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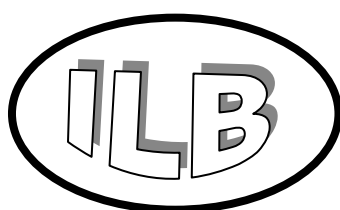
System Dynamics and Innovation in Food Networks 2014

*Proceedings of the 8th International European Forum on System Dynamics and Innovation in
Food Networks, organized by the International Center for Food Chain and Network
Research, University of Bonn, Germany
February 17-21, 2014, Innsbruck-Igls, Austria
officially endorsed by*

*EAAE (European Association of Agricultural Economists)
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CIGR (Intern. Commission of Agric. and Biosystems Engineering)
INFITA (Intern. Network for IT in Agric., Food and the Environment)*

edited by

U. Rickert and G. Schiefer



Innovation through Networking: The Case of the Agricultural Sector

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Abstract

Innovation is widely recognized as being an important strategic tool for companies to increase their competitive advantage. Hereby, networks have become increasingly important as external sources for the necessary knowledge, ideas and financial resources. The main contribution of this paper is to shed light on how different network partners can explain or facilitate the different types of innovations in the agricultural sector. In contrast to other studies, we make a distinction between all four types of innovation: product, process, marketing and organizational innovation. Thus, this study has the objective to gain insight into the innovation process of farmers in terms of how they innovate, which network partners they consult in relation to innovation type, the obstacles they face, and where the network activities could be better aligned with the needs of the farmers, which could help to enable them to optimally support innovation and networking.

The study is based on 36 in-depth interviews with farmers spread over five subsectors in Flanders (northern Belgium).

Our most important findings are that the consulted partners and the observed barriers are different dependent on the innovation type. Hence, our study delivers a set of valuable insights and implications for farmers, network coordinators and policymakers. Farmers must be aware of the importance of partner suitability and network heterogeneity for the innovation type they are aiming at. Furthermore, farmers have to be aware of the fact that efficient networking is not the optimisation of single relationships independently of each other, but instead the management of synergies and coordination of all relationships in an efficient way. In addition, network coordinators should set up a clear strategy and communicate for which innovations their network can advise and help the farmer.

These first conclusions should be further proven and supported by future research in order to draw general conclusions for the agricultural sector. As the sample of our study is limited to 36 respondents spread over five subsectors, it is necessary to conduct a quantitative study to achieve a representable sample and to include more subsectors. In addition, the study is limited to the Flemish region and literature in other countries about this subject is scarce. Hence, other researchers are encouraged to investigate if the results of Flanders can be supported by other regions in Europe and the world.

Keywords: *Farmers; network; innovation; Flanders; qualitative research*

1 Introduction

Nowadays, it is widely recognized that the networks the company is embedded in, have become increasingly important in the innovation process of SMEs (Fearne and Hughes, 1999; Omta, 2002; Pittaway *et al.*, 2004). Over time, major changes have taken place in the relationship between farmers and the whole of agricultural research, extension and education establishments (Klerkx and Leeuwis, 2009). The same authors state that within the agricultural research, new approaches towards innovation have been developed in response to the restrictions of the linear models of innovation, namely agricultural innovation systems (AIS) thinking which has become an increasingly applied framework to better understand innovation (e.g. Hall *et al.*, 2003; Klerkx *et al.*, 2010; Morris *et al.*, 2006; Spielman *et al.*, 2008). In these innovation system approaches, innovation is considered the result of a process of networking and interactive learning among a heterogeneous set of actors, such as farmers, input industries, processors, traders, researchers, extensionists, government officials, and civil society organizations (Hall *et al.*, 2006; Leeuwis, 2004; Röling, 2009). A *network* is defined as a set of relations through which the company acquires, assimilates, transforms and exploits knowledge, thus serving as the medium for the combined transformation of the company's internal and external resources into an innovation

(Cowan and Jonard, 2004; Omta, 2004; Zahra and George, 2002). Furthermore, we define *innovation* as an on-going process of learning, searching and exploring, resulting in new products, new processes, new forms of marketing and organization (Lundvall, 1995). Thereby, product innovation is defined as the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses; process innovation as the implementation of a new or significantly improved production or delivery method; marketing innovation as the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing; and finally organisational innovation as the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations (OECD, 2005).

Literature has already analysed the effect of different network partners on the success of innovations. For instance, vertical collaboration allows a firm to gain considerable knowledge about new technologies, markets and process improvements (Whitley, 2002). Listening to suppliers and clients should deliver innovation results more quickly (Nieto and Santamaria, 2007). Tether (2002) also found that collaboration with clients enables a firm to develop or improve products. Collaboration with clients could be beneficial to reduce lead times and risks of new product development, while enhancing flexibility, product quality and market adaptability (Chung and Kim, 2003). With regards to horizontal collaboration, competitors are likely to be contacted to share common problems that are outside the competitor's area of influence – for instance a regulatory change (Tether, 2002). With respect to research organisations and universities, several studies have shown their importance for technological innovations (Bozeman, 2000; Vuola and Hameri, 2006). Others highlight them as most effective partner to achieve innovations intended to open new markets and segments (Belberbos *et al.*, 2004).

