Journal on Chain and Network Science Special Issue: Networking for Innovation in agrifood SMEs

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Foreword: networking for innovation in agrifood SMEs

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This special issue of the Journal on Chain and Network Science on 'Networking for innovation in agri-food SMEs' is organized around six articles, one editorial article and five research articles. It is noteworthy that four articles out of six (namely the editorial and the research articles by Abdirahman *et al*., 2014a; Ruitenburg *et al*., 2014 and Minarelli *et al*., 2014) are proposed within the framework of the FP7 European NetGrow project (www.netgrow.eu) developed around a consortium of nine European research teams from Belgium, Denmark, France, Germany, Hungary, Ireland, Italy, the Netherlands and Sweden, under the supervision of Ghent University.

The NetGrow project (2010-2014) has the overall objective to enhance network learning in order to increase innovation, economic growth, and sustainable competitive advantage for European food SMEs. Instrumental for achieving this is a thorough understanding of: the nature of network learning, the attitude of food SMEs in different EU member states and the functioning and performance of different types of networks. According to this general approach, the NetGrow project has several specific research objectives, including: (1) gaining a profound understanding of the role of network learning in developing innovation in food SMEs and of its impact on economic growth and sustainable competitiveness, its success factors and barriers; (2) identifying the characteristics of food SMEs network preferences and behaviour explaining the positive effect of networking on innovation; (3) analysing differences in the preference for network characteristics between food SMEs with a different innovation capacity; (4) developing an analytical prototype tool for evaluating network learning performance which allows comparison of performance between regions, countries and sectors; (5) identifying and explaining the differences between high- and low performing networks by testing the network learning performance tool; and finally (6) enhancing the competences and skills of food SMEs, network organisations and policy makers related to this topic of innovation networks and networking activities for innovation.

Zam-Zam Abdirahman, Maryem Cherni and Loïc Sauvée (2014a) put forward in their editorial article 'Networked innovation: a concept for knowledge-based agri-food business' the concept of networked innovation, its content and its interest for research on innovation in knowledge economies. They suggest that research on innovation in agrifood business is looking for new perspectives and for new ways of implementing actual results and of combining different theoretical perspectives. Thus the concept of 'networked innovation' is proposed to summarize the core notions necessary to mobilize for the understanding of the complex phenomena of innovation in modern agrifood knowledge-based businesses and economies. The definition of the concept is rooted in a processual treatment of knowledge creation and transformation that comes out mainly from the relevant literature on organization theory, strategic management and knowledge management. Then they develop the content of the concept around three main items: the multilevel embeddedness of innovation; the roles and forms of learning for innovation; the becoming nature of innovation processes.

In the first research article 'Distinguishing the innovation behaviour of micro, small and medium food enterprises' Francesca Minarelli, Meri Raggi and Davide Viaggi (2014) put forward, in a European food economy characterised by the importance of SMEs, the idea that networking represents for SMEs an opportunity to meet their needs in terms of know-how, technological and financial resources with the main purpose of fostering innovation and facing global competition. In the meantime most scientific studies investigating networking for innovation focus on SMEs as a whole without exploring possible differences between SMEs. Then they address the question of SME behavior related to innovation in considering their heterogeneity in terms of size. The article identifies different 'innovation

profiles' of Italian food SMEs linked to their structural factors associated with different profiles, with particular attention to size and networking. Besides the identification of possible heterogeneity within the SME group with regard to innovation behaviour, the article presents further value by providing useful information on surveyed Italian food SMEs in terms of firm structure and innovation.

Zam-Zam Abdirahman, Loïc Sauvée and Ghasem Shiri (2014b), in their research article entitled 'Analysing network effects of Corporate Social Responsibility implementation in food small and medium enterprises' propose an analytical framework of CSR implementation putting forward the issue of network effects. According to these authors, innovation networks and networking activities, as in any innovation process, are major means to enhance and foster CSR in SMEs, but the interests and concrete consequences of the network perspective for innovation capacity enhancement are rarely addressed. To do so the authors suggest considering CSR implementation as a type of managerial innovation and they define by analogical reasoning the main categories of network effects found in the literature. From these findings, three critical dimensions of network effects are identified: structural, interactive and cognitive, each of them affecting specific dimensions of the innovation process. This analytical framework is synthesized and adapted for CSR implementation and then applied to a case study of a food SME involved in a collective initiative in France, putting in evidence these effects. Finally the authors suggest that revealing such effects is a mean to craft specific diagnosis and accompanying tools that would enhance the innovation capacities, thus relevant to SME managers, network coordinators and policy makers in their will to foster the development of CSR principles.

In their article 'The role of prior experience, intellectual property protection and communication on trust and performance in innovation alliances', Richard J. Ruitenburg, Frances T.J.M. Fortuin and S.W.F. (Onno) Omta (2014) suggest, in the context of open innovation, that there is a tension between the desire to be open, to profit from the knowledge of others, and the desire to be closed to prevent others from making use of the firms profitable knowledge. Thus the authors explore the role of formal and non-formal IP protection arrangements and communication on the building and maintenance of trust and ultimately on performance. It was found that for companies active in an innovation alliance it is important to understand how prior experiences, IP protection and communication influence the level of trust in an alliance, and that, in turn; the level of trust is positively related to innovation performance. From these results recommendations are given for open innovation managers how to make optimal use of the innovation potential of the alliance partner(s), by fostering communication within the alliance and by using formal IP protection arrangements as a platform to create trust within the alliance.

Christophe Assens and François Coléno (2014) develop in their article 'How to manage free riders in a network of competitors: the case of animal genetic selection industry in France' the idea that setting up a network is considered as a key factor for the success of an SME to innovate and to create value through innovation. They suggest that there are difficulties in setting up such a network in the case of competing companies. Such 'coopetition' is based on knowledge transfer and resource sharing. But this kind of partnership may be used in an opportunistic way by some partners. Consequently the objective of their article is to focus on these difficulties in managing a network of competing SMEs in order to manage an innovation whilst avoiding opportunistic strategies, using the analysis of the animal genetic selection industry in France. The authors show that coopetition emerge when a company is dominating the market and is in need of complementarity. But in the meantime the situation may evolve overtime and change the equilibrium between members of the network, which could increase the risk of free riding.

Finally, Alexia Hoppe, Luciana Marques Vieira, Marcia Dutra de Barcellos and Guilherme Rodrigues Oliveira (2014) give in their article 'Research and development project of innovative food products from an inter-organizational relationship perspective' an analysis of the motivations and barriers to develop an innovative food product from the perspective of the two main participants in a development project. The perceptions of a Brazilian food co-operative and a Technological Centre have been analysed throughout a case study. The results indicate the existence of a complex dyadic relationship between them and also that the food innovation network is still in its early stages in south of Brazil. On the one hand, the main motivation for the Technological Centre is to contribute to the national development policy. On the other hand, for the company there is the possibility to obtain partial funding for products development. The company is venturing while bringing to the food market an innovative product. Finally it is clear that these kinds of inter-organizational collaborative efforts can bring benefits to food networks in general.

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Guest editor

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Networked innovation: a concept for knowledge-based agrifood business

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Abstract

Research on innovation in agrifood business is looking for new perspectives and for new ways of implementing actual results and of combining different theoretical perspectives. To do so we propose the concept of 'networked innovation' to summarize what we consider as the core notions necessary to mobilize to understand the complex phenomena of innovation in modern agrifood knowledge-based businesses and economies. Firstly we summarize the theoretical backgrounds and propose our own definition of the concept, which is rooted in a processual treatment of knowledge creation and transformation that came out mainly from the relevant literature on organization theory, strategic management and knowledge management. Then the content of the notion is developed around three main items, which are: (1) the multilevel embeddedness of innovation; (2) the roles and forms of learning for innovation; (3) the becoming nature of innovation processes. In the concluding comments some implications of the research for agrifood business are proposed.

Keywords: agrifood, innovation, knowledge, network, multilevel, process

1. Introduction

Until today a growing number of innovation researchers are working to develop our understanding of innovation processes. Some of them are interested in the sources of innovation (Von Hippel, 2007), the organizational changes in innovation process (Van de Ven and Poole, 2005; Van de Ven *et al.*, 2000), innovation and proximity (Bouba-Olga and Grossetti, 2007, 2008), sectoral approaches of innovation (Malerba, 2002), the role of users in the innovation process (Von Hippel, 2009). Others are interested by the role of networks in innovation processes (Cross *et al.*, 2003; Swan *et al.*, 1999), particularly the social network processes (Borgatti and Cross, 2003; Borgatti and Foster, 2003; Borgatti *et al.*, 2009; Coulon, 2005; Freeman, 1991; Wasserman and Faust, 1994, 2004). A large number of fields and different contexts have been explored (Edquist, 2010).

More specifically, in the context of innovation in agrifood business, the learning and network dimensions of innovation processes have been widely acknowledged and highlighted (Batterink *et al.*, 2010; Gellynck *et al.*, 2007; Omta, 2002; Sarkar and Costa, 2008; Schiefer and Dieters, 2013; Sporleder and Peterson, 2003). Others subjects such as innovation capacity, innovation drivers and determinants of innovation process in this sector have also been studied (Avermaete *et al.*, 2004; Fortuin and Omta, 2009; Gellynck *et al.*, 2007, 2011).

