognized and organisation knows, how many of them will be needed in the future and they can retain talents. Such approach is really the clear talent management.

Table 2. Correlation table

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
A	1	<b>0,78</b>	<b>0,55</b>	<b>0,58</b>	<b>0,51</b>	0,38	0,47	0,37	0,24	0,36	0,34	0,20	0,32	0,24	0,11
B	<b>0,78</b>	1	<b>0,58</b>	<b>0,63</b>	<b>0,64</b>	<b>0,52</b>	0,42	0,48	0,25	<b>0,52</b>	0,43	0,42	0,49	0,41	0,23
C	<b>0,55</b>	<b>0,58</b>	1	<b>0,73</b>	<b>0,67</b>	<b>0,51</b>	0,46	<b>0,62</b>	<b>0,58</b>	<b>0,57</b>	<b>0,55</b>	0,40	<b>0,57</b>	<b>0,51</b>	0,22
D	<b>0,58</b>	<b>0,63</b>	<b>0,73</b>	1	<b>0,84</b>	<b>0,62</b>	0,46	<b>0,52</b>	0,42	<b>0,61</b>	<b>0,59</b>	0,48	0,46	0,46	0,21
E	<b>0,51</b>	<b>0,64</b>	<b>0,67</b>	<b>0,84</b>	1	<b>0,65</b>	0,35	0,45	0,37	<b>0,67</b>	<b>0,59</b>	0,47	0,42	0,42	0,22
F	0,38	<b>0,52</b>	<b>0,51</b>	<b>0,62</b>	<b>0,65</b>	1	0,34	0,36	0,45	<b>0,63</b>	<b>0,65</b>	<b>0,54</b>	<b>0,55</b>	<b>0,52</b>	0,15
G	0,47	0,42	0,46	0,46	0,35	0,34	1	0,46	0,32	0,32	0,31	0,41	0,46	0,43	0,20
H	0,37	0,48	<b>0,62</b>	<b>0,52</b>	0,45	0,36	0,46	1	<b>0,63</b>	<b>0,51</b>	0,45	0,44	<b>0,60</b>	<b>0,57</b>	0,27
I	0,24	0,25	<b>0,58</b>	0,42	0,37	0,45	0,32	<b>0,63</b>	1	<b>0,51</b>	<b>0,57</b>	0,33	<b>0,56</b>	<b>0,55</b>	0,31
J	0,36	<b>0,52</b>	<b>0,57</b>	<b>0,61</b>	<b>0,67</b>	<b>0,63</b>	0,32	<b>0,51</b>	<b>0,51</b>	1	<b>0,60</b>	<b>0,52</b>	<b>0,56</b>	<b>0,53</b>	0,28
K	0,34	0,43	<b>0,55</b>	<b>0,59</b>	<b>0,59</b>	<b>0,65</b>	0,31	0,45	<b>0,57</b>	<b>0,60</b>	1	<b>0,69</b>	<b>0,58</b>	<b>0,55</b>	0,24
L	0,20	0,42	0,40	0,48	0,47	<b>0,54</b>	0,41	0,44	0,33	<b>0,52</b>	<b>0,69</b>	1	<b>0,60</b>	<b>0,64</b>	0,29
M	0,32	0,49	<b>0,57</b>	0,46	0,42	<b>0,55</b>	0,46	<b>0,60</b>	<b>0,56</b>	<b>0,56</b>	<b>0,58</b>	<b>0,60</b>	1	<b>0,84</b>	0,35
N	0,24	0,41	0,51	0,46	0,42	<b>0,52</b>	0,43	<b>0,57</b>	<b>0,55</b>	<b>0,53</b>	<b>0,55</b>	<b>0,64</b>	<b>0,84</b>	1	0,34
O	0,11	0,23	0,22	0,21	0,22	0,15	0,20	0,27	0,31	0,28	0,24	0,29	0,35	0,34	1

Source: own survey

Other significant correlations were found in the area of personnel planning. Organisations, who have strategic personnel plans also work on list of essential talents, they knows, how many talents they will need in the future and talents are developed based on formulated plans and organisation is successful at retaining talented employees.

Third part of surveyed organisations are focused on performance management. There are significant correlations found in the area of integrated with the strategic goals, talent management is integrated with compensation system and performance development of employees.

Surveyed organisations use either talent management, personnel planning or performance management. All three revealed types of organisations have no problem to retain talented employees. On the other hand, 50 per cent of surveyed organisations do not use any of presented human resource management practices.

### 3.1 Discussion

Talent management is nowadays important approach of all organisations, who take care about their current and future competitiveness, performance and attractiveness for skilled, trained, knowledge and talented employees (Collings and Mellahi, 2009; Armstrong, 2007). Also half of surveyed Czech organisations act in this manner. It can be summarize that talent management cannot be tackled separately, but in connection with the other personnel activities of the organization in every field. Should the organization decide to integrate talent management into its management, it is possible to increase its contribution by managing work performance and thus exploit the synergic effect in every activity that such a complex approach brings (Lockwood, 2006; Frank, Taylor, 2004). All talented employees need recognition for their work, as confirmed by Thorne and Pellant (2007), Branham (2009), Vnoučková (2013) who state that talented employees need recognition the most because they need to feel that they are contributing to something important and that their work has

a purpose. When recognition and feedback are provided to employees they lead to increased employee tenure in the organisation, even despite relatively unfavourable pay conditions (a continually lower income or wage level that does not reasonably correspond to the general difficulty of agricultural work (physically gruelling work, longer work hours, seasonality, the conditions and environment of workplaces in animal and vegetable production, etc.)), which continue to persist in the agriculture and forestry industry in the Czech Republic according to CSO (2014). Urbancová and Hlavsa (2014) state that this sector is less attractive for younger, qualified employees particularly given the wage disparity.

Based on these results it can be stated that in today's highly competitive environment it is necessary to focus on modern trends in the area of human resources management, which unquestionably include talent management. It is even more important in specific industries such as agriculture and forestry. This argument confirms also Wilden et al. (2010), who state that changing demographic and economic conditions in many developed and developing economies are contributing to significant growth of competitiveness in the labour market, where there is heavy competition for good employees. As a result, strategic investments in obtaining suitable, qualified employees are a necessary. It is confirmed by Kaliprasad (2006) who says that in the current competitive environment, talented people are important in every field.

#### **4 Conclusion**

The theoretical contribution of this study has been to present key approaches to talent management in agriculture and forestry organizations. 50 per cent of surveyed organisations in agribusiness are focused on talent management and development of their employees. They are focused either on talent management, personnel planning or performance management.

The practical contribution of the article was to identify possible ways how to improve employee and talent management in agriculture and forestry organisations. They are suggested to work on talent recognition, support and development. Still half of surveyed organisations lack the focus on talent management; even lack of focus of human resource management.

Future research in this field should focus on causes of problematic implementation of talent management in the agriculture and forestry sector and the ways how to overcome them.