Studies investigating the appropriateness of network partners in relation to different innovation types are scarce and need far more research attention (de Man and Duysters, 2005; Howells *et al.*, 2004; Pittaway *et al.*, 2004). Most of the existing studies focus much more on technological process innovations and product innovations than on non-technological and intangible ones, i.e. marketing and organizational innovations. However, there are strong reasons to use a comprehensive innovation concept and give more attention to non-technological and intangible kinds of innovations (Edquist, 2006; Pittaway *et al.*, 2004; van Galen and Verstegen, 2008). Additionally, the insights obtained in this area are based on high-tech companies functioning with R&D units. The agribusiness sector forms thus a promising case study, being considered as a low-tech sector (CIAA, 2009; Gellynck *et al.*, 2007; Kirner *et al.*, 2009; Lagnevik *et al.*, 2004), to contribute to the above identified gaps in the literature.

1.1 Barriers for networking

Although networks are considered a relevant means for innovation, empirical studies show that farmers' participation in networks is often limited (Deimel and Theuvsen, 2011). Possible explanations are related to the difficulties experienced by small and medium enterprises (SMEs) with regards to networking as found in literature (De Groot, 2003; Hoffmann and Schlosser, 2001; Kaufmann and Tödtling, 2002; Senker and Faulkner, 2001; Van Gils and Zwart, 2004). SMEs are rarely interacting with universities, research organizations, technology centres, and training institutions (Cooke *et al.*, 2000; Kaufmann *et al.*, 2002). An important reason for the lack of relations with innovation partners outside the business sector is the small number of employees in SMEs who are able to act as nodes establishing and maintaining links to innovation networks. This restricts the potential to search for and collect innovation-related information and to collaborate in cooperative innovation projects. In the case of the few adequately qualified persons working in SMEs, they face a lack of time due to routine and administrative work. Furthermore, SMEs focus more on the region than large firms as far as external relations in the innovation process are concerned (Gellynck *et al.*, 2007; Kaufmann *et al.*, 2002). A too dominant focus on the region, however, limits the scope of available technical information, technologies, and accessible markets. This also includes the lack of adequate innovation partners to cooperate. Moreover, it seems that SMEs often experience difficulties in defining and expressing their demands to get information that meets their requirements (Klerkx and Leeuwis, 2008). On the opposite, the providers of knowledge have to be responsive to clients' needs, i.e. they have to be 'demand driven' (Byerlee *et al.*, 2002; Katz and Barandun, 2002). However, researchers are often unaware of SMEs' innovation needs (Caputo *et al.*, 2002; Pannekoek *et al.*, 2005). 'Cognitive distance' between the different actors involved may cause coordination and learning problems during innovation processes (Nooteboom, 2000), and different norms and expectations with regard

to desired output exist (AWT, 2005; Beesley, 2003). Although these obstacles are found for networking for SME's in general, little literature focuses on the agricultural and horticultural sectors in particular.

1.2 Resource based view

The literature on resource based view shows that, in terms of innovation inputs, firms will look to partners to provide the resources and capabilities they lack, maximizing firm value by effectively combining the partners' resources and exploiting complementarities (Gulati, 1995; Kogut, 1988). Collaboration with a firm possessing complementary and relevant resources is much more efficient and fruitful. Literature has already analysed the effect of different network partners on the success of innovations. For instance, vertical collaboration allows a firm to gain considerable knowledge about new technologies, markets and process improvements (Whitley, 2002). Listening to suppliers and clients, at early stages of product development should deliver innovation results more quickly (Nieto *et al.*, 2007). Tether (2002) also found that collaboration with clients enables a firm to develop or improve products. Collaboration with clients could be beneficial to reduce lead times and risks of new product development, while enhancing flexibility, product quality and market adaptability (Chung *et al.*, 2003). Competitors are likely to be contacted to share common problems that are outside the competitor's area of influence – for instance a regulatory change (Tether, 2002). With respect to research organisations and universities, several studies have shown their importance for technological innovations (Bozeman, 2000; Vuola *et al.*, 2006). Others highlight them as most effective partner to achieve innovations intended to open new markets and segments (Belberbos *et al.*, 2004).

1.3 Objectives

Within our study, the objective is to gain insight into the innovation process of farmers in terms of how they innovate, which network partners they consult in relation to innovation type, the obstacles they face, and where the network activities could be better aligned with the needs of the farmers, which could help to maintain and improve network participation within the agricultural sector. Hence, our study will deliver valuable insights and implications for farmers, network coordinators and policymakers, to enable them to optimally support innovation and networking.

The paper is structured as follows: The next section describes the research method used. In section 3, an analysis and discussion of the main findings is given, followed by a conclusion and implication session, including missing themes and potential future research areas.

2 Method

The research strategy is a case-study design. Data were gathered through semi-structured in-depth interviews with farmers (owners and managers of the farms) in Flanders (Northern Belgium). They were asked open ended questions with regard to their innovation. Besides, data were collected on other attributes of the farmer (age, education, years in farming) and the farm (future expected development, total operated acres, number of animals etc.).

In this paper, five subsectors were studied: organic farming (3), poultry (10), fruit (2), vegetable (8) and ornamental plant cultivation (13) (See Annex 1). In total, 36 interviews were conducted. Respondents were selected via sector organizations, research institutes or via the other responding farmers. No incentives were made for participation. Farmers were contacted by telephone to arrange an appointment for a personal interview. During several non-consecutive months in 2011, 2012 and 2013, the interviews were conducted at the farm by the author (EL), requiring one to two hours per respondent. All interviews were recorded and transcribed by the interviewer. The data were sorted and coded using NVIVO. The innovations implemented were categorized in product, process, marketing or organizational innovations. Second, obstacles were coded 'obstacles' and third the possible partners were coded colleagues, suppliers, buyers and research institutes. Via queries, all the text related to a specific type of innovation could be provided. By making use of matrix coding queries, we found which network partners and obstacles belong to which type of innovation.