For us, one of the future challenges of agrifood companies facing innovation is to develop a knowledge-management logic, putting knowledge as the core strategic asset. To do so we need new perspectives on this complex topic of innovation process, linking together several angles of the phenomena. In order to capture the essence of innovation some authors have proposed the concept of 'networked innovation' (Swan and Scarbrough, 2005) in order to identify the multifaceted and complex phenomena of innovation. Not yet stabilized, we will nevertheless consider that this concept of networked innovation could be a valuable notion to put forward because it brings together several branches of the researches on innovation that have been until now scattered in different and sometimes antagonist fields. More importantly we show that this concept is in fact an original way to define a novel unit of analysis and to study its permanent transformation in a contextual construct.

In Section 2 we trace back the origin of this concept and propose our own definition of *networked innovation*.

Stemming from this definition we identify three central items that according to us are helpful to characterize the specificity of the concept in Section 3: the embeddedness of innovation in a multilevel approach, the learning dimensions of innovation, the becoming nature of innovation processes. Each of these notions is developed in the following subparts. From this concluding comments for agrifood business are drawn in Section 4.

2. Networked innovation: antecedents of the notion and tentative definition

The studies linking innovation with the network forms of organizing economic activities have witnessed a rapid development since the mid nineties, following the seminal works of authors such as Powell *et al.* (1996) and Oliver and Liebeskind (1998). One of the common denominator of these researches is to put forward some central features of innovation in modern economies. Among these features, we will find the multilevel approach of innovation processes and its interaction learning characteristics (Asheim and Coenen, 2005; Conway and Steward, 2009; Lam and Lundvall, 2007; Lundvall and Johnson, 1994). Indeed, innovation, due to the dispersed and heterogeneous nature of knowledge that is necessary to implement it, needs different categories of players and different processes of knowledge conversion (Crossan *et al.*, 1999; Nonaka, 1991, 1994; Tsoukas, 1996). These players are themselves highly diverse in terms of size, nature, strategies, structural and cognitive characteristics. In a pioneering work, Conway and Steward (1998) suggested a mapping of the network, which highlighted the networking activity of key players and their respective positions. The mapping shows the configuration of the network and its components: actors, links and flows. In this vein 'the network concept is a useful framework for evaluating the structure and operation of existing networks, and for highlighting factors that might improve their performance' but 'there is a risk that networks are used widely and not always appropriate' (Conway *et al.*, 2001; Jones *et al.*, 2001). Furthermore, the range of informal and formal relationships that will support innovation processes will be increasingly diverse. The processes can be focused on collaborative relationships (Pettigrew *et al.*, 2001; Ring and Van de Ven, 1994), on developing trust-based organizational relationships and formal innovation networks (Dhanaraj and Parkhe, 2006), or in creating a web of informal social networks (Conway and Steward, 2009), fostering learning and interactions between the players involved in innovation (Argyris and Schön, 1996).

Thus emerge an idea of innovation as being, simultaneously, permanent networking activities and supported by innovation networks. This will be encapsulated, in a growing literature, in the term 'networked'. Understanding and learning from innovative companies are key issues from the perspective of market trends knowledge and profiles of innovative companies. For Alfranca *et al.* (2004), this knowledge could be particularly useful when a core business influences technological developments in any international industry for a long period of time. There is an important link between the market and innovation. In this vein, Colurcio *et al.* (2012) are interested in the networked innovation processes in the food sector by focusing on asymmetric relationships for three reasons: (1) the context of food market is not favorable for innovation because of its saturation, conservative consumers behavior about food preferences; (2) innovation in food sector is very risky; and (3) the opportunities for network innovation depend on the market, which might support or accentuate power asymmetries.

According to Swan and Scarbrough (2005), the starting point of the definition of networked innovation is to be found in Hardy *et al.* (2003) and Philips *et al.* (2000), who define it as 'innovation that occurs through relationships that are negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanisms of control' (Philips *et al.*, 2000). These authors have identified and integrated, in relation to this notion of networked innovation, the different bodies of research that differentiate 'three broad types of effects, which refer as strategic, knowledge creation and political effects of collaboration' (Hardy *et al.*, 2003). These findings constitute a first step in the definition of the concept. For them, in complex innovation processes, companies are willing to gain capacities through the transfer or the pooling of resources. Hardy *et al.* (2003) suggest that 'a primary rationale for collaboration is the acquisition of resources through the direct transfer of assets, the sharing of key equipment, intellectual property, or personnel, and the transfer of organizational knowledge' (Hardy *et al.*, 2003: 324). But the interorganizational collaborations have also knowledge creation effects. In other words, alliances and collaborations are vehicle for learning about new technologies, new modes or organizations or new human skills. This is, in this case, a situation where a partner will learn from another partner, a situation often describe as a single-loop learning (Argyris and Schön, 1996). But frequently the interorganizational relationship also helps creating new knowledge not possessed or not available before. Powell *et al.* (1996) suggest for instance that 'sources of innovation do not reside exclusively inside firms; instead they are commonly found in the interstices between firms, universities, research laboratories, suppliers and customers'

(Powell *et al.*, 1996: 121). A third aspect of collaboration effects is their political consequences. The term political here is taken in its primary meaning of power effects of one organization over another one. A power relationship could facilitate or constrain actions, or even shape them. This point is crucial for a deeper understanding of innovation processes. Indeed, the structural patterns in which players are embedded will probably have 'a significant impact on the degree to which organizations are able to control their own actions and influence those of others' (Hardy *et al.*, 2003: 327). This structural dimension affecting innovation processes has also been widely developed in the literature (Pittaway *et al.*, 2004; Powell and Grodal, 2005).

For Swan, and in line with these different streams of research, it is possible to identify three main characteristics of networked innovation: 'the importance attached to mechanisms of knowledge creation; the critical part played by social networks; and the pervasive role of technology' (Swan, 2005). We will stress upon the first two aspects which are also found in authors who put forward the importance of knowledge in relation to network dimensions (see for instance Gulati, 1999; Nooteboom and Gilsing, 2004; Tidd *et al.*, 2004; Tsai, 2001), but we will extend these ideas toward the topic of knowledge integration. Indeed this question of knowledge integration in innovation processes is the central node of the networked approach of innovation. For some authors the explicit/tacit nature of knowledge should be considered as a determinant aspect of innovation: while explicit knowledge necessitates market-oriented relationships, tacit knowledge needs different forms of integration (Jensen *et al.*, 2007). The embeddedness of knowledge integration is also developed in complementary researches (Nonaka and Toyama, 2003). But the characteristics of knowledge can also be seen from a relational point of view: the development of shared comprehension is seen as a pre-requisite on integration. Different types of boundary-spanning activities are thus created by players in order to overcome different kinds of barriers (Cantner and Graf, 2006; Chan and Liebovitz, 2006; Conway and Steward, 2009; Giuliani and Bell, 2004). Influenced by network theorists (Bass *et al.*, 2004; Pittaway *et al.*, 2004), other researchers (i.e. Borgatti and Li, 2009; Borgatti *et al.*, 2009) put forward the idea of the combination of actors and relationships that is the starting point of the structural analysis of innovation processes embedded in network relationships.

Following this overview of the literature and combining it in a novel concept, we propose our own definition. Networked innovation is

> 'a conceptualization of knowledge creation and distribution processes, seen as a phenomenon contingent to the intentional design of inter-organizational and interindividual relationships and mechanisms. This design is activated by the players with different kinds of interaction and learning processes which aim is, for the implementing players, to bring a significant competitive advantage. This wide diversity of players has different structural and cognitive characteristics. Thus it necessitates, in an analytical perspective, a contextualization of the situation of their own idiosyncratic positions regarding this knowledge creation and distribution environment.'

This definition puts clearly forward a distinctive approach on innovation: the unit of analysis is neither the innovation itself, nor the innovation system, nor the player. This is instead the knowledge, seen here not just as a flow of information and resources but as a process being continuously translated, transformed, remodeled by actors, with the intentionality of reaching a competitive advantage. This point is central to the understanding of the networked innovation seen as an original concept. Indeed, doing so, in modifying the lenses through which the innovation is studied, allows us linking different bodies of literature previously scattered. Following and extending the main authors that have mobilized this perspective, it is henceforth possible to organize what could constitute the basic components of such a conceptual view of innovation and delineate its main characteristics around three core items.

3. A delineation of the concept of networked innovation in three items

We propose here to summarize what could be the basic theoretical components of the concept of networked innovation: the multilevel embeddedness of innovation, the learning roles and forms in innovation processes, and the becoming nature of innovation.

Taking stock of the multilevel perspective: the embeddedness of innovation

'Embeddedness refers to the fact that economic action and outcomes are affected by the partners' relations and by the structure of the overall network of relations' (Duyster *et al.*, 2003). From this definition, we can distinguish three levels of embeddedness: structural, relational and positional embeddedness (Granovetter, 1985, 1992), at which some authors also add the institutional level (Grandori and Soda, 1995). The institutional level of innovation is embedded, foremost, in a contextual dimension. In particular, it

is argued that the national systems of innovation play a considerable role in the diffusion of innovations and in the development of networking activities. Institutions, defined as the set of the legal system (i.e. the banking and finance system, the structure of labor markets, the education system and the political system) can make network formation easier (Grandori and Soda, 1995). Taking the cluster as a unit of analysis, many authors consider that all firms are similarly concerned with external environment, and equally benefit from external economies and opportunities for joined action in the cluster. Likewise, firms are equally facing the constraints of the environment. Access by firms to some types of resources can be influenced by the constraints of the context, concerning resources in particular, and may drive firms to adjust their networking behavior and also to give the innovation network configuration specific traits (Salavisa *et al.*, 2012).

