Producer’s organization and digital technologies for farms’ competitiveness

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Abstract
The agricultural sector is characterized by increasing complexity and several factors could have a negative impact on agricultural small and medium-sized enterprises’ (SMEs) competitiveness. There are two way to improve farms competitiveness: dimensional growth, achievable through the horizontal aggregation of producers (POs), and innovation, achievable through Information and Communication Technologies (ICTs). Although several studies have pointed out the positive influence of ICT tools on SMEs performances growth, there is a lack of works concerning the way POs use ICTs web based in order to improve innovativeness and competitiveness of their small farmers. After a preliminary literature review regarding the main drivers for the adoption of ICT and technological innovations in agriculture, an exploratory analysis was performed through a set of in depth interviews to opinion leaders in associated farms of a PO. This qualitative methodological approach aims to investigate the POs contribution in enhancing process or product innovation, improving competitiveness and transferring knowledge, among the associated farms through the use of ICT tools. Findings confirm the main hypothesis on which this study is based upon and are supported by theoretical implications shown in the literature review.

Keywords: Competitiveness, Digital web based technologies, Innovation, Knowledge transfer, Producers Organizations (POs)

JEL Classification: O13, O32, O47

1. Introduction
Over the last years the agriculture sector is achieving higher importance for people health and for countries’ economies. The low productivity represents one of the hardest problem of the agricultural sector which is facing huge challenges and increasing pressures from a plethora of stakeholders (governments, consumers, distribution system, etc.) in order to assure some of the current issues, such as to feed a growing population and guarantee food security, to improve high standards of food quality and healthiness, but also to increase farms competitiveness and to improve farmers’ working conditions (Kale, Rohilla, Meena & Wadkar, 2015; Pignatti, Carli & Canavari, 2015; Bunte, Dijkstra, Groeneveld, Hofstede, Top, van der Vorst & Wolfert, 2009). Therefore, small and medium-sized enterprises (SMEs) compete into this dynamic context in rapid evolution. Agricultural SMEs, which hold the major part of the agricultural production, play a significant role for the domestic economic development and they contribute to local income, employment, exports, and entrepreneurship development (Boohene, Sheridan & Kotey, 2015; Wolfert, Verdouw, Verloop & Beulens, 2010). In such varied and complex sector, the horizontal aggregation of several small players is a strategy to increase farmers’ bargaining power toward large retailers networks, to improve their innovativeness and to enhance their products’ brand awareness among a larger number of potential consumers: that’s the key mission of Producer Organizations (POs). As also defined by the European Commission in 2009, PO aims at providing better market opportunities to its members and at increasing their competitiveness (Petriccione & Sollazzo, 2012). In order to cope with the agri-food sector challenges, another strategic choice and a mandatory step for agricultural development is the
adoption of technological innovations, which present several potentialities in order to improve competitiveness at different phases of the agricultural value chain and to buffer some of the limits to agricultural development. Actually, the implementation of technological innovation could generate income, share tasks and skills, increase productivity, accelerate communication and much more (Pignatti et al., 2015; Zaremohzzabieh, Abu Samah, Muhammad, Omar, Bolong, Hassan & Shaffril, 2015). In the light of this, development of influence of Information and Communication Technology (ICT) on agricultural activities cannot be underestimated and SMEs should consider the use of ICT tools as a significant strategy to improve their competitiveness (Boohene et al., 2015). According to this strategic perspectives, through the use of digital web based technologies, POs should also invest in knowledge dissemination in order to systemically increase the quality of their networks (European Commission [EU], 2009) and to support farmers in sharing skills and experiences. Indeed, ICTs based tools allow to create, store and disseminate this knowledge among the associated farms in a rapid way (Kale et al., 2015).

The aim of the paper is to analyse if and how the POs, by using the digital web based technologies, affect their associated farms’ performances in terms of:

- product/process innovation enhancing,
- competitiveness improvement,
- knowledge transferring and sharing.

1.1 The role of ICT tools in agricultural sector: a review

The adoption of ICT tools by SMEs and its determinants have been deeply investigated in literature (Spinelli, 2016; Pignatti et al., 2015). Several studies have pointed out the positive influence of ICT tools on SMEs performances growth in terms of productivity, profitability, market share and global market accessibility (Boohene et al., 2015).