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## Correctness of open data in the agricultural sector

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**Annotation:** The issue of so-called “Open data” has been recently intensively investigated and discussed in detail. This topic is relevant primarily in connection with the public sector that has proved its merits. The topic of open data itself includes not only asking the question of transparency and improve public services, but may also represent a certain potential business opportunities in the form of the creation of new products and services. Economic benefits of open data are therefore currently the subject of a precise examination of not only academia, but also major consulting firms. This benefit, however, can be realized only if the data are true, so-called correct. In connection with these data it is also discussed about the “Open data economy”. Similarly, this may be related to the agriculture sector. Such data might have some potential, which can initiate a qualitative change in the functioning of the entire agricultural sector.

**Key words:** Open data, information needs, data integrity, data quality, ISO SQUARE, agriculture, eGovernment.

**JEL classification:** L86, D83, Q19

### 1 Introduction

The supply of fast, accessible and high-quality information to individual users is the key aspect of information strategy of the agricultural sector. This aspect is closely related to the so-called information need. The information need is defined as a basic social need for information of the quality and quantity necessary to solve certain tasks and problems. The real information need is based on the task and problem solved by the particular person. Information needs influence the processes of the information systems. The processes and activities in the agricultural sector demand a high level of information and knowledge. It is therefore important to provide not only the data alone, but also bound with their context, or the knowledge, in accordance with the latest trends of knowledge based society and economy. In conjunction with this information need, the issue of so-called open data has been mentioned recently. In conjunction with open data, the governments and public organizations release more and more data sources, either as a consequence of the trend of higher transparency or as an economic stimulus of the knowledge based economy (Berg, 2013). These data may contribute to the satisfaction of this need. However, it is necessary to say, that this can be achieved only with open data which are in some way correct and this correctness should be a concern of all interested parties. The methodical approach consists of primary analysis of current state of open data usable for agriculture including selection of model data. The paper deals with further analyses of quality and its new proposed aspects.

### 2 Materials and Methods

The aim of the paper is the definition of the correctness of the open data as an important aspect of the quality of the data, which is a precondition for meaningful use in the commercial



sector, including agricultural. To meet the above objective, we used methods and techniques for evaluating the quality of software products, including standardized procedures of the international system of quality standards SQuaRE. In terms of this system, we defined the concept of quality as an external quality, i.e. the extent to which a product satisfies stated and implied needs when used under specified conditions. Other used methods will be relational databases, in particular methods of data integrity enforcement.

Open data have become an important information source in both public and commercial sector accessible on the Internet. These data come from non-government organizations, universities, ministries etc. They are accessible on-line in a structured and machine readable form. The usage of the data should not be limited by any technical or other restrictions and they should be available at no cost or for a minimal (symbolic) price. These data may be described as follows:

- They are at the lowest level of abstraction, which forms the knowledge.
- The amount and accessibility of these data emphasizes the development of appropriate methods of analysis.
- This development requires a constantly improving quality of the open data management.

In connection with the open data issue, there is often mentioned an open data economy. With no doubt it is clear that the agricultural sector must be a part of this economy. Should this sector become a full-fledged part of this type of economy, it must accept the open data issue. Current level of e-government in agriculture introduces a great opportunity to propagate such data (Rysová et al., 2013, Tyrychtr et al., 2015). The supposed savings in the agricultural sector can represent only the first step of the economic benefit of open data. The prosperity of the economic subjects and the whole sector can be enhanced by activities started as a consequence of efficient exchange of open data. It is in the interest of the Ministry of Agriculture to make the data available to all parties with as low legal and licensing restrictions as possible and also in the highest possible technical quality. The issue of information need is also closely related to open data.

The high information need of the agricultural sector is a logical consequence of the variety of activities carried out in a typical agricultural company. This variety emerges from the principles of agriculture and from the effort to diversify the strategy of agricultural business to decrease the potential risk by splitting the activities to different domains. The increased information need of the agricultural sector is also influenced by:

- the existence of a large amount of agricultural activities suffering from the lack of available specialists or other information sources;
- the existence of a large amount of problems accompanying these activities, which require a rapid and highly skilled solution.

Often, it is necessary to gather the missing data from external sources, which allows to exploit the open data potential in practice.

The subjects involved in the process of open data exchange in the agricultural sector may be divided into the following categories:

- *Suppliers* are the subjects who supply open data. Publishing the data could be a part of their broader strategy to increase the trust of their customers, to strengthen their integrity or simply a marketing strategy. In the agricultural sector, this subject should be

covered by the Ministry of Agriculture and its primary objective should be the transparency of the whole sector.

- *Aggregators* should collect and process the data. The core of their business will be in creating an added value by aggregating and processing the data and storing them in appropriate databases.
- *Enrichers* should add some expert opinion to the data and this expertise should be offered as a service to the clients. Thus the original data will be enriched by some relevant added value which will be helpful to the customers.
- *Enablers* should bring the tools, methods and technologies which make the open data accessible for processing (Lewis, 2013).

According to the needs of the agricultural sector, this classification of subjects of open data exchange should be extended by the category of *users of open data*. These subjects should efficiently use open data as a relevant information support of their tactical and strategic decisions in the context of their business activities. In practice open data unfortunately was inaccurate, incomplete and inconsistent in Czech agriculture (Halbich, Vostrovský, 2012). On the other hand, there are some accurate open data, but those must be aggregated as well (Hloušková et al., 2014). The main objectives of open data management by the suppliers will be:

- Integrity of open data as a crucial part of their quality
- Comprehensibility of these data for all potential users
- Authenticity of open data required for their analysis
- Availability of the data for efficient access and processing

The goals of open data management by their users will then be:

- Aggregation of these data into categories of broader groups of subjects without losing their value.
- Exploitation of these aggregated data for their own business activities

All the above mentioned objectives can be reached only if the supplied data will be correct. This correctness will be determined primarily by their credibility, topicality and directness. Correctness can be commonly described as the ability of the data to fully represent the real world from the viewpoint of time, effects and credibility.