The relational embeddedness refers to the direct links between actors and their role in knowledge transfer and acquisition (Gulati, 1998). Relational embeddedness focuses primarily on the quality of relations between network actors (Granovetter, 1992) developed through a history of interactions (Nahapiet and Ghoshal, 1998). Therefore, at the dyadic level, relational embeddedness generates trust and feeling of closeness (Moran, 2005; Nahapiet and Ghoshal, 1998). Coleman (1988) considers the network as advantageous when partner relationships are redundant and dense because it involves trust between them, encourage them to form future inter-firm alliances (Chung *et al.*, 2000). For Chang (2011), the degree of relational embeddedness depends on two conditions: pre-existing ties between partners and frequent contacts. In the two cases, firms search to reduce uncertainty. This is especially true when partners work closely on complex tasks (Jones *et al.*, 1997), which is difficult to complete or require a high degree of collaboration and coordination or also when the task is developed in parallel by both partners (Terwiesch *et al.*, 2002). Relational embeddedness has two levels: (1) relational closeness is indicated by the number and the quality of contacts which will have individuals from each partner; and (2) collaborative commitment is indicated by the willingness of a firm to sustain its partner.

The structural embeddedness, which refers to the interconnectedness between network members, signifies the establishment of norms at the network level (Rowley *et al.*, 2000). Whereas relational embeddedness takes into account the dyadic level and stimulates the creation of trust between the actors in the network, structural embeddedness refers to the structural positions that the network members occupy and their impact on the information value (Gulati, 1998). Several authors have searched what kind of network structure is better for innovation. Some studies highlight the idea that the actors of a network are different and that is why they perform differently. For Burt (1992, 2001), a network sparsely connected is more efficient than a network densely connected, particularly because information is non-redundant. But theory highlights the importance, not only of ties and inter-units (between individuals or organizations) connectedness, but also the importance of holes than can exist in the network. An actor of a network can benefit from the existence of holes. It can play the role of bridge in the network, by creating links with other actors where connection has failed to form. The firm in such bridging position, called the node, benefits of many advantages. The most important is the access of non-redundant information and ideas arising from others members. Then a firm in a position of a node is more able to innovate than others. Finally in the case of clusters can emerge 'powerful leading firms' (knowledge gatekeepers) (Gebreeyesus and Mohnen, 2013) that are able to perform R&D or to play a role of 'bridging enterprises' that link the actors of the cluster with the external environment (Boschma, 2005; Boschma and Ter Wal, 2007).

The positional embeddedness puts forward the following central idea: the position for each member in the social system is a determinant of its role, behavior and decisions in alliances formation (Gulati and Gargiulo, 1999), and of the resource fit between partners (Rooks *et al.*, 2013) i.e the resource alignment between one's needs and the partner provisions (Das and Teng, 2000). One network actor may occupy strategic position which allowed it to have many significant ties with others. This strategic position is called centrality (Rooks *et al.*, 2013). Rooks *et al.* (2013) have proposed that resource fit is affected by the network position of firms. For Ahuja (2000), central firms, which have a strategic position in the network, have more capacity to innovate than others. In similar terms, central firms are more able to benefit from their alliances than less central firms (Gilsing *et al.*, 2008). In terms of information access, these firms are better informed about what happens in the network (Gilsing *et al.*, 2008) and consequently it will increase their possibilities to create new alliances (Gnyawali and Madhavan, 2001; Gnyawali and Steward, 2003).

Beyond the consensus about the importance of each level of innovation embeddedness, we consequently presume that innovation processes are deeply embedded and that levels count. In other words, all forms of embeddedness play a strong role in enhancing innovative capacity of firms and of the network as a whole.

Learning roles and forms in innovation processes

Since Cohen and Levinthal's (1990) seminal article putting forward the central idea of learning and knowledge accumulation, the notions of innovation and learning are intrinsically intertwined. For these authors, learning is fundamentally a cumulative knowledge-based process. Indeed 'the notion that prior knowledge facilitates the learning of new related knowledge can be extended to include the case in which the knowledge in question may itself be a set of learning skills' (Cohen and Levinthal, 1990: 129-130). Thus 'this progressive improvement in the performance of learning tasks is a form of knowledge transfer that has been referred to as learning to learn' (Cohen and Levinthal, 1990: 129), a competence which has been identified as the central skill of innovation competence. Another idea linking innovation and learning is the notion of learning performance. Learning performance 'is greatest when the object of learning is related to what is already known' (Cohen and Levinthal, 1990: 130), but at the same time 'knowledge diversity also facilitates the innovative process by enabling the individual to make novel associations and linkages' (Cohen and Levinthal, 1990). Consequently, their works lead to the view of innovative capacity as the ability of an organization to create a *structure of communication* between on the one hand this organization and on the other hand its external environment, and within the organization (between for instance subunits), opening the way to the open innovation approaches (Chesbrough, 2003). Finally Cohen and Levinthal (1990) argue that 'the problem of designing communication structures cannot be disentangled from the distribution of expertise in the organization', a conceptualization which emphasizes the forms and characteristics that could take learning processes in innovation settings (Nooteboom, 2000).

On this point, the works of Argyris and Schön (1996) can be considered as a complementary stream of research on learning, useful in their attempt to define the concrete forms that could take learning processes in companies and sectors. More specifically, and in line with this tradition focused on innovation learning, some works (such as Gherardi, 1995, 2000; Gherardi and Nicolini, 2002; Van Wijk *et al.*, 2003) have provided valuable results and insights. For instance, following the seminal book of Argyris and Schön (1996) on organizational learning, the role of actors within networks and the networking activity for learning has been widely acknowledged (Gherardi, 1995; Hislop, 2003; Hislop *et al.*, 2000; Van Wijk *et al.*, 2003). Usually, three levels of learning are identified: individual, group and organization, with subsequent learning processes (Crossan *et al.*, 1999). Crossan *et al.* (1999) explain organizational learning as a dynamic process and as a tension between assimilation of new knowledge (exploration) and using what has been learned (exploitation). This learning occurs at multiple levels (mainly individual, group and organizational levels) and is described in four processes: intuiting, interpretating, integrating and institutionalizing. Another key finding is the fact that learning processes are usually, in organizational innovations, single-loop of learning, meaning that actors modify their actions according to results or a double-loop or second-order form of learning, meaning that actors question the values and assumptions, with radical (in the case of disruptive innovation for instance) and complex changes involved (Argyris and Schön, 1996). On this question of learning, other works have also focused on the characteristics of the learning activities. Lundvall (2010) for instance identify the different forms of learning under the categories of learning by doing, by using, by interacting, by spillovers effects. But learning related to the issue of innovation can also be viewed in a holistic manner. This is the perspective adopted by authors such as Gherardi and Nicolini (2002), and authors from the knowledge management field (Van Wijk *et al.*, 2003). For these authors, learning is not an isolated phenomenon. Its strength lies in the complementarity of the network relationships, seen as a stable structure, with the interacting processes that occur (mainly) at the inter-individual level. Thus emerges a view of learning for innovation very close to an idea of networking activity for innovation. These perspectives, i.e. the dynamic interrelationships between network and organizational learning, are well summarized by Berthon *et al.* (2007); for them the networking activity is double-sided phenomena: it is a 'channel for learning but, recursively, the network is transformed by the learning taking place. In other words, the network is, at least partially, constructed by the learning processes dynamically, deliberately and in an emergent manner' (Berthon *et al.*, 2007: 23). Innovation networks and networking for innovation are thus the two sides of the same coin: consequently innovation should be studied as such, i. e. as a global phenomenon of becoming. Similar views for the food sector are developed by Colurcio *et al.* (2012), Mele *et al.* (2010) and Russo Spena and Colurcio (2010).

Innovation network(ing) as a phenomenon of becoming

Innovation processes are inherently seamless, complex, evanescent and fluid phenomena. But, in complementarity with the strands of theories about embeddedness and learning previously developed, how to capture their essence? Many social scientists have argued that theory should provide tools to understand it accordingly. For researchers, considering the innovation activity of firms seen as a whole necessitates mobilizing at the same time

the existence of formal innovation networks and the practice by managers of informal network activity, but also of permanent interactions at structural networks level as well as networking activities level between various entities. Nevertheless research works on innovation usually considers separately these two main perspectives: the first one is focused around the role, characteristics and dynamics of formal structured networks; the second stream of research deals with the innovation activity in itself and especially with the way companies will create and activate informally different (individual) partners. But relatively few research works consider these two perspectives jointly. Authors such as Geels (2004), Langley *et al.* (2013), Miettinen (1999), Bathelt *et al.* (2004) and Dhanaraj and Parkhe (2006) provide interesting approaches on such perspectives. They rely, implicitly or not, to an idea of any organizational phenomena as 'processes of becoming' (Hernes, 2008), in coherence with constructionist approaches of the knowledge within firms (Tsoukas, 1996).