3 Results and discussion

For each type of innovation, we mention the importance in our sample, and in the different studied subsectors (See Annex 1). Hereby, it is important to mention that some cases show characteristics of different types of

innovation. For example a company that introduces a new product, often needs to redevelop the process, or the introduction of a new process can lead to a new organizational method. Hence, some innovations are classified under two categories and are thus counted twice. Furthermore, some farmers also introduced several innovations, which let us include their experience with different innovation processes.

Next, some examples of innovations implemented are given, followed by the different consulted network partners, and observed obstacles for networking and innovation. These findings are compared with findings from other studies. In table 1 and 2, a summary of the results is shown, indicating respectively the consulted network partners per type of innovation, and the observed obstacles per type of innovation.

Product innovations were the second most important category of innovations in our study (16). This is also found in the study of Deuninck et al. (2008). In our study, the product innovations were most important for the fruit sector and ornamental plant cultivation (See Annex 1). Five of the new products were new for the company, but not for the market. Examples are a change-over from the breeding of indoor plants to outdoor plants, from tomatoes to chrysanthemums and from turkeys to layer hens. The other products were not only new for the company, but also for the market. Examples are the introduction and breeding of foreign products for the Belgian market or the development of new products or product varieties within the company itself, often in collaboration with research institutes. This collaboration with research institutes can be with an individual farmer, but is also often with a producer organisation. This is also found by several other studies (for an overview see: Stewart-Knox and Mitchell, 2003), but this kind of collaboration seems to be difficult in practice. Gathering market information in order that new market niches can be located for new product areas prior to product development may reduce the risk of product failure and enhance chances of product success (Stewart-Knox *et al.*, 2003). The gathering of market information can be facilitated by networking. In the agricultural sector, an auction is often an example of an intermediary between the consumers and producers that explores the consumer demand and informs its members about this. In case no auction is involved, direct contact between farmer and consumer is important. Fritsch and Lukas (2001) also state that innovative efforts targeted at achieving product innovations are associated with customer collaboration. There is strong evidence that getting more market information from customers and, in some cases, direct involvement between buyers and firms leads to more successful new product development (Atuahene-Gima, 1995; Souder *et al.*, 1997).

Important influencing players in the changeover to other product varieties, especially in the plant cultivation, are the suppliers of young plants. They develop plants according to the needs of end-consumers, do a pilot test within the company and try to find farmers who are willing to grow the plants on a larger scale. According to literature, collaboration with suppliers enables a firm to reduce the risks and lead times of product development, while enhancing flexibility, product quality and market adaptability (Chung *et al.*, 2003).

In five of the studied cases, co-financing of the Flemish government was obtained for the development of new products, which is highly appreciated within the sector. This is in kind of co-financing in research projects coordinated by research institutes.

Important barriers faced by farmers introducing new products are that it is initially often difficult to find the right partners to collaborate with, that knowledge about the production process is limited, and that it often takes some time to make consumers aware of the existence of new products and to convince them to use them. Another aspect mentioned is that a lot of knowledge is available in research institutes, but that there is a lack of communication and practical applications.

Process innovation is the most common type of innovation in our sample. In this study, more than half of the respondents (21) introduced a process innovation. This type of innovations was mostly implemented by poultry and vegetable farmers (see Annex 1). In the study of Deuninck et al. (2008), even 71% of the studied innovations were process innovations. Examples are the installation of solar panels, cogeneration engine, heat recuperator, new technical solutions to improve quality, automatisations, new fertilization techniques or changes with ergonomic reasons.

The most important network partners for those innovations are installers of systems and colleagues who are mostly active in the same subsector. An important contact point are the agricultural exhibitions. There farmers can have a look at installations. In addition, they have the possibility to contact the different suppliers of production systems and to compare their offers. The importance of suppliers for process innovations was also found in other studies (e.g. Gemünden *et al.*, 1996; Miotti and Sachwald, 2003; Whitley, 2002). Suppliers actively bring new ideas or provide equipment to the farms to develop better production facilities, reduce production costs or decrease processing time. With colleagues, farmers can exchange experiences or visit their company to have a look at the system in action. The organisation of an open day is currently frequently done, especially in the poultry sector. Farmers are proud to present their new stable or equipment to colleague-farmers, and they, at their turn, seize the opportunity to have a look at the newest techniques, to network, and to exchange knowledge and experiences. With regard to the chance of success, a lot of farmers wait till the improved processes have proven their effectiveness. They do not want to face the disadvantages of being the first mover.

The majority of the process innovations are partly funded by a bank loan, sometimes accompanied by subsidies of the Flemish agricultural investment fund. Almost all the investments in the poultry sector were process innovations. This subsector, where huge amounts of money are required for the building or rebuilding of stables, experiences most difficulties to fund the investments. Banks are rather reluctant to lend money to them, except if they have enough own capital, in the studied cases around 30%. Most of the farmers are not wealthy enough to do this. The only alternative they have is to make up a contract with a hatchery, feed supplier or egg merchant as a guarantee for the bank, which almost always leads to less earnings. In this way, the contractor guarantees an income for the farmer for several years. Logically, this is not for free as the contractor incorporates the market risk instead of the farmer. For process innovations in the other sectors, respondents did not complain about difficulties to obtain a bank loan, but they mentioned that for young starters, it is not easy.