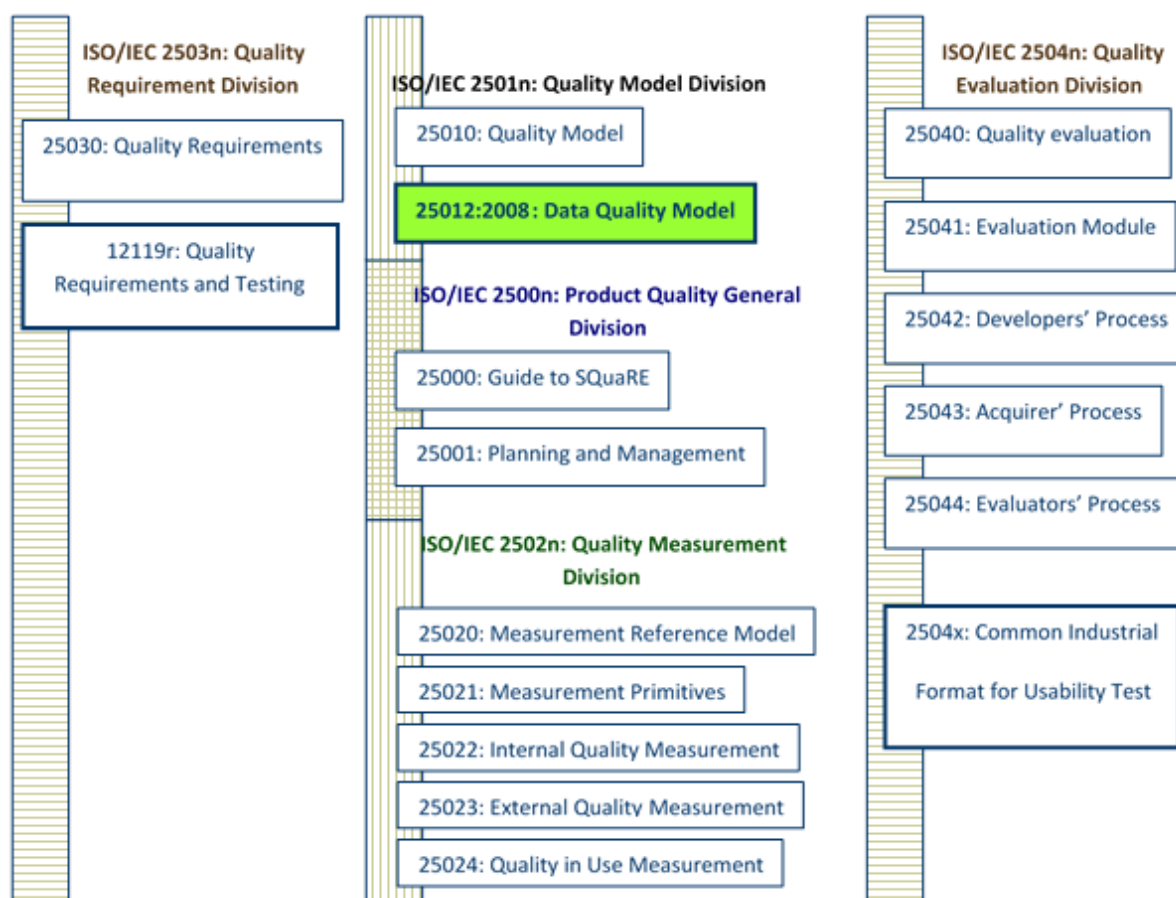
### 3 Results and Discussion

The problem of open data quality evaluation includes issues determined by fragmented and insufficiently updated national strategies, additional documents and miscellaneous legislation. The problem, which should be primarily considered in the open data quality evaluation, is so-called software quality in use, which expresses, how much the software product (in this case open data) satisfies the needs of the user (Vaníček, 2004). The main need of the user is an efficient use of open data in the process of decision making as a real information support. The software quality in use is one of the main categories of software quality specified by the SQUARE international standard and it expresses the quality of use of the product in specified conditions of the user (ISO SQUARE). It is specified by the attributes and metrics of quality of use and it is evaluated by comparison with indicators expressing the expected benefit of use of the product (Vaníček, 2006). Quality can be understood as a measure of meeting user requirements (SQuaRE). Open data quality must then be

evaluated in the same way as any other product, according to its quality characteristics. In order to assess the quality of open data, the requirements of its users on quality standards must be taken into consideration. Prior to the open data quality assessment, it is thus necessary to gather these requirements and analyze them thoroughly.

The principle requirement on open data quality is its ability to serve as a foundation in the process of objective decision-making. The most important partial requirements include *timeliness*, *credibility*, and *explanatory value*. These three general characteristics are also known as time-, content-, and usability-correctness. Should open data become the full-fledged source of competitive advantage for agricultural enterprises, these dimensions of correctness must be established and maintained. It should naturally be the prime concerns of every *open data supplier* to implement standards that ensure compliance with correctness requirements.

Fig. 1. Basic SQuaRE project outline



Source: Adopted by Vaniček, 2004

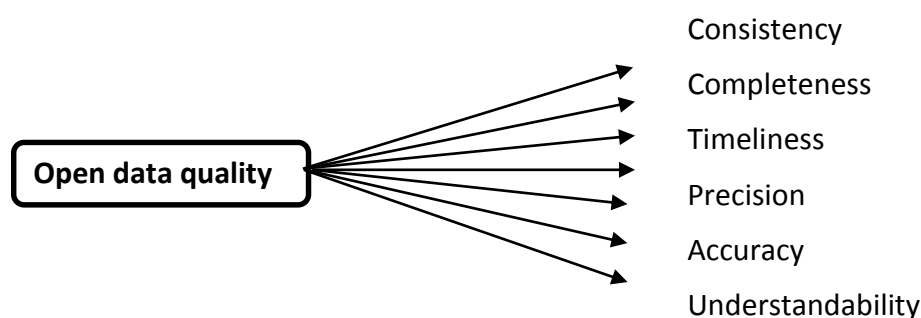
The quality of every product is evaluated with the help of defined set of metrics, which assess particular product characteristics. The SQuaRE series of International Standards defines in the section *ISO/IEC 25012: Data quality model* set of quality characteristics. Some of these follow:

- *Consistency* is the extent to which data do not contain obvious contradictions.
- *Timeliness* is the extent to which data reflect current state of reality correctly.
- *Completeness* is the extent to which data items represent a context perceived by target data users

- *Precision* is the extent to which can data-attribute values provide the level of information required for executing intended tasks.
- *Accuracy* is the extent to which data represent reality. It has two dimensions:
  - a) Syntactic
  - b) Semantic
- *Understandability* is the extent to which data can be expressed using suitable languages, symbols, and units; the extent to which data meaning is clear.
- *Efficiency* is the ability of data to be easily accessed, processed, and updated under given conditions with adequate resources.

The domain of open data research has not been established for a long time, and is therefore not addressed in much detail within the SQuaRE series of standards, see Fig.1. Above presented general model of quality must be modified in order to assess open data quality (correctness). While selected data quality characteristics of the original SQuaRE series of standards can be adopted, several new characteristics related to general purposes of open data must be defined and included into the quality model. Authors of this paper propose following open data quality model see Fig. 2, which amends the original SQuaRE data quality standard in a way that better relates to problems of open data.

Fig. 2. Proposed model of open data quality



Source: Authors

The newly proposed characteristics such a result of own research have following roles in the quality model:

- *Addressability* is the ability to assign partial data attributes to an entity they relate to.
- *Aggregability* is the extent to which data can be grouped to higher order categories in order to increase their information value.

The open data quality characteristics listed above should be implemented by software, which is used as open data source. In agriculture, a relational database (RDB) technology serves as such software in majority of cases, both on supplier and user side (survey conducted by authors of this article within IGA, FEM CULS in Prague research grant no.: 20131038). The main logical principle of the RDB technology related to the realization of correctness is *data integrity* (Castro, 2014; Wang, 2014; Salman, 2012; Valeanu, 2006). It is crucial to include data integrity rules and constraints when designing and consequently realizing a database system, which can be used for enforcing data correctness and increases the credibility of data stored (Menezes, 1996; Motro, 1989; Awad and Gotterer, 1992; Zviran, et al., 2000). From the data integrity point of view, correctness means that data provably relate to objects they belong to, have

values that correspond with reality, and contains correct relations to other data (objects from different context).