Hernes (2008) has summarized and shown the importance of recent fields of organization theory for the study of innovation, and more specifically Actor-Network Theory (hereafter ANT) proposed by Callon (2002), Latour (2005) and Law (2007). The starting point to consider for this theory is that innovation processes create connection with, and between, various actors. But, in looking at innovation processes, the most important fact for the tenants of this theory, and which is lacking or under emphasize to most of the traditional theories about innovation, is not to identify particular actors but to 'single out those elements that seem to influence what is going on' (Hernes, 2008). These elements are called 'actants' (Latour, 2005). Thus an 'actant' is an object or a person (or an organization) that is stronger than others and has survived. Hernes argues that 'rather than looking for context, we are better advised to follow connections and association that are made between heterogeneous actors. Then to see networks as relational rather than consisting of neatly delineated actors adds fluidity and freedom to the notion of actors' (Hernes, 2008). What could tie actors between them is called association and the nature of such an association is not important per se. The question which matters is the purpose of this association and its strength over time, which can be of course an innovation process. Thus for ANT theorists nothing is stable in nature and the inherent characteristics of connected entities are neither human nor technical.

Consequently, in considering this status of actants in innovation processes, one must consider first what constitutes relations. This is the notion of referencing which 'enables meaningful interaction to take place between actors'. These references are not stable but instead evolve constantly as 'chains of transformation'. Of course the constant circulation and transformation of knowledge in innovation processes provide a perfect validation of such a perspective. For Hernes, 'the idea of circulating reference helps circumvent dichotomies such as those between subject-object and global-local' or between levels. Nevertheless, this ANT theory does not reject traditional approach of structured actors, called macro-actors, and of levels. These macro actors, like institutions and organizations, may emerge and stabilized over time. But at sub levels of innovation processes, there is more than these permanent structures. Thus the complementarity of network embeddedness and ANT lies in the fact that innovation encompasses these interactions, simultaneously structured *and* fluid.

Finally, for ANT, 'making sense of relations that tie actors together, rather than making sense of the actors themselves, thus becomes constitutive of actor-networks. Networks, then, do not consist of stable nodes and links, but consist of relations that shape actors recursively. Actors become actors through their relations with other actors' (Hernes, 2008). Other recent research works in sociology have also developed the idea of a complementarity between network relationship categories and types, for instance individual and organizational relationships (called the 'double link design', Lazega *et al.*, 2007). Similarly, some works show that innovation processes extend beyond formal organizations: activation of relevant networks overcome categories or formal classifications (cf. Conway and Steward, 2009, for an overview). Thus complementarity, instead of exclusivity, should be the focus. In modifying the lenses through which one could analyze innovation, the idea of innovation network(ing) as a phenomenon of becoming open up new avenues. The focus is then on socio technical networks, define by Callon (2002) as 'a way in which actors and intermediaries are constituted and defined one another within such networks'. Then, as suggested by Akrich *et al.* (2002a) 'as for the socio-technical analysis, it positions itself at the exact place where innovation is situated, in this hard-to-grasp middle-ground where technology and the social environment which adopts it simultaneously shape one another' (Akrich *et al.* 2002a: 205). This approach considers the innovation as the result of complex and multiple interactions between diverse actors such as firms, universities, public institutions, researchers, and so on. Innovation is defined as the 'art of interessement' of allies (Akrich *et al.*, 2002a, 2002b). It succeeds as soon as it reaches the 'art of interesting an increasing number of allies who will make you stronger and stronger' (Akrich *et al.*, 2002a), building up progressively an association of

actants. This view of innovation puts a lot of emphasis on the duality of innovation incorporating both formal and informal dimensions.

4. Concluding comments

Finally, drawing from these different perspectives and based upon relevant works from the fields of sociology, organization theory and knowledge management, we suggest considering the concept of networked innovation. This concept allow considering innovation processes as multi-sided processes where the structural and formal dimensions of innovation must be considered in parallel with the innovation activity in itself, embedded in different contexts, and putting interaction learning for knowledge integration and transformation as the central issue. This concept encapsulates the idea of a syncretic approach of innovation useful to be mobilized in the era of agrifood knowledge-based economies, in emphasizing the multiple forms of knowledge creation, transformation and distribution between a wide diversity of partners. Further research on innovation using these lenses could be greatly relevant and could be operationalized thoroughly in the future, in taking as a starting point the postulates about what really is innovation in its core components in knowledge-based businesses, and especially in the highly dynamic and complex agrifood and life sciences sectors (Powell *et al.*, 2005; Sarkar and Costa, 2008).

This concept also opens some new directions for future research on innovation. First of all, scholars have to explore combinations between levels (mainly between policy and network levels) interindividual and interorganizational learning interactions (Gittell and Weiss, 2004; Langley *et al.*, 2013; Yu *et al.*, 2013), as it is sketched in Figure 1. These cross-leveled studies are interesting and would allow researcher to

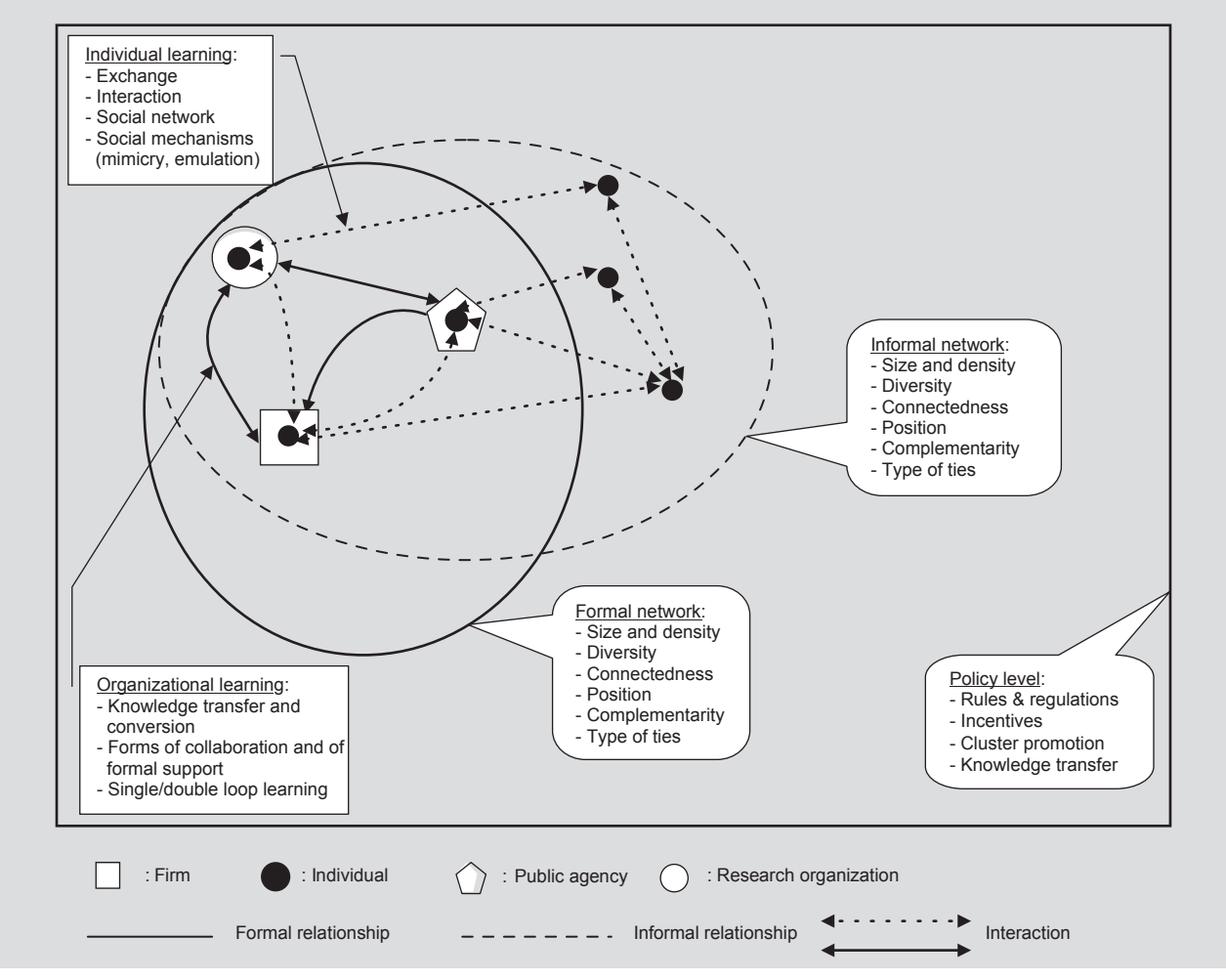

Figure 1. Networked innovation: a chart.

explore and analyze the relationship between different levels (Hofmann, 1997) that are usually under emphasized in the literature. The informal network is not left as the interaction between partners is the antecedent of the integration of resources (Mele *et al.*, 2010). Our chart also shows that this informal network is created around the formal network setting, and the crossing between the two gives rise to the networked concept. We also emphasize the importance of the complementarity between formal and informal networks (Lazega *et al.*, 2007) that plays an important role in the dialectics of innovation processes. Finally future researches should integrate networked innovation perspectives in their studies on interorganizational collaborations in innovative projects. Indeed, the networked innovation concept has also practice-based implications (Gherardi, 2000; Van de Vrande *et al.*, 2010) and provides an integrative perspective on innovation management by combining formal and informal networks.