A common problem in the Flemish agricultural sector is that, although contacts with colleague-farmers are mentioned as very important, the sector is characterized by actors who are not willing to communicate openly and honestly with each other. Other problems faced are in the area of permits, regulations and legislations. The requirements of governmental institutions become increasingly stringent. Besides, the society adopts an increasingly critical attitude toward farmers and can stop the progress of innovative projects if they are perceived as hindering, e.g. smell or noise nuisance. Other issues mentioned are the inconsistency and continuous changes over time in regulations and the difficulty to obtain objective information, the latter especially in the poultry sector.

In the category of marketing innovations, ten cases were observed of which eight were implemented in the ornamental plant cultivation, one in the organic farming and one in the vegetable sector (see Annex 1). These innovations range from the launch of a website or even web shop, over a new promotional method in which colleagues collaborate to promote their products via a joint label instead of maintaining individual distinguishing capabilities, to the development of a new product design in collaboration with customers and consumers.

Marketing innovation seems to be a process which requires continuous contact with colleagues, wholesalers and consumers. This is in line with findings in literature, showing that buyers can usefully support innovators through identifying market opportunities and likely market potential (Pittaway *et al.*, 2004). By studying other literature, we see that the importance of lead customers in helping to define innovations and, therefore, reduce the risk associated with market introduction, has been recognised since at least the 1970s (Gardiner and Rothwell, 1985; Kline and Rosenberg, 1986; Quinn, 1985; Rothwell, 1977; Von Hippel, 1978; Von Hippel, 1988).

For farmers producing end-products and thus delivering their products directly to end consumers, it is much more easy to respond to the market needs because they have direct contact with them. Farmers not delivering to end-consumers mention that this is often a restriction for marketing innovation as they cannot distinguish themselves with labels, packages etc. as in the former case. This can be due to several reasons, such as membership in a cooperation or auction, the lack of skilled labour, and a knowledge lack in marketing techniques. For farmers delivering their products to a cooperative or auction, it is impossible to have direct contact with the end-consumers. Here, the cooperative plays an intermediary role. Besides, when being member of the cooperative, it is very hard to distinguish your products from others by developing a new product design, label, package, etc. as the majority of the products are sold in batches together with the products of the other farmers. Some farmers mentioned that they really want to differentiate themselves to earn more money by going value-added, reaching for new markets where the number of competitors is smaller and the customers are less price sensitive and more attracted by various product attributes. They are looking for possibilities within the cooperative, but this seems to be tough. This is confirmed by Nilsson (1999) and Diederer *et al.* (2000) who state that a traditional co-operative has good prospects to be successful when it comes to applying a cost-leadership strategy, while problems are due to become serious if it tries to follow one of the other strategic classes that Michael Porter (1980) proposes, i.e. the differentiation or focus strategy. In addition, the implementation of marketing innovation such as the introduction of different types and sizes of packages requires people who are able to operate the packaging machines. As most of the employees in the agricultural sector are seasonal labourers who only stay for a while, it is difficult to build up the required experience to do this. Hence, there is a lack of skilled labour for the majority of the Belgian farms which are structured in this way. Next to that, farmers mentioned that it is often difficult to obtain knowledge about marketing techniques. In the case the farmers have direct contact with the buyers, they can visit them to ask if they perceive changes in the market, if they find everything what they want in the assortment or if they face problems with certain products in order to be able to carry out the necessary changes.

However, despite the important role of packages and labels in buying behaviour of consumers (De Pelsmaeker and Janssens, 2007; Deliya and Phamar, 2012) a lot of farmers are not aware of that. They often think that it is enough to produce quality products and do not care about the presentation of them. According to the respondents, most of the farmers, especially older farmers, are not open for e.g. new product design, new packaging or a new label. They prefer to continue their work as they are used to, namely raising high-qualitative plants without paying attention to their marketing. Even when their suppliers try to stimulate their creativity, they are not interested. Claes (2006) confirms this finding that some farmers are rather reluctant to change.

One of the obstacles related to marketing innovation is that the development of the collaborative initiatives for promotion often takes a lot of time. One of the initiatives was even never launched because the members – producers of the same kind of product – in the end preferred to promote their own firm instead of the product in general. In another example, in which producers of a big variety of plants are present, some farmers were willing to join the group, but the initiators refused them because other members of the group already market the same products and competition within the group was expected to have a negative impact on the collaboration.

Organizational innovation, eight cases with organisational innovation were observed. Out of the eight cases, five were situated in the ornamental plant cultivation, one in the organic farming, one in the vegetable sector and another one in the poultry sector (see Annex 1). The innovations range from a new legal structure of the company, the renewal of the infrastructure and hence the reorganisation on the work floor, new collaboration for logistic reasons, for promotion and for the development of new product varieties, to the transition from traditional farming to organic farming.

In the cases studied, we see that prior to the implementation of the organizational innovation, the farmer has a lot of contacts with a heterogeneous group of people from within as well as from outside the agricultural sector. Contacts with people from outside the agricultural sector seem to be very important in organizational innovations. Furthermore, next to the traditional networks in the agricultural sector, cross-sectoral networks such as business clubs where employers of different sectors can meet each other play a significant role in this type of innovation. Those contacts and conversations are perceived fruitful and inspiring for issues related to generic business and management such as marketing, financial and business planning, which are frequently better developed in other sectors than in the agricultural sector (Bamberg *et al.*, 1997). These authors found that farmers gain skills in financial analysis and computing from off-farm workplaces and from attending short courses. Other sources of learning for generic business management were mainly expert advisors such as accountants.