The proposed quality characteristics of open data related to data integrity can be implemented using SQL CREATE TABLE command with following syntax:

```
CREATE TABLE <table-name> (<attribute-name>
    <data-type> [NOT NULL] [PRIMARY KEY] [CHECK]... [FOREIGN KEY (<attribute-name>
    REFERENCES <table-name>(< attribute-name>...]
```

Data integrity is generally split into three categories:

- entity
- domain
- reference

*Entity integrity* ensures unique identification of stored entities by the means of primary key. In relationship with open data, this means that individual data attributes are conclusively assigned to the object they belong. The quality characteristics of *consistency* and *addressability* can hence be realized within the boundaries of this kind of integrity.

*Domain integrity* ensures accessibility of data from the data domain point of view. When a data domain is specified for every attribute, the risk of both conscious and unconscious entry of faulty data is highly mitigated, and the risk of omitting a data entry is fully eliminated. Domain integrity constrains can also be used for selecting up-to-date data only. This presents a feasible mean to ensure the *timeliness* quality characteristic.

*Referential integrity* ensures the correctness of relationships among related object within the context described. This integrity corresponds with the broader context of supplied data, and is helpful together with entity integrity in establishing *aggregability*.

Metadata that are focused to open data standardization may also help to improve data quality in agriculture (Šimek et al., 2012).

## Conclusion

In order to take advantage of open data potential in agriculture in practice, it is necessary to address following questions which closely relate to correctness:

- How can open data transparency be helpful for agricultural enterprises in pursuing their business activities?
- How can a higher level of correctness of open data in the agriculture be achieved?
- How can the willingness of their suppliers to maintain this correctness be simulated?
- How can the discrepancy between the need to publish open data in agriculture and the need to protect their strategic and personal content be addressed?
- Should the agricultural enterprises take the leading role and open their own data, or should they rather contribute to existing activities of agricultural portals?

When above mentioned questions are feasibly solved, it is possible to expect following benefits for agriculture:

- higher overall transparency of the resort, thanks to the public character of partial business activities of agricultural enterprises
- relevant information support for tactical and strategic decision making

With a given likelihood, it can be concluded the main purpose of pursuing open data correctness by the means of data integrity is eventual realization of the expectations mentioned above.

## Acknowledgements

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## Solidarity on the example of farmers' pension insurance in Poland

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**Annotation:** Farmers in Poland are under a separate pension protection system. They pay much lower premiums than those insured under the general scheme, in consequence, the subsidies provided by the State budget for their pensions constitute around 90%. One reason for the continuation of this privileged pension is a reference to solidarity, but the functioning of many farms in Poland, because of low income, is made possible only by a low pension premium. In the paper this privilege is determined in a comprehensive way: 1. What is solidarity? 2. Is the responsibility of the community unlimited? 3. Should an individual under solidaristic reciprocity transfer to the community specific benefits, in exchange for the social privilege? 4. Should solidarity be looked at through the prism of current actions, or through the increasing budgetary expenditure and thus the impact on the financial position of the country in the future? 5. Whether this privilege affects the financial situation of the State budget? and 6. Can farmers, because of their income, pay higher pension premiums? The aim of the study is to present solidarity based on the example of the social insurance system used for farmers in Poland. The work is based on an analysis of the subject literature and secondary research. The subject literature lacks studies presenting the issue in this way. In the paper we present that, the farmers' pension insurance system is not based on solidarity (thinking about the interests of the individual and the community - in the short term, as well as in terms of the future), it is simply political rent-seeking. Therefore, it requires significant changes to avoid potential State budget problems. Changes are possible due to the accession to the European Union, because farmers' financial situation has improved.

**Key words:** solidarity, pension, farmers, insurance, Poland.

**JEL classification:** Q14, H55, G22

### 1 Introduction

Farmers' social insurance system in Poland functions as an autonomous system. This autonomy stems from the fact that apart from a purely insurance function it realises certain political goals. On the one hand this system provides insurance protection to agricultural producers, which is perceived as an economic and moral need derived from the principle of social solidarity. On the other hand, however, society does not agree with the current rules of the functioning of the social security system for farmers. Dissatisfaction stems from its close dependence on the State budget, which means that the system is rigid and restricts the freedom to make decisions in the public finance sector (Benabou, 2000; Hindriks and De Donder, 2003; Pawłowska-Tyszko, 2013).

Exchange resulting from solidarity is based on an institutional exchange and not on the individual exchange (the tangible exchange is made by units, but the decisions are taken by the community) (Eisenstadt and Roniger, 1980). A privileged pension system for farmers is not the result of solidarity, it is a political rent awarded for political support given. Due to finance (balanced budget), solidarity (with the community) and agricultural



income (role of the low pension premium) starting a debate on implementing changes in the farmers' pension insurance is necessary.

At present farmers in Poland pay low contributions to the pension insurance system. Therefore, over 90% of the financing of the separate system of social insurance for farmers in Poland comes from the State budget.

As a result, farmers have the support of other professional groups. Their social security system is based on solidarity. Nowadays, the most common argument for favouring a particular group in terms of retirement is solidarity (Arce, 2009; Häusermann, 2010). In this case solidarity is based on institutional exchange (Eisenstadt and Roniger, 1980), in which two or more groups mutually exchange products (services), where one of the products is subsidising pensions (Cropanzano, Mitchell, 2005). However, in this context we should be answering the question whether within this exchange farmers offer enough to other professional groups and whether we can talk then about solidarity, or only about political pensions. In this case, a political pension is based on the system of competing for funds from the State budget that in the period following transformation, that is since 1989, only once had a surplus (Krueger, 1974).

The aim of the study is to present solidarity based on the example of the social insurance system applied to farmers in Poland.

## 2 Materials and Methods

Due to the research area the work is based mainly on an analysis of the subject literature as well as on secondary research (Lin, 2009). The subject literature lacks studies presenting the issue in this way. A lot of works refer only to solidarity, or provide solutions for pension schemes, or social security but without reference to the substance of solidarity, in particular, in relation to the Social Exchange Theory. Presented in the paper figures come from Poland's Ministry of Finance. Figures *characterising* the social security system for farmers have been compiled with the Polish budget revenue and budget deficit. It allowed for a complete overview of the analysed research area.

## 3 Results and Discussion

Due to the fact that more than 1.432 million<sup>39</sup> people are insured under the social insurance system for farmers, the privileged character of the system significantly affects the budgetary situation in Poland. This favourable way of treating farmers in Poland is about providing them with the possibility of paying far lower contributions than those paid by entrepreneurs and other persons insured within the general system. The privileged farmers' social insurance scheme was introduced in 1990 as part of aid to farmers due to the hardships related to economic transformation in Poland.