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Distinguishing the innovation behaviour of micro, small and medium food enterprises

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Abstract

The European economy, and particularly the food sector, is characterised by small and medium enterprises (SMEs). Networking represents for SMEs an opportunity to meet their needs in terms of know-how, and technological and financial resources with the main purpose of fostering innovation and facing global competition. Most scientific studies investigating networking for innovation focus on SMEs as a whole without exploring possible differences between SMEs. An important question to be posed is whether the firms within groups of SMEs behave the same in terms of innovation. The purpose of this paper is to understand whether different 'innovation profiles' of Italian food SMEs can be distinguished and to identify the structural factors associated with different profiles, with particular attention to size and networking. The methodology consists of a cluster analysis on data obtained by standardized on-line questionnaires compiled by Italian agri-food SMEs. Moreover, besides the identification of possible heterogeneity within the SME group with regard to innovation behaviour, the paper presents further value by providing useful information on surveyed Italian food SMEs in terms of firm structure and innovation.

Keywords: SMEs, innovation, network, food

1. Introduction and objectives

The food industry is recognised as one of the most important sectors for the Italian economy, providing employment and relevant economic output. Even if traditionally considered in the literature as a low tech sector characterised by a poor level of research intensity and innovation (Christensen *et al*., 1996; Garcia Martinez and Briz, 2000), in recent decades, the increasing level of safety and quality standards in the food sector together with the globalisation of the food market (Galizzi and Venturini, 1996) have generated the need for technological inputs and hence a growing interest in promoting innovation in the agri-food sector (Traill and Meulenberg, 2002)

It is well known that the food industry is characterised by small and medium enterprises (SMEs) (Schiemann, 2008). Evidence from the literature (Roper, 1997) reports that SME businesses have distinctly different innovation behaviour compared to large enterprises, suggesting that an alternative approach needs to be taken for the former. Besides size, other factors have been recognised by the literature as having effects on innovation, such as participation in networks (Ahuja, 2000; Baptista and Swann, 1998; Powell *et al*., 1996) stages of product life-cycle (Pavitt and Wald, 1971) and level of internalization (Kafouros *et al*., 2008; Kirner *et al*., 2009; Wakelin *et al*., 1998). Starting with the first Schumpeterian hypothesis, in academic history, the size effect on innovation has always been the subject of thorough investigations. Yet studies have not reported conclusive results in this direction. In fact, several aspects affect the behaviour of the size-innovation relationship, and in particular a firm's sector (Acs and Audretsch, 1987). In this regard, food industry, studies have confirmed that larger firms are more innovative than smaller ones (Galizzi and Venturini, 1996; Huiban and Boushina, 1998). Not many authors (Colurcio *et al*., 2012; Triguero and Corcoles, 2013) have carried out studies on relationships between the size and innovativeness of food enterprises and even less have differentiated between micro, small and medium sized firms.

In fact, to the best of our knowledge, few authors have explored the issue of size as a determinant of innovation within the food SME aggregate. The study reported by Turner *et al*. (2009) is the only one carried out on food SMEs that reports on the heterogeneity within SMEs in terms of innovation. This study explores how SMEs use projects, project management and the existence of size segmentation within SMEs aggregate. The results are based on data collected from a questionnaire that reported a response rate of the 20%. The information is reported distinguishing micro, small and medium-size class based on employer number classification. The findings did not highlight meaningful differences in terms of investment in project managements among size classes. Moreover, the study confirms expectations that smaller companies can only afford the management of smaller size projects.

The literature offers other findings demonstrating that some studies were carried out within the SME aggregate. These deal with differences in firm behaviour with respect to risk exposure (Dietsch and Petey, 2004), information technology (Neirotti *et al.*, 2013) public subsidies and project management (Alecke *et al.*, 2012) but none of them is specifically carried out in the food sector.

Consequently, the issue of how and whether differences in innovation behaviour does indeed exist among medium, small micro enterprises in the food sector is mostly unexplored.

The purpose of this paper is twofold. First, it aims to understand what 'innovation profiles' can be recognised in a surveyed group of Italian food SMEs. Second, it investigates how they relate to structural factors, with particular attention on size, and networking. The study is innovative compared with the existing literature on several grounds. First, it applies to Italy, a country in which, to the best knowledge of the author, no similar studies have been undertaken to date. This is also relevant as the Italian food sector is rather unique and it can be expected that straightforward extrapolations from other areas provide misleading insights. In addition, compared with previous studies, this paper first recognises innovation profiles among the group of surveyed Italian food SMEs, and then checks for the existence of any connections with their structural features. This should make it possible to highlight whether Italian food SMEs can be treated as a homogeneous group or whether there are some relevant differences within subgroups of micro, small and medium sized enterprises in terms of their innovation behaviour. For such purpose a cluster analysis was carried out on surveyed data in order to group enterprises with similar innovation behaviour and distinguish emerging differences related to size.

This is expected to yield relevant insights into needs for policy differentiation among the group of food SMEs.

Two hypothesis are presented in the paper as a research framework:

- H1: the existence of heterogeneity within the food SME aggregate in terms of innovation behaviour which is highlighted through the cluster analysis.
- H2: the heterogeneity can be related to some firms' characteristic,s in particular the size, as reported in the literature review carried out in this section.

The paper is organised in five main sections, besides the present one. In Section 2 data collection and sampling is illustrated. Section 3 describes the data analysis methods. Section 4 illustrates the results, followed by a discussion in Section 5 and the conclusion in Section 6.

2. Data collection

The present work makes use of data collected through a web-survey developed for the European project NetGrow. While the survey addressed several European countries, in this paper we only use the results from the Italian part. Italian food SMEs were contacted by e-mails addressed to firm managers or CEOs. Each email provided a web link to have access to the web-survey.

Necessary e-mail contact information was partially collected from the AIDA database (Analisi Informatizzata delle Aziende). AIDA represents a broad database containing comprehensive information on some Italian companies, such as company name, financial information, corporate structure, street address etc. However, only some e-mail addresses were available for the firms listed in the database. Some missing email contacts were collected by internet searches and consequently added.

Within a total number of food 19,600 SMEs extracted from the database, 1,677 SME e-mail contacts were already available from the AIDA database and an additional 343 were located on the internet. The composition of the group of firms, in term of firm size, is composed of 23% micros 50% small and 25% medium sized firms.

The web survey compiling phase took place between October 2012 and March 2013. Forty- seven SMEs returned valid fully compiled questionnaires, Ninety were left incomplete.

A Cluster analysis was carried out only on the completed section of questionnaires.

It must be said that in the composition of such a sample, which is 40% micro 43% small and 17% medium sized enterprises, the percentage of micro enterprises is overestimated. For this reason, the small number of respondents, the sample does not intend to be representative of the SME population neither carry out inference based on the results of the analysis. The purpose of the study was in fact of providing some evidences of heterogeneity within surveyed SME and relate them to firm's characteristics. The questionnaire was developed from previous academic reviews and output from a series of Delphi Rounds (Viaggi *et al*., 2012) and tested among the other European countries involved in the project.

The questionnaire is composed of two sections, one investigating on determinants and strategic behaviour of SMEs in networking and the other analysing preferences expressed by SMEs for some network types. In the first section, which represents the object of this analysis, respondents were asked to provide information in relation to the following factors: firm primary's geographical market, firm size, profit and employees trend in the last two years, firm's innovation strategy, innovation type (in terms of products process, markets and model business realized in the last two years) and their cooperative and networking behaviour with partners.

3. Data analysis

The data analysis was conducted in three stages, performing respectively: (1) descriptive statistics; (2) two step cluster analysis; and (3) crosstabs. In order to recognize innovation profiles among the SME surveyed, a cluster analysis was carried out. The innovation variables employed in the cluster classification are: innovation strategies, product innovation, process innovation, market innovation, business model innovation. Since we are dealing with qualitative variables, the Pearson's chi square was performed in order to test significant association between variables, in particular between firm's size and variables identified for the description of innovation profile, network participation and firm structure Variables describing the innovation profile in the web survey are shown in Table 1. Each of the four variables capturing the product, process, market and business model innovation was re-coded from a 7-point variable into a 5-point variable, depending on the number of innovations in the last two years (0 = no innovation, 1 = 1 innovation, 2 = 2 or more innovations, 3 = don't know, 4 = missing values).

Dealing with categorical and multinomial variables the Two Step cluster analysis was selected as the most appropriated procedure. The optimal cluster number was automatically determined generating 3 cluster profiles. Consequently, cross tabs were generated to add firm features descriptive of each cluster profile.

Table 1. Variable identifications: details of survey items used as variables.