By definition, ICT is a technology that allows communication and transmission of information, electronic capture and processing (Parliamentary Office of Science & Technology, 2006). It is more than physical software and hardware because it includes electronic technologies, resources and techniques used to acquire, manage and share information and knowledge, and it is useful to develop online resources for effective tasks performance and to simplify sharing of electronic data (Boohene et al., 2015; Zaremohzzabieh et al., 2015). ICT tools are wildly spread into almost every socio-economic activities and they are also employed for rural economic development. Actually, numerous studies reveal that ICT adoption improve productivity and socio-economic development (Boohene et al., 2015; Zaremohzzabieh et al., 2015).

The large set of technological innovations introduced in agricultural sector can be divided in tools and equipment for in-field activities and in information management systems (Pignatti et al., 2015). The use of digital web based technologies could affect agricultural SMEs’ performances in terms of product or process innovation enhancing, competitiveness improvement and knowledge transferring and sharing.

Regarding the enhance in process and/or product innovation, researches on the use of ICTs in the agri-food sector are developed on experiences from agriculture, industry or retail, experiments in living lab or field trial environments, and moved from scientific contributions related to the food sector. Several scholars focus on the different ways of utilizing ICT for the agro-food sector’s needs: precision agriculture in primary production (Pignatti et al., 2015; Stafford, 2007; Zhang, Wang & Wang, 2002) as well as tracking and tracing of food products along the food value chain (Trienekens & van der Vorst, 2006) and the identification of product characteristics through labels and logos for consumer support (Sahota, Haumann, Givens &
Baldwin, 2009) represent the most important research topics in serving the sector’s and consumers’ needs, emerging by the literature review. A discussed topic in the literature regards the constraints that agricultural SMEs find in adopting innovative ICT tools in their processes, due to several reasons, such as level of education, farm size, type of production, income, ease of use, perceived benefits and training (Pignatti et al., 2015; Bewley & Russell, 2010). Nevertheless, technological innovations could provide many benefits and opportunities for improvement in the agricultural sector characterized by some organizational and managerial lacks. Actually at farm level, ICTs can intensify efficiency and productivity, both in terms of performance (e.g. production’s optimization, reduction of costs, etc.) and of working conditions (e.g. automation, digitalization, etc.), they can improve the access into new market segments and production areas and they can also enhance yields and products’ quality and farmers’ revenues, especially in geographical areas where high quality agricultural products are produced (Pignatti et al., 2015). Through the aggregation of farms belonging to the same regional area, POs can create niche networks and communities of practices that could contribute to the economic growth and, more extensively, to the social wellbeing of a region (Wolfert et al., 2010; Wilson, 1996; Jonassen, 1994). Studies on the relationship between ICT and farms’ performances highlight a positive correlation between the use of digital web based technologies and productivity (Bughin, Chui & Manyika, 2012; Bunte et al., 2009; OECD, 2003).

From the perspective of competitiveness improvement, a host of authors highlight how SMEs growth and performance depend on the influence of a range of forces, such as the quality of their management, the tastes of their customers, the government policy, etc. Among these variables, ICT is an highly noted contributor to the farms growth and it has a positive impact on farms profitability. ICT offers huge opportunities to agricultural SMEs and a wide range of possibilities for improving their competitiveness (e.g. access to new market opportunities, direct contacts with suppliers, immediate feedback from consumers, useful information services to general public, etc.); moreover, the ICT adoption boosts farms performance through cost savings (Boohene et al., 2015).