Besides, an aspect typical for organizational innovation is that the period between the initiation and the development often takes several years and thus takes longer than for the other three innovation types. For our cases it took on average about five years between the first idea and the development. As organizational innovation concerns several domains of the company, a lot of decisions have to be made. For this reason, it is very important to have the required knowledge with respect to the different domains. People having a lot of contacts within and outside the agricultural sector, have a larger knowledge base. Pittaway *et al.* (2004) also found that more complex innovations benefit from engagement with a diverse range of partners which allows for the integration of different knowledge bases, behaviours and habits of thought.

Obstacles faced by some of the respondents introducing organizational innovations were to get into contact with people from outside the sector. Another problem perceived by some of the respondents is that there is only limited knowledge necessary for organizational innovation available in Belgium and that they have to deliver a lot of input themselves. Further, farmers would appreciate if more knowledge about management techniques and the creation of vision would be available. Besides, a better financial and logistic support of supply control and collaboration initiatives is much sought after.

Table 1.
Network partners per type of innovation

Product	Process	Marketing	Organizational
<ul style="list-style-type: none"> • Buyers • Suppliers (of young plants) • Research institutes 	<ul style="list-style-type: none"> • Colleagues • Suppliers (infrastructure) • Research institutes 	<ul style="list-style-type: none"> • Colleagues • Buyers (wholesaler/consumer) 	<ul style="list-style-type: none"> • Frequent contact with heterogeneous group of partner (inside & outside sector)

Table 2.
Observed obstacles per type of innovation

Product	Process	Marketing	Organizational
<ul style="list-style-type: none"> • Finding right partner • Knowledge is limited • Time consuming • Lack of communication of research results 	<ul style="list-style-type: none"> • Colleagues not willing to communicate openly and honestly • Difficulty to obtain objective information • Laws and regulations 	<ul style="list-style-type: none"> • No direct contact with end-consumers => difficult to distinguish via labels, packages etc. • Farmers not aware of importance of packages and labels • Fear of losing own identity when collaborating 	<ul style="list-style-type: none"> • Get into contact with people from outside sector • Limited knowledge about management techniques and creation of vision • Need for better financial and logistic support of supply control and collaboration initiatives

4 Conclusions and implications

This paper provides first insights into how farmers innovate, which network partners they consult in relation to innovation type, where they face obstacles and where the network activities could be better aligned with the needs of the farmers, which could help to maintain and improve network participation within the agricultural sector. This study is among the first in this field of research focusing on a low tech industry. Besides, in contrast to the majority of the innovation studies focusing on technological innovation (van Galen *et al.*, 2008), this study focuses on the four different types of innovation, i.e. product, process, marketing and organizational innovations. Our study applies the resource-based view (Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984) as a background. On a general level, our findings provide support for the basic tenet of the resource-based view that, in terms of innovation inputs, firms will look for partners to provide the resources and capabilities they lack, and maximizing firm value by effectively combining the partners' resources and exploiting complementarities.

In conclusion, we found that a different approach for the different types of innovation is needed as the network partners differ quite strongly dependent on the innovation types. This paper further contributes to the literature by identifying obstacles and success factors typical for SMEs active in the agricultural sector willing to innovate. Furthermore, while existing literature concerning the network partner interaction for innovations provides some general statements, our study yields more specific insights. By mapping the consulted partners for each innovation type, we found that they differ depending on innovation type. These findings are in line with the postulation of (Gruner and Homburg, 2000) that the impact of collaboration on innovation success varies for different innovation aims. Hence, farmers must be aware of the importance of partner suitability and network heterogeneity for the innovation type they are aiming at.

In the following section, we provide managerial implications based on these conclusions.

4.1 Managerial implications

In general it is recommended to make sources of information and educative activities easily accessible for farmers, because participation in organised education and training assists in the establishments of the farmer's networks for knowledge exchange and innovation. Hence, farmers need to experience successful education and training outcomes in order to motivate them to undertake further education and training (Kilpatrick, 1996). It is recommended to organize attractive meetings with different short topics to the point and focused to a specific audience. Hereby, practical and understandable knowledge is preferred above theoretical explanations (Kühne *et al.*, 2012).

With regard to the difficulties of funding, especially for process innovations in the poultry sector, it would be recommended to set up networks facilitating access to financial resources such as business angel networks. Co-investment of business angel firms in entrepreneurial businesses has been shown to provide better quality and larger funds for the entrepreneurial business (Pittaway *et al.*, 2004). Besides, the links between investors therefore provide an important networking infrastructure for the commercialization of innovation (Florida and Kenney, 1998). In some countries, such forums are already set up within the agricultural sector with the aim to provide a platform to link business angels with participants having commercially viable ideas.

Furthermore, farmers have to be aware of the fact that efficient networking is not the optimisation of single relationships independently of each other, but instead the management of synergies and coordination of all relationships in an efficient way (Gemünden *et al.*, 1996). In addition, network coordinators should set up a clear strategy and communicate for which types of innovation their network can advise and help the farmer.

As there are small differences between the five studied subsectors w.r.t. the network partners used, the different sectors could learn from each other and improve their innovation capacity through cross-sectoral networking, in particular for market and organizational innovation.