The farmer pays monthly social insurance contributions (to the Pension Fund – pension, disability benefit – and to the Contribution Fund of the Farmers Social Insurance – accident benefit, sickness benefit, maternity benefit) in the amount of 130 PLN per month<sup>40</sup> (including 88 PLN for pension insurance), while the person earning 1,750 PLN (that is the amount of the

<sup>39</sup> As of 31 December 2014.

<sup>40</sup> According to the rate from 02 January, 2015 published by the National Bank of Poland 1 Euro cost 4.3078 PLN.

mandatory minimum wage in Poland in 2015) pays 375.84 PLN and the entrepreneur 1092.28 PLN<sup>41</sup>. The privileged character of the system has also the personal character since the insured can be not only farmers and their spouses, but also the so-called 'household dwellers', practically every person who helps the farmer in running the farm. This last possibility is often overused by people insured in that capacity who work in Poland's grey economy or abroad.

Table 1 shows the annual deficit of the social security scheme for farmers against Poland's budget and the budget deficit. Since 2008 these amounts have been slightly altered (these values were also similar at the time of accession to the European Union – 2004). The grant for social security is about 16-17 billion PLN annually (with revenues from contributions of approximately 2 billion PLN). Given that this is the funding to secure one social group, attention should be focused on the role of this group in the context of the State budget.

A similar subsidised system operates in several European countries, therefore, the World Bank suggests changes to social insurance for farmers (Kasek, Laursen and Skrok, 2008). Also the Council of the European Union indicates that the social privileges granted to farmers in Poland impose significant costs on public finances, so due to low contributions they have to be heavily subsidised by taxpayers (State subsidies for the social security for farmers in Poland are worth almost 1% of GDP). Because farmers on high incomes cannot be systematically excluded from the scheme, the system is therefore open to abuse. The Council recommends introducing a system for recording and assessing farmers' incomes that would constitute an indispensable first step towards a reform of the social security scheme for farmers (European Commission, 2015).

**Table 1.** The Polish budget revenue, the budget deficit and the Polish budget expenditure on social insurance of farmers in thousands of PLN (\*plan)

Year	Polish budget revenue	Polish budget deficit	Budget expenditure on social insurance of farmers
2003	152 110 586	37 043 005	15 043 199
2004	156 281 202	41 417 118	15 159 061
2005	179 772 217	28 360 727	14 735 700
2008	253 547 261	24 346 216	15 636 431
2009	274 183 500	23 844 979	16 441 845
2010	250 302 781	44 591 097	15 671 039
2011	277 557 221	25 124 388	15 841 818
2012	287 595 114	30 406 746	16 220 093
2013	279 151 205	42 194 081	16 464 764
2014*	277 782 224	47 505 145	16 698 614
2015*	297 197 818	46 080 000	17 565 664

Source: own study based on the data published by the Ministry of Finance RP (<http://www.mf.gov.pl/7.05.2015>)

According to Molm, Collett and Schaefer (2007) solidarity means the integrative bonds that develop between persons, and between persons and the social units to which they belong.

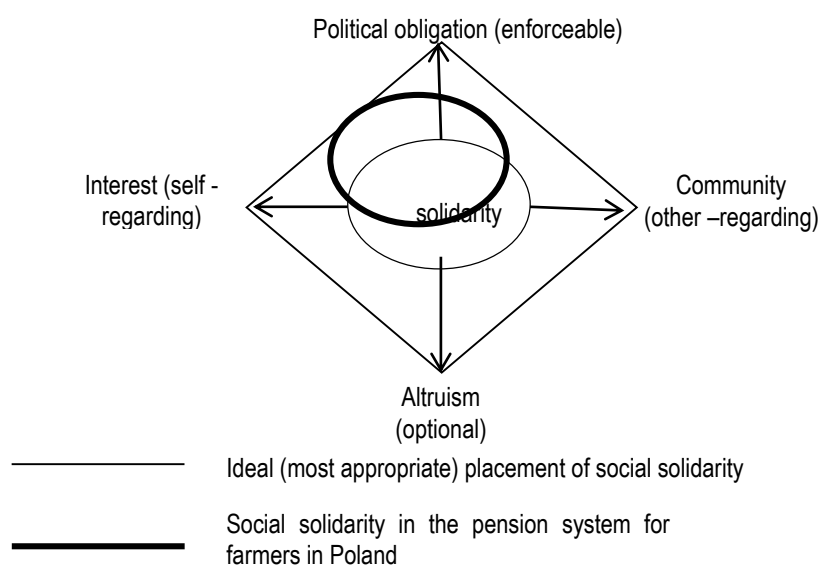
<sup>41</sup> For of the first two years of conducting business entrepreneurs, following certain conditions, may pay a lower contribution in the amount of 446.20 PLN.

At the same time solidarity has several 'subjective feelings of solidarity' including trust which means that none of the parties will overuse the other, or social unity which is the desire of both parties to reach common goals.

Therefore, solidarity means the striving of both parties towards a common goal, taking action in the common interest, the interest of both partners or of individuals and communities (Walczak, 2015). None of the parties should be favoured and what needs to be emphasised is that the boundary of solidarity is reciprocity, both the mutuality of the group shown to the individual and of the individual to the group (Leitner and Lessenich, 2003; Ratajczak-Tuchołka, 2012). Therefore, what matters is the essence of social life which is based on cooperation, shared responsibility and the interdependence (Szumlicz, 2015) of the group's members. But according to Soler (2004) the historical concept of solidarity in past times has experienced a semantic shift from the meaning 'social integration' to the idea of asymmetric relationships in terms of giving and receiving. Thus sometimes, some generations seem to give more than they expect to receive or may receive more than they have given or will give in the future, this is considered 'public solidarity' (Soler, 2012), and in this sense solidarity goes beyond reciprocity (Ostner, 2004). Solidarity in the event of the pension security of farmers in Poland is based on society's political commitment to fund public services that insured persons are entitled to.

According to Figure 1, solidarity should be based on thinking about community, not only about oneself, although it should be stressed that individualism is not opposed to solidarity and should not replace an individual's independence (Szumlicz, 2015). Therefore, in this respect the system deserves a negative evaluation. For over 20 years the State budget has been paying out billions of PLN to support social security for farmers. Unfortunately, nobody from the rural environment (or from any party representing this environment in the Polish parliament) has ever presented the problem from a definitional approach to the concept of solidarity. Solidarity can be discussed only when it is motivated by all of the indicated factors; however, if these behaviours are not observed, the pension system can be referred to as based on the group interest or simply a political annuity, not based on the principles of solidarity.