According to the European strategies 2020 and to the rural development policies, SMEs’ smart and sustainable growth is also supported by the knowledge transfer (Reg. (EU) n. 1305/2013, CAP 2014-2020). Knowledge is often considered as a key resource for the farms competitive advantage (Rullani, 2004; Davenport & Prusak, 1998) and its management involves strategies and processes designed to support value creation, to sustain and enhance the capturing, assessment, sharing and creation of organization’s intellectual assets, in order to improve SMEs performance and competitiveness (Boohene et al., 2015). Knowledge management justifies the ICTs adoption for SMEs managing, due to the significant shift from businesses oriented toward the production of goods to businesses oriented toward the production of knowledge. Actually, the ability to create, utilize and develop knowledge based assets influence SMEs success, (Boohene et al., 2015; Bunte et al., 2009). This evolution has a disruptive impact on practices, structures and organizational skills also in the traditional economic sectors. The technology business ecosystem gives a strong impetus to the process of codifying and redefining educational needs (OECD, 1996). Indeed, ICT tools help to transfer knowledge among SMEs members, to support the creation of new knowledge and to enhance internal relationships, communication and collaboration processes (Boohene et al., 2015). The use of ICT tools enhance practices, retain and reuse knowledge and experience in new activities, and share informal knowledge and experience (Toikka, 2007). Then the social technologies increase the possibilities of horizontal growth through a workers organization know how exchange because break down the space-time barrier (Davidson & Goldberg, 2010; Hendriks, 1999). Greater availability and easiness access to knowledge united to possibilities to share and distribute information are today an important factor for SMEs growth and development (Davidson &
Goldberg, 2010; OECD, 1996). The new technologies support collaboration in the organization and between organizations (Bunte et al., 2009). This social aspect (sharing, collaborating, communicating, etc.) of technologies in the companies could rise the interaction among workers and the efficiency of work in term of productivity (Bughin et al, 2012).

While several studies focus on the diverse benefits deriving from the use of ICTs in agricultural sector, there is a lack of works concerning the way POs, in particular, use ICTs web based to transfer and share knowledge to their small farmers in order to improve their innovativeness and competitiveness.

Our research interest is then focused on how the POs use the digital web based technologies to transfer knowledge to farmers and to promote innovation in the agri-food sector. The study discusses how the POs define their contribution in the innovation of processes and products, how do they help the dissemination and the sharing of best practices, how do they improve farms competitiveness.

2. Data and Methods

Since the aim of this study is to investigate the POs contribution in enhancing process or product innovation, improving competitiveness and transferring knowledge, among the associated farms through the use of ICT tools, a preliminary literature review was conducted in order to identifying the main drivers for the adoption of ICT and technological innovations in agriculture. Then, an exploratory analysis was performed through a set of in depth interviews to opinion leaders in associated farms of a PO: this qualitative methodological approach aims to explore associated experiences and opinions in order to shed light on basic or latent mechanisms and interactions related to the use of ICTs in agricultural sector.

The exploratory nature of this study requires a hybrid research designs. Firstly, evidences were provided for defining variables to investigate. Within this research framework, it is hypothesized that PO, by using ICT tools, can help the associated farms in improving their innovation, competitiveness and knowledge levels. In order to investigate the research questions, the questionnaire was structured with 19 questions, some of these were built with binary options, some others were developed to scaling responses; for these latter questions five Likert Scales items have been adopted, using the following Likert rating scales (Allen & Seaman, 2007): Not important at all; Unimportant; Neutral; Important; Most important. The survey was structured in three sections: the first one aims at highlighting the general characteristics of the farms and the role PO plays; the second one seeks to describe the ICT tools used by the farms; the last section aims at investigating the way PO use digital web based technologies in order to enhance product/process innovation, to improve farms competitiveness and to transfer and share knowledge among associated farms.

Data collection was performed throughout online interviews to the associated farms of a PO in Apulia Region (Italy), during the period July - October 2015. Data were ascribed in a Microsoft Excel spreadsheet. Whereupon, using the functional language R (also called GNU S), descriptive statistics analysis were performed.

3. Results and Discussion

Since a preliminary analysis of the agriculture framework, it emerges that Italian agricultural sector is rather well-structured. Following Romania, Italy is the country with the largest number of farms in the European Union. In 2010 (date of the last survey), 1.630.420 farms operate in Italy. In the last decade the number of farms decreased by 32.2%, while the average farm size
increased by 44.4%. This is due to a multi-year concentration process of agricultural land in a significantly reduced number of farms. Actually, approximately the 50% of Italian farms operates in four regions of Southern Italy: Apulia is the region with the highest number of farms (17%), followed by Sicily (13%), Calabria (8%) and Campania (8%). In 2011, the farms’ competitiveness level (added value per employee for every 100 Euro of unit labour costs) is about 130 Euro, recovering over 2010 (Istat, 2011). Despite the great concentration of farms, the agricultural sector of the South of Italy is highly fragmented and it essentially consists of SMEs. Nevertheless forms of associations are widely spreading: Apulia counts 34 cases of Producer Organisations (Istat, 2011).