	Variable description	Type of variable
Innovation variables		
Product innovation	Number of new products realized in the last 2 years	Multinomial
Process innovation	Number of new processes realized in the last 2 years	Multinomial
Model innovation	Number of new business models realized in the last 2 years	Multinomial
Market innovation	Number of new markets realized in the last 2 years	Multinomial
Innovation strategy	First to market, not first but following rapidly, focus on niche market	Multinomial
Firm's structure variables		
Firm's size	Micro (less than 10 employees), Small (10 to 50 employees), Medium (50 to 250 employees)	Multinomial
Firm's geographical market	Local, National, European, Global	Binary
Participation to network	Industry associations, business club, clusters, technological parks	Binary
Profit trend	Decreased, unvaried, increased	Multinomial
Employment trend	Decreased, unvaried, increased	Multinomial
Years in business	From how many years is the enterprise in business	Ordinal

4. Results

Details regarding the type and the description of variables used for the cluster analysis are reported in Table 1. They are classified in innovation variables entered for the clustering analysis and firm structure variables adopted for the cross tab creation. Descriptive statistics of the forty seven SMEs are shown in Table 2. The table provides a general preliminary description of the frequency expressed by each modality of the surveyed variables: years in business, number of employees, trend of employment, participation in network, area of geographical market, innovation strategy, product innovation, process innovation, market innovation and model innovation. As it can be seen in Table 2, SMEs declare to have increased their profit in the last two years. Considering negative trends in the economy in the period in which the survey was carried out this is likely not in line with the general trends of many Italian SMEs. This underscores a possible bias in the sample, likely because enterprises with better performance can be more inclined to answer questionnaires of this kind. In addition, the very poor level of innovation in business models put in place by the SMEs surveyed should be noted. High innovation performance in markets is declared likely due to the perception of new opportunities by entering new markets. Table 3 reports the level of internalisation in relation to firm size. This table highlights some details in regard to the geographical market approach. It can be observed that a large portion of the SMEs in the sample count on international markets and few are active in local markets In particular, micros are more focused on local markets and the medium sized firms are those that mostly focus on the internalisation of their markets. Moreover, it should be noted that even if the modality of small enterprises is represented by the international market area, this class size shows a more homogeneous distribution compared to the other firm sizes. This behaviour is probably to be ascribed to the fact that within the class of small firms, firms closer in size to micro or medium size tend to behave similarly in these size classes.

Table 4 shows the output of the cluster analysis performed using the five innovation variables as discriminants and delineating the three innovation profiles matched with the firm structure modality for each cluster. Table 5 presents an in-depth description of each cluster composition.

As highlighted in Table 4, two patterns are clearly defined: cluster 1 and cluster 3. Cluster 1 is characterised by small firms with higher innovation compared to the other two clusters. They are also more oriented toward the national market and try to be first on the market.

Table 2. Descriptive statistics of the small and medium enterprises (SME) survey group.

Variable	Modality	%
Years in business	0-20	23%
	21-30	21%
	31-45	21%
	46-70	17%
	71-170	17%
SME	micro	40%
	small	43%
	medium	17%
Trend of employment	decreased	13%
	unvaried	43%
	increased	45%
Trend of profit	decreased	15%
	unvaried	15%
	increased	70%
Participation to network	in-network	85%
	out-network	15%
Local geographical market		17%
National geographical market		34%
European geographical market		23%
Global geographical market		34%
Innovation strategy	first to market	34%
	seldom first to market	15%
	focus on niche market	51%
Innovation in product	None	23%
	One	19%
	2 or more	47%
	don't know	9%
	n.a.	2%
Innovation in process	none	40%
	one	26%
	2 or more	15%
	don't know	15%
	missing data	4%
Innovation in market	none	21%
	one	19%
	2 or more	51%
	don't know	9%
	missing	
Innovation in model business	none	55%
	one	19%
	2 or more	
	don't know	17%
	missing data	9%

Table 3. Geographical market area and size of small and medium enterprises.

	Local	National	European	Global	Euro/Global	Nat/Euro
Micro	13%	15%	6%	4%	0%	2%
Small	2%	13%	9%	17%	0%	2%
Medium	2%	2%	0%	9%	4%	0%

Table 4. Cluster profiles.

Final clusters	Cluster 1		Cluster 2		Cluster 3	
Number of cases per cluster	9		22		16	
Innovation strategies	first to market		first to market/focus on their niche market		focus on their niche market	
New products	yes [2 or more innovations]		yes [2 or more innovations]		none	
New processes	yes [2 or more innovations]		yes [1 innovation]		none	
New markets	yes [2 or more innovations]		yes [2 or more innovations]		none	
New Business models	yes [1 innovation]		none		none	
Firm's structure	Cluster 1	% per column	Cluster 2	% per column	Cluster 3	% per column
Years in business	21-30	33%	21-30	18%	31-45	31%
SME	small	56%	small	41%	micro	50%
Trend of employment	unvaried	56%	increased	59%	unvaried	50%
Trend of profit	increased	78%	increased	77%	increased	56%
Participation to network	in-network	56%	in-network	100%	in-network	81%
Internationalization	national	44%	global	59%	national	50%

Cluster 3 shows a pattern characterised by micro firms producing no innovation, mostly oriented toward their niche market and operating at the national level.

Cluster 2 represents an intermediate level in which enterprises' innovation profile is characterised by having an equal frequency for two types of innovation strategies: being first to market and focusing on their niche market. These firms are slightly less innovative compared to those in cluster 1 and in fact they are particularly oriented toward global markets, probably thanks also to their intensive networking activities.

SMEs belonging to cluster 3, as already mentioned, do not produce innovation at all, but mostly participate in networks. This is in contrast with the suggested linkage between innovation and networking often postulated by research and policy; however, in the survey, in the question referring to networking, participation in networks for innovation purposes was not separated from participation in networks for other purposes. In this perspective, since the third cluster is characterised by micro sized firms, it is coherent that micro firms have more propensity to participate in networks, but likely for reasons not directly related to innovation.

An aspect emerging is that clusters 1 and 2, although both characterised a majority of small sized firms and similar innovation behaviour, show strong differences in their levels of internalisation. The first cluster consists of small firms oriented toward national markets, and the second has a global market focus. However, from the more accurate analysis of the cluster composition reported in Table 5, cluster 2 includes most of the medium size firms that, as shown in Table 3, are largely active on international (European and Global) markets.

Table 5. Cluster descriptives.

Firm's structure	Cluster 1	% per column	Cluster 2	% per column	Cluster 3	% per column
Years in business	0-20	11%	0-20	27%	0-20	25%
	21-30	33%	21-30	18%	21-30	19%
	31-45	33%	31-45	9%	31-45	31%
	46-70	11%	46-70	14%	46-70	25%
	71-170	11%	71-170	32%	71-170	0%
SME	micro	44%	micro	32%	micro	50%
	small	56%	small	41%	small	38%
	medium	0%	medium	27%	medium	13%
Trend of employers	decrease	0%	decrease	9%	decrease	25%
	unvaried	56%	unvaried	32%	unvaried	50%
	increased	44%	increased	59%	increased	25%
Trend of profit	decrease	11%	decrease	14%	decrease	19%
	unvaried	11%	unvaried	9%	unvaried	25%
	increased	78%	increased	77%	increased	56%
Participation to network	in-network	56%	in-network	100%	in-network	81%
	out-network	44%	out-network	0%	out-network	19%
Internationalization	local	22%	local	5%	local	31%
	national	44%	national	9%	national	38%
	european	11%	european	27%	european	25%
	global	22%	global	59%	global	6%

5. Discussion

This research underscores the heterogeneity of Italian food SMEs highlighted by the cluster process. The clusters analysed provide three innovation profiles, each one associated to different firm structures. The cluster profiles and their interpretation appear consistent with the existing literature.

The first cluster is characterised by small sized firms with high innovation performance focused on the national market. As confirmed by scientific literature, firms generating innovation do not feel obliged to export in order to reach new markets. Instead, firms characterised by low innovation performance need to look for new markets to be competitive (Wakelin, 1998). The second cluster presents another possible firm strategy, in which firms try to compete by focusing less on innovation in products and processes and more on fostering market innovation by introducing their products in new market areas. The third cluster includes SMEs that try to differentiate themselves by providing individually-tailored products or services for habitual costumers. This behaviour also finds support in the literature (Bennett and Smith, 2012) as a method adopted by small firms in order to be competitive.

In addition, the very poor level of innovation in business models applied by the SMEs surveyed should be noted. This should likely be ascribed to the simple structure of the SMEs and the fact that they tend to have less managerial and professional expertise (Thong *et al.*, 1996).

Even though the response rate was rather low and the sample was likely not representative, the results show some different innovation profiles in the surveyed group and highlight the heterogeneity within the SME aggregate. In addition, the results yield new empirical information related specifically to Italian food SMEs. This is relevant, as previously stressed in the literature, as innovation can differ not only by industrial sector but also by countries (Alecke *et al.*, 2012; Colurcio *et al.*, 2012).

Moreover, by grouping SMEs through the cluster analysis it was possible to highlight some important aspects that can be retained as hypotheses for further research. The limited number of observations did not allow to use more sophisticated statistical techniques to carry out a

more robust and accurate investigation of determinants of different innovation strategies. However, this is a common issue in most of the related empirical literature, which have been carried out based on case studies or on very small samples of firms. Also, some bias can affect the sample due to the self-selection process implied by the sampling modalities. In general this represents a difficulty observed in many case studies involving questionnaire submissions.

Finally, it can be stated that the questionnaire provided a satisfying amount of information related to innovation aspects and networking, in particular considering that questionnaire was mainly address to CEOs.