Fig. 1. The requirements of solidarity



Source: own study basen on (Nicolaidis and Viehoff, 2012)

This excessively developed solidarity, which affects the State budget, impacts strongly future generations who will be required to repay financial liabilities that currently finance pension payments. The lack of any reforms on reducing the State's participation in this system further increases the burden of future generations who will be obliged not only to repay obligations incurred in the past to finance the system, but also, on an ongoing basis in the future, to fund further payments due to the lack of any reforms conducted in the past. The longer the changes are not implemented, the greater the likelihood that there will be conflicts, in this case between the different generations and between the different groups that are required to finance the aforementioned privileges of the social insurance system (Lowenstein, 2007). It should be noted, that in the light of an ageing population, when is pressure on intergenerational solidarity and while many pension systems are in crisis, changes need to be introduced (Teulings and Vries, 2006). Besides, financing privileges from the State budget can lead to a reduction of necessity and motivation for solidarity (Daatland and Lowenstein, 2005).

A potential solution would be to base the farmers' pension system on the principle of intragroup solidarity where, given farmers' economic stratification, the burden of covering social security costs should be borne by wealthier people. Although some changes within the pension system for farmers have been implemented recently, for instance, raising the retirement age, or the elimination of early retirement<sup>42</sup>, they do not solve the problem of old age security for farmers. Having considered the function and essence of insurance, it will bring neither tangible benefits for the State budget in the form of lower grants to the system, nor a significant increase in the benefits for the interested parties (Puślecki, 2013).

At the end it should be considered whether all farmers can afford the changes in the scope of providing social security for farmers. Can they really afford the increased premiums? The answer to this question is not simple. Farmers in Poland do not pay income tax and they are not required to keep any form of accounting. Therefore, the above question can only be answered on the basis of other, indirect information. The average price of agricultural land in Poland at the end of 2014, as provided by the Agency for Restructuring and Modernisation of Agriculture, amounted to 34,222.60 PLN per hectare, whereas in 2009 it was 17,323.40 PLN per hectare, which indicates an increase in land prices, probably resulting from the increase in the profitability of farmers. As of the end of 2013, farmers in only one of the Rural Areas Development Programme - Modernization of Agricultural Holdings applied for 13.99 billion PLN - with the need for 50% contribution of own funds, it means that the sum of about 7 billion was invested by farmers in agricultural holdings (PROWieści, 2013). In 2013 alone about 1.4 million farmers were granted 14.6 billion PLN within the direct payments programme (ARiMR, 2014). Polish agriculture has changed after joining the European Union, but, like it was mentioned in table 1, budget expenditure on the social insurance of farmers is constant (in real value).

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<sup>42</sup> A small step towards strengthening the intra-group solidarity was the introduction in 2009 of progressive contributions to the pension insurance of farmers possessing agricultural holdings larger than 50 hectares. The increased burden of contributions applies only to a small part of farmers, who constitute less than 5% of all the insured in KRUS (the Agricultural Social Insurance Fund) (Puślecki, 2013).

## 4 Conclusion

The paper presents the concept of solidarity based on the example of social insurance for farmers – the insurance, most of which is funded from the State budget – 16-17 billion PLN annually. In this case subsidising concerns only one professional group, whose incomes have also changed as a result of accessing the European Union (eg. direct payments programme and Rural Areas Development Programme). Therefore, the privileges are based on the interests of one social group and on the political obligation imposed on others to finance benefits arising from it, and should not be called ‘solidarity’ but political rent-seeking. Because the benefits, to a greater extent, are based on the interests of the individual and not the community. Moreover, it must be stressed that efforts should be made to base the system in question on the principles of solidarity (inter-solidarity or intra-solidarity), that is to implement reforms that will allow farmers to pay fair contributions. It should be noted that without making any of the changes, what is suggested by the World Bank, this system could be a serious State budget problem, not only now, but also in the future.

The fact that farmers pay too low social security contributions leads to a situation where the system is largely maintained by taxpayers. It should be stressed that the current regulations on the farmers' pension system do not provide adequate protection for old age. Therefore, as in the non-agricultural system, it is necessary to start saving more. Since contributions paid by farmers are lower than those paid, for example, by entrepreneurs conducting non-agricultural business, saving should be far easier for them.

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## List of Authors

### B

Bartová, L. (SK) 39  
 Benda, P. (CZ) 47, 399  
 Benešová, I. (CZ) 376  
 Bergmann, D. (IR) 20  
 Bílková, D. (CZ) 55  
 Boháčková, I. (CZ) 64  
 Borská, J. (CZ) 73

### C, Ā

Cvik, E.D. (CZ) 82  
 Čechura, L. (CZ) 90, 145  
 Čierna, Z. (SK) 354  
 Čmejrek, J. (CZ) 99  
 Čopík, J. (CZ) 99

### D

Dobák, D. (SK) 354  
 Donnellan, T. (IR) 5  
 Dömeová, L. (CZ) 109  
 Dvořáková, K. (CZ) 117

### F

Fandel, I. (SK) 479  
 Ferenczi Vaňová, A. (SK) 502  
 Foltýn, I. (CZ) 126

### G

Góral, J. (PL) 135

### H

Hádková, Š. (CZ) 191  
 Halbich, Č. (CZ) 528  
 Hálová, P. (CZ) 145  
 Havlíková, M. (CZ) 145  
 Hennyeyová, K. (SK) 425  
 Hes, A. (CZ) 159  
 Higuchi, A. (PERU) 168  
 Hockmann, H. (DE) 90  
 Holúbek, I. (SK) 176  
 Homolka, J. (CZ) 393  
 Hönig, V. (CZ) 240

Hořková, P. (CZ) 256  
 Hron, J. (CZ) 184  
 Husák, J. (CZ) 191

### Ch

Chetvertakov, S. (DE) 199

### J

Janků, M. (CZ) 208  
 Jarkovská, M. (CZ) 495  
 Jarolímek, J. (CZ) 433, 456  
 Jindrová, A. (CZ) 109  
 Junek, P. (CZ) 425

### K

Kadlecová, E. (CZ) 73  
 Keane, M. (IR) 5, 20  
 Kharcheva, I. (RU) 216  
 Khoruziy, L. (RU) 216  
 Kontsevaya, S. (RU) 216  
 Konyová, V. (SK) 39  
 Kopřiva, R. (CZ) 224  
 Kostina, R. (RU) 216  
 Kořovská, I. (SK) 502  
 Kobzev Kotásková, S. (CZ) 224  
 Kotyza, P. (CZ) 363  
 Kovářová, K. (CZ) 308  
 Krajčírová, R. (SK) 502  
 Kučírková, L. (CZ) 159, 308  
 Kurdyš-Kujawska, A. (PL) 232

### L

Lančarič, D. (SK) 471  
 Laputková, A. (CZ) 376  
 Linhart, Z. (CZ) 240  
 Lórinčová, E. (CZ) 316

### M

Macák, T. (CZ) 184  
 MacGregor Pelikánová, R. (CZ) 82, 248  
 Mach, J. (CZ) 64, 256  
 Maier, T. (CZ) 264  
 Maitah, M. (CZ) 385

Makunina, I. (RU) 216  
 Malec, K. (CZ) 393  
 Malý, M. (CZ) 145  
 Masner, J. (CZ) 440, 456  
 Maxová, J. (CZ) 273  
 Milovanovič, V. (CZ) 282  
 Mrháčková, I. (CZ) 126  
 Mucke, T. (DE) 332  
 Munk, M. (SK) 471