With regards to the four different type of innovation, following managerial implications are formulated:

For product innovations, this study reveals that farmers hardly have contact with the end-users of their products, despite its importance for product and market innovations. Some of the interviewed farmers are aware of this fact but say that it is difficult to come into contact with them, while others don't care about this. Hence, it is important to first awake farmers to the importance of contact with end-users, and second, to facilitate contact between farmers and end-users. Another issue is that research institutes should support sufficiently the cultivation of new products. If farmers want to experiment with new products, research

institutes should be able to help them in this process and align their activities with the present needs for knowledge among farmers.

For process innovations on their part, farmers declare that laws and regulations often form a barrier. Complaints are about requirements of governmental institutions becoming increasingly stringent, about inconsistency in the regulations and quick changes over time. Hence, for farmers together with network coordinators such as consultants, it is advisable to check systematically the laws and regulations to be taken into account. Policy makers on their turn should aim for a simplification of laws and regulations and judge the possible consequences for innovation and the development of the farm. Next to that, policymakers could try to affect a cultural shift among farmers. Up to now, this population is characterized by individualistic personalities. Farmers should be stimulated to become more open toward each other and to see the advantages of collaboration. From the results, it is clear that once farmers possess the necessary contacts and knowledge for their innovation, the process mostly passes off smoothly. As farmers introducing process innovations often wait to implement the innovation till they have enough information and certainty about the effectiveness, publicly funded research institutes could help to point out effectiveness in order that farmers are faster willing to introduce the innovation.

As already mentioned under product innovation, also for marketing innovations, contact with end-consumers is important. As farmers have insufficient contact with them, it is difficult for them to know the end-consumer's needs. Packages and labels for example play an important role in the buying behaviour of consumers (De Pelsmaeker *et al.*, 2007; Deliya *et al.*, 2012), but a lot of farmers are not aware of that. They often think that it is enough to produce qualitative products and do not care about the presentation of them. For the majority of the farmers, the organization and facilitation of accessibility to marketing training courses is an important issue. Farmers should become sufficiently aware of the importance of marketing activities and be able to take advantages of it. For farmers delivering their products for example to an auction, the aspect and awareness of marketing techniques is less important up to now. However, they often face another hindrance in this domain, namely that auctions are experienced as a barrier for a differentiation strategy. Hence, farmers should try to collaborate for the set-up of a private initiative that enables them to realize added value for their products, possibly aside from the auction.

Concerning organizational innovations, contact with a lot of different partners is important to gather sufficient information in order to define the best implementation strategy. Hence, the exchange and development of ideas on farms should be stimulated and supported. This can be done through the stimulation of farmers to gather knowledge in other sectors than the agricultural sector and to shift to less common information channels. The formation of these contacts should be supported by network coordinators organizing appropriate activities on which people from different sectors are invited and collaboration is encouraged. Hereby, attention for innovation beyond the technological environment should be promoted.

4.2 *Missing themes and future research*

The sample of this study is limited to 36 respondents spread over five subsectors.

In order to draw conclusions for the agricultural sector in general it is necessary to conduct a quantitative study to achieve a representable sample and to include more subsectors. In addition, the study is limited to the Flemish region and literature in other countries about this subject is scarce. Hence, other researchers are encouraged to investigate if the results of Flanders can be supported by other regions in Europe and the world.

Acknowledgements

The authors would like to thank the farmers who spent time to participate in the interviews and also those who were instrumental in gaining contacts with them. Last but not least, we want to thank the Flemish Agency for Innovation by Science and Technology (IWT 090918) for providing us the possibility to conduct this research.