6. Conclusion

The analysis carried out refers to differences in the innovation profile detected within a group of questionnaire responses from food SMEs.

SMEs are a very heterogeneous group of businesses, particularly those operating in the food sector. They include a wide variety of firms such as winery, food-manufacturing, laboratories with high technological capacity and skills. Some are dynamic, innovative, and market-oriented while others are satisfied to remain small and family owned. It can be highlighted by the cluster profiling that not all SMEs have the same innovation behaviour in terms of generating innovation or innovation strategies. As noted, micro firms focusing on niche markets do not generate innovation, instead small firms tend to foster innovation and enter markets first. Medium size firms that do not represent the most numerous modality for any of the three cluster profiles, tend to be concentrated mainly in the second cluster profile.

In particular, the relationship between size and innovation is not straightforward. Not only the firm size but also the combination with other factors influence the innovation. In fact, as highlighted by the clustering micro and small firm sized show different innovation profiles.

The main policy message arising from this analysis is that different innovation strategies within SME categories need tailored policy instruments. In particular, consistent with firms' attitudes and innovation capability, it seems that some may benefit more from the design of proper innovation policy schemes, while others may benefit from the establishment of marketing support. Hence policies could also have a role complementary to the spontaneous patter followed by SMEs, by helping in developing strategies that are not implemented at the moment.

The heterogeneity within the SME classes captured by the cluster analysis remains a largely unexplored topic among academics. Even if the number of employees represents a common parameter for the classification, however, it represents a very approximate indicator for different and complex innovation behaviours. This study can be considered as a preliminary analysis for the development of indicators that allow for the identification of specific patterns that are typical for food SMEs. While this study does not yield more specific prescriptions for policy making, it highlights the relevance of further research specifically aimed at a more careful classification of the SME groups for support to innovation policy. Such insights would also represent an important input for the proper configuration of networks aimed at fostering innovation.

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Analyzing network effects of Corporate Social Responsibility implementation in food small and medium enterprises

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Abstract

Building on a literature review and an illustration with a concrete example, the goal of this article is to propose an analytical framework of Corporate Social Responsibility (CSR) implementation in food small and medium enterprises (SMEs) putting forward the issue of network effects. Indeed innovation networks and networking activities, as in any innovation process, are major means to enhance and foster CSR in SMEs, but the interests and concrete consequences of the network perspective for innovation capacity enhancement are rarely addressed. To do so we suggest considering CSR implementation as a type of managerial innovation and define by analogical reasoning the main categories of network effects found in the literature. From these, three critical dimensions of network effects are identified: structural, interactive and cognitive, each of them affecting specific dimensions of the innovation process. This analytical framework is synthesized and adapted for CSR implementation and then applied to a case study of a food SME involved in a collective initiative in France, putting in evidence these effects. Finally some managerial implications and concluding comments are drawn.

Keywords: food, implementation, learning, network, SME

1. Introduction

Corporate Social Responsibility (CSR) is as an active approach by which an organization intends to raise awareness of belonging to an environment, the consequences of its intervention in this environment and to correct or anticipate the consequences that are negative (Carroll, 1999; Dejean and Gond, 2004). The food sector, composed largely of small and medium enterprises (SMEs), carries strong characteristics especially in innovation aspects (Gellynck *et al.*, 2007; Hartmann, 2011). Indeed, the food company aiming at a sustainable development is often hampered by the complexity of problems and is not aware of its strengths and weaknesses, both in terms of positioning in its environment, of access to resources, of relationships with strategic partners and with major stakeholders. The issue of implementation of CSR in small and medium enterprises, that is to say, the actual implementation, with the necessary activation of a set of partners and mobilizing human, financial, organizational resources, is rarely addressed in an analytical perspective, especially from a network point of view.

The purpose of the article is to provide an analytical framework and evidence building of network effects in a CSR collective initiative in France targeted to food SMEs. The article is organized into four parts. In the first part (2) we specify the notion of CSR implementation, its context and its specificities for food SMEs. In the second part (3) we specify the network aspects of CSR implementation in relation with theoretical backgrounds. Then this approach is put into context through a case study of a food SME which has implemented CSR with the support of a collective initiative (4). Concluding comments follow (5).

2. Corporate Social Responsibility in SMEs: the network dimension

CSR is a major trend in modern business in which companies are expected to account explicitly for all aspects of their performance, economical, environmental and social. Such an implementation of complex CSR principles encompasses important managerial changes, in practices, processes and structures. CSR implementation in a company is a category of managerial innovation (OECD, 2005; Pitsis

et al. 2012) as these practices and procedures will be new to the firm (Damanpour and Aravind, 2012). As such managerial innovations induced by the implementation of the CSR principles in SMEs mobilized networks of different nature (Cramer, 2005; Fenwick, 2010; Jenkins, 2006, 2009; Perera, 2008, 2009). Their characterization has focused the attention of many researchers (Bonneveux and Saulquin, 2009; Jamali *et al.*, 2009). The works of Bonneveux and Saulquin (2009) for instance highlight the role of the network, seen as a framework 'which fit together resources and capabilities between the internal and external stakeholders', to allow integrated approaches of social responsibility. Thus the group of companies studied by the authors plays a role of coordinator of several families of players, where the territorial dimension (geographical proximity) will have an important task. The existence of the network organization reduces the information asymmetry on CSR and provides a more concrete representation of actions to integrate when a company wants to implement CSR. This experiential aspect of the networking activity is also acknowledged by Cramer (2005) and Fenwick (2010) in their research on CSR implementation at the company level. The network, as a collective actor, is also an interlocutor of the various stakeholders which allows a greater exchange of experiences, knowledge and resources, both tangible and intangible (Bonneveux and Saulquin, 2009).

For Jamali *et al.* (2009) the SME context of CSR implementation adds peculiarities, especially due to the importance of relational attributes and non-formalized rules and procedures. In opposition to large companies, SMEs usually rely on discretionary values and direct interpersonal links with stakeholders. For Jamali *et al.* (2009) 'the weaknesses of SMEs stemmed in turn from a limited integration and institutionalization of CSR processes and limited identification with the business case for CSR, and strategic CSR conceptions and orientations.' Jenkins (2006, 2009) also suggests considering this question of business case as central, suggesting that SME facing CSR needs considering more specifically the following aspects,: need of a change agent, i.e. a business champion able to guide the change process; need of external networks in order to have access to new skills and information; need of internal networks, that will transform and disseminate in-house this new knowledge.

A major difficulty in studying network effects in the implementation of CSR principles is its complexity and duration (Helfrich, 2010; Maon *et al.*, 2009). Moreover the implementation of the standard itself induces an activation of specific CSR stakeholders, which should not be confused with the creation of (often new) relationships with other types of actors, such as actors facilitating the setting up (consultants for instance) or institutional actors whose role would be to bring the innovation through a collective approach (such as a network coordinator). In other words, there are several categories of learning phenomena that are activated simultaneously, and will vary overtime (Maon *et al.*, 2009).

The process of implementing a managerial innovation such as CSR encompasses both structural and dynamic dimensions. Indeed, a company wishing to implement these principles must reconfigure its place in its environment by mobilizing jointly its individual and organizational partners over a relatively long period of time. In the words of Jenkins (2009), a SME has to 'build a CSR strategy from simple beginnings to a process of learning and networking'. The objective of the approach is to characterize these events in a heuristic manner. To illuminate the complexity and develop a contextualization of these phenomena applied to the food SMEs context (Fort *et al.*, 2005) we propose an analytical approach based on these two dimensions, reticular and procedural, of adopting CSR seen as a managerial innovation. As a highly complex phenomenon, the implementation of CSR in SMEs necessitates the delineation of different categories of effects. Following Agarwal *et al.* (2012) we will consider that the 'social capital of the organization (and its members) might be seen to be a potentially important determinant of the extent to which managers as change agents can engage in the learning, experimentation, reflection and communication (…) as it shapes the organization's access and exposure to new ideas.' These authors, in coherence with the social capital innovation theorists, identified three dimensions which will serve as a basis for the study of the network dimension: structural, interactive and cognitive.

3. Network effects in CSR implementation: theoretical backgrounds

We will consider successively three categories of network effects. The structural effect category finds its roots mainly in the structural analysis of networks, while interactive effects question more specifically the idea of a networking activity that will support or give rise to real innovations. Finally, the cognitive effect focuses on the impact of the time dimension on any networking activity, leading to irreversibility, to path dependency and to the accumulation of new and specific knowledge. A synthesis follows.

Exploring the structural dimensions of innovation networks

For Conway and Steward (2009) the network perspective applied to innovation research has considerably renewed and extended our knowledge on innovation processes. We will consider here the structural branch of these researches, rooted mainly in the social network analysis (Borgatti and Li, 2009; Borgatti *et al.*, 2009). The starting point of the process of structural analysis of networks is to consider any network as a combination of actors and relationships (Borgatti and Li, 2009; Burt, 1997, 2000). In the structural analysis of networks, the actors are not independent but rather interdependent and influence each other. To take into account the unique situation of each member and the network structure as such, the structural approach combines two complementary perspectives: the global network, that is to say its density, the average distance between each of its members, the existence of subsets more or less structured; and the ego network, that is to say the situation of an actor (an individual, a SME) in its environment and its degree of inclusion, its mode of insertion into the global network (Borgatti and Li, 2009, Borgatti *et al.*, 2009; Coulon, 2005). Actors are considered as nodes, and relationships between them as ties. Thus researches on innovation mobilizing the structural analysis of networks (Coulon, 2005) produces representation of innovation processes as maps (Conway *et al.*, 2001) or charts of nodes and relationships (Giuliani and Bell, 2005).