## N

Nágllová, Z. (CZ) 292  
 Näther, M. (DE) 300  
 Navrátilová, M. (CZ) 308, 316  
 Nový, J. (CZ) 416

## O

O'Connor, D. (IR) 20  
 Olejniczak, J. (PL) 324

## P

Paustian, M. (DE) 332  
 Pavlík, J. (CZ) 433  
 Pechrová, M. (CZ) 340, 447  
 Pieńkowska-Kamieniecka, S. (PL) 536  
 Piterková, A. (SK) 471, 479  
 Plášilová, L. (CZ) 256  
 Poláková, Z. (SK) 176  
 Prášilová, M. (CZ) 347  
 Procházková, R. (CZ) 347

## R

Rábek, T. (SK) 479  
 Regnerová, M. (CZ) 159  
 Rosa, A. (PL) 232  
 Rovný, P. (SK) 354

## S, Š

Savov, R. (SK) 471  
 Serenčes, R. (SK) 176  
 Slaboch, J. (CZ) 363  
 Sládek, P. (CZ) 184  
 Smolová, H. (CZ) 519  
 Smutka, L. (CZ) 282, 376, 385  
 Steininger, M. (CZ) 385

Steklá, J. (CZ) 393  
 Stočes, M. (CZ) 399, 440  
 Svatošová, L. (CZ) 407  
 Svoboda, R. (CZ) 463  
 Svobodová, J. (CZ) 407, 416  
 Šálková, A. (CZ) 308  
 Šálková, D. (CZ) 159, 495  
 Šánová, P. (CZ) 416  
 Šeráková, P. (CZ) 416  
 Šilerová, E. (CZ) 425  
 Šimek, P. (CZ) 433, 440  
 Šimpach, O. (CZ) 340, 447  
 Šišková, J. (CZ) 316  
 Škubna, O. (CZ) 385  
 Šmejkalová, V. (CZ) 456  
 Špička, J. (CZ) 292  
 Šréd, K. (CZ) 463  
 Štiková, O. (CZ) 126

## T

Theuvsen, L. (DE) 300, 332  
 Tóth, M. (SK) 471, 479  
 Tyrychtr, J. (CZ) 487, 528

## U

Ulman, M. (CZ) 47, 399, 487  
 Urbancová, H. (CZ) 519

## V

Vaněk, J. (CZ) 440  
 Varvažovská, P. (CZ) 495  
 Váryová, I. (SK) 502  
 Vasilenko, A. (CZ) 487  
 Verter, N. (CZ) 510  
 Vnoučková, L. (CZ) 519  
 Vogeltanzová, T. (CZ) 425  
 Vostrovský, V. (CZ) 487, 528

## W

Walczak, D. (PL) 536

## Z, Ž

Zegarra, E. (PERU) 168  
 Žáková-Kroupová Z. (CZ) 145, 273

## CONTENT

	Page
<b>Plenary session – Keynote speakers</b>	
<b>The European Dairy Sector in a new Era</b> .....	5
<i>Trevor Donnellan and Michael Keane</i>	
<b>The challenges posed by price volatility in the EU dairy sector</b> .....	20
<i>Declan O’Connor<sup>1</sup>, Dennis Bergmann and Michael Keane</i>	
<b>Parallel sessions</b>	
<b>Structural Changes in the Slovak Regional Agriculture</b> .....	39
<i>Ľubica Bartová and Veronika Konyová</i>	
<b>Usability and Accessibility analysis of Czech agrarian portals</b> .....	47
<i>Petr Benda, Martina Šmejkalová and Miloš Ulman</i>	
<b>Wages in Czech Agricultural, Industrial and Construction Sectors</b> .....	55
<i>Diana Bílková</i>	
<b>Labour productivity in agriculture – value known or unknown?</b> .....	64
<i>Ivana Boháčková and Jiří Mach</i>	
<b>Legal Aspects of Agricultural Land in the Czech Republic</b> .....	73
<i>Jana Borská and Eva Kadlecová</i>	
<b>Agricultural policy and law as reflected by Websites of Czech organic farmers</b> .....	82
<i>Eva Daniela Cvik and Radka MacGregor Pelikánová</i>	
<b>Technological Progress in European Pork Production</b> .....	90
<i>Lukáš Čechura and Heinrich Hockmann</i>	
<b>Risk management of rural municipalities as a limit of their basic self-governing functions</b> .....	99
<i>Jaroslav Čmejrek and Jan Čopík</i>	
<b>Positive Disparities in Micro Regions</b> .....	109
<i>Ludmila Dömeová and Andrea Jindrová</i>	
<b>Predictive ability of financial health assessment in agriculture</b> .....	117
<i>Kristýna Dvořáková</i>	
<b>Model AGRO-2014 and problem discrimination of Czech food producers</b> .....	126
<i>Ivan Foltýn, Olga Štiková and Ilona Mrhálková</i>	

<b>Subsidies and Technical Efficiency of Large-Scale Farms in Poland</b> .....	<b>135</b>
<i>Justyna Góral</i>	
<b>Provision of Public Goods in Czech Agriculture</b> .....	<b>145</b>
<i>Pavλίna Hálová, Zdeňka Žáková Kroupová, Michaela Havlíková, Lukáš Čechura and Michal Malý</i>	
<b>Availability of food on the Czech market for specific groups of customers and the quality of life</b> .....	<b>159</b>
<i>Aleš Hes, Daniela Šálková, Lenka Kučírková and Marta Regnerová</i>	
<b>A general appraisal of empowerment in Peru: A case study of Condoray and its rural promoters</b> .....	<b>168</b>
<i>Angie Higuchi and Eduardo Zegarra</i>	
<b>Cost ratio and profit ratio of sugar beet production in production conditions</b> .....	<b>176</b>
<i>Ivan Holúbek, Roman Serenčėš and Zuzana Poláková</i>	
<b>Deterministic Decision Making in Agricultural Production</b> .....	<b>184</b>
<i>Jan Hron, Tomáš Macák and Pavel Sládek</i>	
<b>Rural Community Schools in the Czech Republic and their Activities within the Context of Rural Development</b> .....	<b>191</b>
<i>Jakub Husák and Šárka Hádková</i>	
<b>Corn and soy in Russia: the latest fad or a new cash cow?</b> .....	<b>199</b>
<i>Sergey Chetvertakov</i>	
<b>EU Legal Regulation of State Aid In Agriculture - Selected Issues</b> .....	<b>208</b>
<i>Martin Janků</i>	
<b>Taking the managerial decisions at the enterprise in the age of agriculture globalization in Russian Federation</b> .....	<b>216</b>
<i>Stanislava Kontsevaya, Ludmila Khoruziy, Irina Kharcheva, Irina Makunina and Kostina Raisa</i>	
<b>Development of Rural Communities and the Factors Forming Local Political Representation</b> .....	<b>224</b>
<i>Radek Kopřiva and Sylvie Kobzev Kotásková</i>	
<b>Factors influencing the use by farmers of disaster loans - empirical research</b> .....	<b>232</b>
<i>Agnieszka Kurdyś-Kujawska and Anna Rosa</i>	
<b>Break Even Point in Circular Economy of Biofuels</b> .....	<b>240</b>
<i>Zdeněk Linhart and Vladimír Hönig</i>	