The case study of this work is a PO in Apulia region in the South of Italy that is one of the first regions nationwide in producing fruit and vegetable, thanks to favourable climatic conditions. The PO, acknowledged in 2012, is one of the largest producers organization in the Apulia region, composed by 40 producers, and it operates in the production area between the north and the south of Bari. More than half of the analyzed companies are cooperatives, which include within them many farms: this makes the subsequent data analyzed even more representative of the situation of the examined territory.

From the survey it emerges that PO is determinant for the associated farms, due to its dedication in allowing the achievement of significant aims, such as the innovation enhancement, the competitiveness improvement and the knowledge sharing. Actually, the associated farms evaluate positively the PO ability to ensure a better access to markets and its support in stabilizing producer price: they consider it a right way to guarantee a greater competitiveness whit respect to their competitors. Associated farms are also quite satisfied of the PO actions related to enhancement in innovation, such as the improvement of products quality. It seems that the training activities are not a strength of the PO supply (Figure 1).

**Figure 1: Farms satisfaction level with respect to PO activities**

![Bar Chart: Farms satisfaction level with respect to PO activities]

Source: Authors’ elaboration

Nevertheless, all respondents participate in periodic training, because they believe that attending training courses can help to improve the company’s competitiveness. Farms attend courses on several theme, such as promotion of product, process and organizational innovation, update of professional profiles, etc. In general these training courses are held in the form of classroom seminars, while companies consider e-learning courses not very effective.
Regarding the ICT tools used by the farms, in general the respondents essentially use the web based technologies to improve their marketing network and to enhance their relationship with customers and suppliers. Sometimes farms also use applications on Smartphone for the best management of company’s activities, like the logistical and the distribution aspects (Figure 2).

**Figure 2: Using purposes of ICT tools**

[Chart showing purposes of ICT tools with bars for Marketing network, Relationship network, Internal communication, Logistic and distribution, and Productivity levels.]

Source: Authors’ elaboration

Lastly the survey investigate how PO, through the use of digital web based tools, help the associated farms in obtaining better business results (Figure 3).

**Figure 3: Business results obtained by the use of ICT tools**

[Bar chart showing business results such as Service level increase, Innovative ability increase, Brand fame increase, Turnover increase, Productivity increase, Product quality increase, Access in new market, Production cycle reduction, Production costs reduction, Logistical costs reduction.]

Source: Authors’ elaboration

The collected answers highlight that PO intervention help to increase the innovative abilities of the associated farms in order to enhance product or process innovation. Moreover, it is important the possibility that the PO offers to have access in new markets: this can help farms to improve their competitiveness.

4. Conclusion

This work provides an exhaustive background regarding the benefits of the adoption of ICTs in agricultural SMEs, associated in a PO.
The agricultural sector is characterized by increasing complexity. Several factors (e.g. quickly change in consumption needs; greater attention to food safety, healthiness and sustainability; growing market power of large retailers networks; etc.) could have a negative impact on agricultural SMEs competitiveness. There are two way to improve farms competitiveness: dimensional growth and innovation. The former is achievable, in the medium term, through the horizontal aggregation of producers (POs); the latter is achievable through the knowledge transfer process, whose greatest potential derives from ICTs web based, which help to share skills and experiences among the producers.

This work outlines the relationships between the PO’s use of ICTs and its associated farms’ performances, in terms of competitiveness, innovativeness and knowledge transferring capacity. Findings confirm the main hypothesis on which this study is based upon and are supported by theoretical implications shown in the literature review.

This exploratory research is ongoing and its findings are far from being final. Further research and analysis in order to corroborate our hypothesis is necessary. The sample of companies could be expanded numerically, but also geographically.

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