References

- Atuahene-Gima, K. 1995. An exploratory analysis of the impact of market orientation on new product performance. *Journal of Product Innovation Management* 12: 275-293.
- AWT. 2005. Innovatie zonder Inventie. Technologiebeleid, A. v. h. W.-e. The Hague, The Netherlands.
- Bamberry, G., T. Dunn and A. Lamont. 1997. A pilot study of the relationship between farmer education and good farm management. Barton, Rural Industries Research and Development Corporation.
- Beesley, L. G. A. 2003. Science policy in changing times: are governments poised to take full advantage of an institution in transition? *ResearchPolicy* 32(8): 1519-1531.
- Belberbos, R., M. Carree, B. Diederer, B. Lokshin and R. Veugelers 2004. Heterogeneity in R&D co-operation strategies. *International Journal of Industrial Organization* 22: 1237-1263.
- Borgatti, S. P. and C. F. Foster 2003. The network paradigm in organizational research: A review and typology. *Journal of Management* 29(6): 991-1013.
- Bozeman, B. 2000. Technology transfer and public policy: a review of research and theory. *Research Policy* 29(4-5): 627-655.
- Byerlee, D., G. Alex and R. G. Echeverría. 2002. The evolution of public research systems in developing countries: facing new challenges. IN: Byerlee, D. and R. G. Echeverría. *Agricultural Research Policy in an Era of Privatization*. Wallingford, CABI Publishing.
- Caputo, A. C., F. Cucchiella, L. Fratocchi, P. M. Pelagagge and F. Scacchia 2002. A methodological framework for innovation transfer to SMEs. *Industrial Management & Data Systems* 102(5): 271-283.
- Chung, S. and G. M. Kim 2003. Performance effects of partnership between manufacturers and suppliers for new product development: the supplier's standpoint. *Research Policy* 32: 587-603.
- CIAA. 2009. Data & Trends of the European Food and Drink Industry. Brussels, Belgium, Confederation of the food and drink industries of the EU (CIAA).
- Claes, D. 2006. Het belang van trends in de sierteelt. Geel, Katholieke Hogeschool Kempen.
- Cooke, P., P. Boekholt and F. Tödtling. 2000. The Governance of Innovation in Europe: Regional Perspectives on Global Competitiveness. London, Pinter.
- De Groot, S. A. 2003. Van OVO naar VOV: nieuwe institutionele arrangementen voor kennisverwerving en -ontwikkeling van agrarisch ondernemers. The Hague, The Netherlands, LEI.
- de Man, A.-P. and G. Duysters 2005. Collaboration and innovation: a review of the effects of mergers, acquisitions and alliances on innovation. *Technovation* 25(12): 1377-1387.
- De Pelsmaeker, P. and W. Janssens 2007. A Model for Fair Trade Buying Behaviour: The role of Perceived Quantity and Quality of Information and Product-specific Attitudes. *Journal of Business Ethics*(75): 361-380.
- Deimel, M. and L. Theuvsen 2011. Networking in Meat Production Systems: The Influence of Cooperative Structures on Farmers' Participation. *International Journal on Food System Dynamics* 2(1): 23-35.
- Deliya, M. M. and B. J. Phamar 2012. Role of Packaging on Consumer Buying Behavior - Patan District. *Global Journal of Management and Business Research* 12(10).
- Deuninck, J., K. Carels, D. Van Gijsegheem and I. Piessens. 2008. Innovatie in land- en tuinbouw in Vlaanderen: resultaten van het Landbouwmonitoringnetwerk. Brussel, Beleidsdomein Landbouw en Visserij: 47.
- Diederer, P., H. van Meijl and A. Wolters. 2000. Eureka! Innovatieprocessen en innovatiebeleid in de land- en tuinbouw. Den Haag, LEI.
- Edquist, C. 2006. Systems of innovation: perspectives and challenges. IN: Fagerberg, J., D. C. Mowery and R. R. Nelson. *The Oxford Handbook of Innovation*. Oxford, Oxford University Press, USA: 680.
- Fearne, A. and D. Hughes 1999. Success Factors in the Fresh Produce Supply Chain: Insights from the UK. *Supply Chain Management* 4(3): 120-128.

- Florida, R. L. and M. Kenney 1998. Venture Capital, High Technology and Regional Development. *Regional Studies* 22: 33-48.
- Fritsch, M. and R. Lukas 2001. Who co-operates on R&D? *Research Policy* 30: 297-312.
- Gardiner, P. and R. Rothwell 1985. Tough customers: good designs. *Design Studies* 6 (1).
- Gellynck, X., B. Vermeire and J. Viaene 2007. Innovation in food firms: Contribution of regional networks within the international business context. *Entrepreneurship & Regional Development* 19(3): 209-226.
- Gemünden, H. G., T. Ritter and P. Heydebreck 1996. Network configuration and innovation success: An empirical analysis in German high-tech industries. *International Journal of Research in Marketing* 13(5): 449-462.
- Granovetter, M. 1973. The strength of weak ties. *American Journal of Sociology* 78: 1360 - 1380.
- Gruner, K. E. and C. Homburg 2000. Does customer interaction enhance new product success? *Journal of Business Research* 49: 1-14.
- Hall, A., W. Janssen, E. Pehu and R. Rajalahti. 2006. Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems. Washington DC., World Bank.
- Hall, A., R. V. Sulaiman, N. Clark and B. Yoganand 2003. From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research. *Agricultural Systems* 78: 213-241.
- Hamdouch, A. 2010. Conceptualising Innovation Networks and Clusters. IN: Laperche, B., P. Sommers and D. Uzundis. *Innovation networks and clusters: The knowledge backbone*. Brussels, P.I.E. Peter Lang S.A.
- Hoffmann, W. H. and R. Schlosser 2001. Success factors of strategic alliances in small and medium-sized enterprises - An empirical survey. *Long range planning* 34(357-81).
- Howells, J., A. D. James and K. Malik 2004. Sourcing external knowledge: a decision support framework for firms. *International Journal of Technology Management* 9(4): 143-154.
- Katz, E. and A. Barandun. 2002. Innovative Approaches to Financing Extension for Agriculture and Natural Resource Management. LBL Swiss Centre for Agricultural Extension. Lindau, Switzerland.
- Kaufmann, A. and F. Tödtling 2002. How effective is innovation support for SME's? An analysis of the region of upper Austria. *Technovation* 22(3): 147-159.
- Kilpatrick, S. 1996. Change, training and farm profitability. Canberra, National Farmers' Federation.
- Kirner, E., S. Kinkel and A. Jaeger 2009. Innovation paths and the innovation performance of low-technology firms - An empirical analysis of German industry. *Research Policy* 38(3): 447-458.
- Klerkx, L., N. Aerts and C. Leeuwis 2010. Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems* 103: 390-400.
- Klerkx, L. and C. Leeuwis 2008. Matching demand and supply in the agricultural knowledge infrastructure: Experiences with innovation intermediaries. *Food Policy* 33(260-276).
- Klerkx, L. and C. Leeuwis 2009. Operationalizing Demand-Driven Agricultural Research: Institutional Influences in a Public and Private System of Research Planning in The Netherlands. *Journal of Agricultural Education and Extension* 15(2): 161-175.
- Kline, S. J. and N. Rosenberg. 1986. Chain-linked model of innovation. IN: Landau, R. and N. Rosenberg. *An Overview of Innovation: The Positive Sum Strategy*. Washington, DC, US, National Academy Press.
- Kühne, B., E. Lambrecht and X. Gellynck. 2012. Factors affecting farmer's decisions about participation in networks important for knowledge exchange and innovation: lessons from Flanders. 6th International European Forum on System Dynamics and Innovation in Food Networks. Innsbruck - Igls, Austria.
- Lagnevik, M., I. Sjöholm, A. Lareke and J. Östberg. 2004. The Dynamics of Innovation Clusters. Cheltenham Glos UK, Edward Elgar Publishing Limited.
- Leeuwis, C., Ed. 2004. *Communication for Rural Innovation: Rethinking Agricultural Extension*. Oxford, Blackwell Science.