<b>The Significance of Domain Names for Agribusiness – Czech and Austrian comparative study</b> .....	<b>248</b>
<i>Radka MacGregor Pelikánová</i>	
<b>Factors influencing costs of milk production in the EU –importance of herd size</b> .....	<b>256</b>
<i>Jiří Mach, Lenka Plášilová and Pavla Hošková</i>	
<b>Relation Between Excise Tax and Beer Consumption in Chosen EU States</b> .....	<b>264</b>
<i>Tomáš Maier</i>	
<b>Performance of Czech Dairy Farms</b> .....	<b>273</b>
<i>Jana Maxová and Zdeňka Žáková Kroupová</i>	
<b>Establishing food security for Bangladesh’s rural poor through sustainable collective farming practices</b> .....	<b>282</b>
<i>Vladimir Milovanovič and Luboš Smutka</i>	
<b>Structural and economic performance of the meat processing industry in the Central Europe</b> .....	<b>292</b>
<i>Zdeňka Náglová and Jindřich Špička</i>	
<b>Is African swine fever an economic threat to the EU?</b> .....	<b>300</b>
<i>Maria Näther and Ludwig Theuvsen</i>	
<b>Consumer preferences and attitudes of the young generation to the business concept of Fair Trade in the Czech Republic</b> .....	<b>308</b>
<i>Miroslava Navrátilová, Lenka Kučirková, Kateřina Kovářová and Andrea Šalková</i>	
<b>Assessment of Young People’s Expectations of Agritourism in the Czech Republic</b> ....	<b>316</b>
<i>Miroslava Navrátilová, Enikő Lőrinczová and Jitka Šišková</i>	
<b>Should we differentiate systems of own revenues in rural and urban local self-governments’ budgets? Example from Lower Silesian voivodeship.</b> .....	<b>324</b>
<i>Jarosław Olejniczak</i>	
<b>Performance measurement for pig production by the use of the Balanced Scorecard</b> .....	<b>332</b>
<i>Margit Paustian, Tanja Mucke and Ludwig Theuvsen</i>	
<b>Are there any differences in efficiency between Czech agricultural holdings managed by male or female farmers?</b> .....	<b>340</b>
<i>Marie Pechrová and Ondřej Šimpach</i>	

<b>Long-term changes in production and structure of Czech agriculture and the devices for modelling of future development of these .....</b>	<b>347</b>
Marie Prášilová and Radka Procházková	
<b>The calculation of the minimum area of agricultural land required to self-sufficiency of average Slovak farm family .....</b>	<b>354</b>
Patrik Rovný, Dušan Dobák and Zuzana Čierna	
<b>Are V4 countries competitive in production of main oil-bearing crops in the perspective of production self-sufficiency and foreign trade development? ....</b>	<b>363</b>
Josef Slaboch and Pavel Kotyza	
<b>Agricultural market of post-Soviet countries and its comparison with selected group of countries .....</b>	<b>376</b>
Luboš Smutka, Irena Benešová, Adriana Laputková	
<b>The Czech agrarian foreign trade – ten years after the EU accession .....</b>	<b>385</b>
Luboš Smutka, Michal Steininger, Mansoor Maitah, Ondřej Škubna	
<b>Economic Effectiveness of Agricultural Holdings in the Czech Republic .....</b>	<b>393</b>
Jana Steklá, Jaroslav Homolka and Karel Malec	
<b>Open data and rural development .....</b>	<b>399</b>
Michal Stočes, Petr Benda and Miloš Ulman	
<b>Changes in the Assessment of Conditions of Living in Regions of the Czech Republic ..</b>	<b>407</b>
Libuše Svatošová and Jitka Svobodová	
<b>Pilot analysis of key factors in honey consumption .....</b>	<b>416</b>
Petra Šánová, Jindřich Nový, Jitka Svobodová and Petra Šeráková	
<b>ICT Influence on Supporting Agribusiness Development .....</b>	<b>425</b>
Edita Šilerová, Klára Hennyeyová, Tereza Vogeltanzová and Pavel Junek	
<b>Increase in work efficiency with information sources in areas of agriculture and rural development using UX .....</b>	<b>433</b>
Pavel Šimek, Jan Pavlík and Jan Jarolímek	
<b>Mobile accessibility of information sources in the areas of agriculture, forestry, water management, food industry and rural development .....</b>	<b>440</b>
Pavel Šimek, Michal Stočes, Jiří Vaněk and Jan Masner	
<b>Projection of Czech agricultural workers' gender structure .....</b>	<b>447</b>
Ondřej Šimpach and Marie Pechrová	

<b>Methodology of usability testing of the next generation of editors for agricultural web portals</b> .....	<b>456</b>
Martina Šmejkalová, Jan Masner and Jan Jarolímek	
<b>Making monopoly profits and price discrimination on food commodity markets</b> .....	<b>463</b>
Karel Šrédľ and Roman Svoboda	
<b>Measuring Agency Costs in Agriculture</b> .....	<b>471</b>
Marián Tóth, Drahoslav Lančarič, Michal Munk, Radovan Savov and Andrea Piterková	
<b>Measuring Risk in Agriculture: The case of Slovakia</b> .....	<b>479</b>
Marián Tóth, Tomáš Rábek, Andrea Piterková and Ivo Fandel	
<b>Current state of the art of ICT and information needs among Czech farms in the context of agribusiness</b> .....	<b>487</b>
Jan Tyrychtr, Miloš Ulman, Václav Vostrovský and Alexandr Vasilenko	
<b>Promoting regional foods as a factor for sustainable development</b> .....	<b>495</b>
Pavla Varvažovská, Martina Jarkovská and Daniela Šálková	
<b>Information Tools of Cost Controlling in Entities of Agricultural Primary Produce in Slovakia</b> .....	<b>502</b>
Ivana Váryová, Alexandra Ferenczi Vaňová, Iveta Košovská and Renáta Krajčírová	
<b>Determinants of crop productivity in Nigeria in the era of agribusiness</b> .....	<b>510</b>
Nahanga Verter	
<b>Possibilities of Talent Development in the Czech Republic</b> .....	<b>519</b>
Lucie Vnoučková, Hana Urbancová and Helena Smolová	
<b>Correctness of open data in the agricultural sector</b> .....	<b>528</b>
Václav Vostrovský, Jan Tyrychtr and Čestmír Halbich	
<b>Solidarity on the example of farmers' pension insurance in Poland</b> .....	<b>536</b>
Damian Walczak and Sylwia Pieńkowska-Kamieniecka	
<b>List of authors</b> .....	<b>545</b>

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