- Miotti, L. and F. Sachwald 2003. Co-operative R&D: why and with whom? An integrated framework of analysis. *Research Policy* 32: 1481-1499.
- Morris, S., C. Massey, R. Flett, F. Alpass and F. Sligo 2006. Mediating technological learning in agricultural innovation systems. *Agricultural Systems* 89: 26-46.
- Nieto, M. J. and L. Santamaria 2007. The importance of diverse collaborative networks for the novelty of product innovation. *Technovation* 27: 367-377.
- Nilsson, J. 1999. Co-operative Organisational Models as Reflections of the Business Environments. *The Finnish Journal of Business Economics* 4: 449-470.
- Nooteboom, B. 2000. Institutions and forms of coordination in innovation systems. *Organization Studies* 21: 915-939.
- OECD. 2005. Oslo Manual - Guidelines for Collecting and Interpreting Innovation Data. Paris.
- Omta, O. 2002. Innovation in chains and networks. *Journal on Chain and Network Science* 2(2): 73-80.
- Owen-Smith, J. and W. W. Powell 2004. Knowledge networks as Channels and Conduits: The Effects of Spillovers in the Boston Biotechnology Community. *Organisation Science* 15(1): 5-21.
- Pannekoek, L., O. Van Kooten, R. Kemp and S. W. F. Omta 2005. Entrepreneurial innovation in chains and networks in Dutch greenhouse horticulture. *Journal on Chain and Network Science* 5(1): 39-50.
- Pittaway, L., M. Robertson, K. Munir, D. Denyer and A. Neely 2004. Networking and innovation: a systematic review of the evidence. *International Journal of Management Reviews* 5-6(3-4): 137-168.
- Porter, M. 1980. *Competitive Strategy*. New York, Free Press.
- Quinn, J. B. 1985. Managing Innovation: Controlled Chaos. *Harvard Business Review* May-June.
- Röling, N. 2009. Pathways for impact: scientists' different perspectives on agricultural innovation. *International Journal of Agricultural Sustainability* 7: 83 - 94.
- Rothwell, R. 1977. The characteristics of innovators and technically progressive firms. *R&D Management* 7(3): 191-206.
- Senker, J. and W. Faulkner. 2001. Origins of public-private knowledge flows and current state-of-the art: can agriculture learn from industry? . IN: Wolf, S. A., Zilbermann, D. *Knowledge Generation and Technological Change: Institutional Innovation in Agriculture*. Boston, Kluwer Academic Publishers.
- Souder, W. E., D. Buisson and T. Garrett 1997. Success through customer-driven new product development: a comparison of US and New Zealand small entrepreneurial high technology firms. *Journal of Product Innovation Management* 14(459-472).
- Spielman, D. J., J. Ekboir, K. Davis and C. M. O. Ochieng 2008. An innovation systems perspective on strengthening agricultural education and training in sub-Saharan Africa. *Agricultural Systems* 98(1-9).
- Stewart-Knox, B. and P. Mitchell 2003. What separates the winners from the losers in new food product development? *Trends in Food Science and Technology* 14(1-2): 58-64.
- Tether, B. S. 2002. Who co-operates for innovation, and why - An empirical analysis. *Research Policy* 31: 947-967.
- van Galen, M. and J. Verstegen. 2008. *Innovatie in de agrarische sector: We kunnen er niet genoeg van krijgen!* Den Haag, LEI Wageningen: 83.
- Van Gils, A. and P. Zwart 2004. Knowledge acquisition and learning in Dutch and Belgian SMEs: The role of strategic alliances. *European Management Journal* 22(6): 685-692.
- Von Hippel, E. 1978. Successful industrial products from customer ideas: a paradigm, evidence and implications. *Journal of Marketing* 42(1): 39-49.
- Von Hippel, E. 1988. *Sources of Innovation*. Oxford., Oxford University Press.
- Vuola, O. and A. P. Hameri 2006. Mutually benefiting joint innovation process between industry and big-science. *Technovation* 26: 3-12.

Whitley, R. 2002. Developing innovative competences: the role of institutional frameworks. *Industrial and Corporate Change* 11: 497-528.

ANNEX 1**Overview of interviews conducted and innovation types introduced in the different agricultural subsectors**

	# interviews	Product	Process	Marketing	Organisational
Organic farming	3	1 (33%) ⁱ	0 (0%)	1 (33%)	1 (33%)
Poultry sector	10	3 (30%)	9 (90%)	0 (0%)	1 (10%)
Fruit sector	2	2 (100%)	0 (0%)	0 (0%)	0 (0%)
Vegetable sector	8	1 (13%)	7 (88%)	1 (13%)	1 (13%)
Ornamental plant cultivation	13	9 (70%)	5 (38%)	8 (61%)	5 (38%)
	36	16	21	10	8

ⁱ Percentage of total introduced innovations in the organic farming sector that are product innovations