Consequently and in considering the CSR context, two families of components must first be identified: actors and relations (Jonker and De Witte, 2006). An important contribution of this approach for CSR is the simultaneous consideration of all types of actors involved (Cramer, 2005), in the first place individuals (which will constitute a social network) and organizations (the basis for an inter-organizational network). The identification of relationships that these actors have with one another is the second component. In line with social network theorists, these relationships can be of several types: continuous (similarities, relationships, interactions) or discrete (financial flows, knowledge flows), directed or not, measured by value or not, formal or informal (Borgatti and Li, 2009). The process of implementing management system standards such as CSR systematically involves usually two groups of major actors (Abdirahman and Sauvée, 2012, 2013; Abdirahman *et al.* 2013; Hatanaka *et al.*, 2005): individuals (managers, consultants etc.) and organizations (SMEs, standardization bodies such as ISO, the International Organization for Standardization, consular agencies, auditors, governmental bodies, banks, etc.). This adaptation of the approach also assumes that is taken into account the heterogeneity and complexity of the flows and interactions generated in the process, and mainly learning processes of knowledge creation and acquisition (Fenwick, 2010). Finally the network reveals itself, by its structural properties, as facilitating (or hindering) the implementation.

Networking activity as a complement of structural aspects

In the context of the implementation of CSR principles, knowledge transfer to the organization necessitates the mobilization of new cognitive resources and the activation of formal structures. An analytical approach applied to the implementation of CSR is therefore assumed that a better understanding of the learning processes is necessary. For Berthon *et al.* (2007), the mechanistic perspective is an essential step in that 'the transfer of knowledge, considered as the dependent variable, proceeds from an optimal layout between the nature of network and the types of knowledge. The question is often that of a systematic identification of structural and relational properties of the network, as brakes or levers of the knowledge transfer.' But this structural determinism cannot explain alone the implementation process. A subject as complex as CSR implies a set of interdependencies and a permanent adjustment between the actors, their objectives and the context in question (Gabriel *et al.*, 2013; Maon *et al.* 2009). Thus emerges a vision of co-constructed knowledge. In the end, a more complete representation of the relationship between network and organizational learning should show that the network is a 'channel for learning but, recursively, that the network is transformed by the learning taking place. In other words, the network is at least partly constructed by the learning processes, dynamically, deliberately and in an emergent manner' (Berthon *et al.*, 2007).

The ambivalent dimension of the network in the phenomena of innovation is demonstrated by Owen-Smith and Powell (2004), Powell *et al.* (1996, 2005) and Conway and Steward (2009). By distinguishing the network itself from the networking event, they show that the study of the innovation process involves taking into account both the structural dimension and interactivity. For Conway and Steward (2009), there is an interaction between the network as a structure and the networking event taking place in this network, with 'on the one hand, the network may constrain or liberate the patterns of interaction and exchanges between network members; on the other, networking behaviour may serve either to ossify (i.e. fix) the existing network membership and relationships, or create a dynamic in the membership and relationships within the network' (Conway and Steward, 2009). Not surprisingly, researches on CSR have widely adopted this vision (Cramer, 2005; Fenwick,

2010). This vision is developed and nicely synthesized by Berthon *et al.* (2007) in their study of implementation of IT standard projects. These authors point out that in the context of innovations mobilizing large transfers of knowledge, social networks and learning processes are involved. Thus, 'the formal structure of network, but also the quality and relational characteristics that are played out, have a role on the nature of the learning that occurs there' (Berthon *et al.*, 2007). One of the reasons that require the taking simultaneous consideration of structural and relational dimensions according to these authors rely on the fact that the individual, place of learning, is demanding of both resources and information but also demands a sense of belonging and social ties.

The processual dimension of CSR implementation: the cognitive network effects

The implementation of a standard goes through qualitatively distinct stages (Abdirahman and Sauvée, 2012; Henson and Humphrey, 2009, 2010) with an evolutionary perimeter of actors involved in the process. These steps are mostly a reflection of the types of actors mobilized and of their changing status or role from one phase to another. It is therefore necessary to consider explicitly the time dimension and its corollary, namely its influence over the types of actors involved, and over the process of adopting the CSR standard. This reflects the fact that the implementation of CSR is done in the long run and differentially mobilizes actors and resources (Capron *et al.*, 2011). Maon *et al.* (2009) rightly point out that CSR must be 'considered as an organizational change process whose aim is to align the organization with the dynamic demand of the business and social environment by identifying and managing stakeholder expectations' (Maon *et al.*, 2009). These phenomena will change the company, but will also change the environment in turn, engaging CSR as an activity 'evolutionary and recursive that acts on and reacts to and with the business environment' (Maon *et al.*, 2009).

The corollary of such a time dimension in the long run is the impact of knowledge creation and accumulation. Consequently the implementation of CSR within a company, with its deep impacts on organizational structures and management procedures, thus requests an original view of the combination between the implementation process and learning phenomena. Change in organization related to learning is an important body of literature, stemming mainly from the seminal works of Argyris and Schön (1996), and Levitt and March (1988). According to Pawlowsky (2003) and his extensive survey of literature on learning, it is clear that 'there are distinct perspectives on organizational learning that differ in respect to certain basic assumptions', nevertheless this author suggests that it is possible 'to see outlines of a picture that visualizes basic building stones of an integrative model of organizational learning'. His review suggests four different dimensions of learning: system-levels (from individual to network); learning modes (cognitive, cultural, action); learning types (single-loop, double-loop, deutero), and phases. Interestingly it is possible to connect these dimensions with approaches commonly found in the literature on CSR. Cramer (2005) for instance stresses the cognitive and learning aspects of CSR implementation in showing that 'it requires a double-loop form of learning, i.e. a critical reflection on the fundamental values, policy principles and operational procedures'. Similarly, authors such as Crossan *et al.* (1999) and Kleysen and Dyck (2001) put forward the role of network forms of organization in these learning processes, because 'relationships become structured, and some of the results of individual learning or shared understanding developed by groups become institutionalized as organizational artefacts' (Crossan *et al.*, 1999).

Following Podolny and Page (1998), and authors in social capital theory (Burt, 1997, 2000; Inkpen and Tsang, 2005; Nahapiet and Ghoshal, 1998), we will identify some characteristics of these cognitive effects that are paramount in the understanding of CSR implementation. The basic idea for these effects is the fact that at a certain period of its development, learning processes lead to different forms of institutionalization within a formal network, which thus become a kind of 'institution', producing its own rules, norms, values and culture, aspects themselves embedded in idiosyncratic resources and skills. In the terms of Powell *et al.* (1996) the network becomes progressively the 'locus of innovation'. Several authors rightly point out this 'institutionalization' dimension as a crucial stage of CSR development (Chiffoleau, 2005; Crossan *et al.*, 1999; Fenwick, 2010; Maon *et al.*, 2009).

Network effects in CSR implementation: a synthesis

The approach developed of CSR implementation is the delineation of the structural characteristics of network, of the characteristics of the networking activity and of the network seen as an institution. We have seen that this idea of three categories of network effects finds its source in the social capital theory (Burt, 1997, 2000; Inkpen and Tsang, 2005; Nahapiet and Ghoshal, 1998) and has already been developed in the context of innovation in general (Zheng, 2010) and managerial innovations in particular (Agarwal *et al.*, 2012). Nahapiet and Ghoshal (1998) for instance define social capital as 'the sum of the actual and

potential resources embedded within, available through, and derived from the network of relationships possessed by an individual of a social unit (…), it comprises both the network and the assets that may be mobilized though that network'. As suggested by Pittaway *et al.* (2004) and Conway and Steward (2009), the connection has been made between the benefits of network and innovation. But the literature on the role and functions of networks on innovation can be approached through at least two interpretations (Conway and Steward, 2009). In the first one the network is seen as a new way of organizing innovation activities, between market and hierarchy: it is thus the governance aspect that is emphasized. In the second one the network is not considered *per se* as a specific mode of organizing activities benefiting (or not) to innovation. Instead it is viewed as a new analytical lens interesting to focus on because it produces a wide range of effects, of externalities, that will influence the innovation processes. Doing so, the network is tracked via the effects it may produce, as a phenomenon affecting any economic life.

Interaction effects between individuals for instance will probably be more important at early stages of the innovation processes, while structural dimensions are more predominant in well-established network relationships. Finally, cognitive effects will be mainly related to the institutionalization (Crossan *et al.*, 1999) of a formal innovation network, especially when it 'becomes formalized into rules, routines and procedures' (Crossan *et al.*, 1999) which also tends to create path dependency, organizational memory, common resources and sense-making (Weick, 1995). These network effects on innovation are summarized in Table 1.

4. A case study of network effects in CSR implementation

First of all we detail the research protocol and its theoretical foundations, which is mainly an exploratory research based on one case study. Then we explain the context of CSR implementation and the main characteristics of the case study, which is an ongoing regional collective initiative around CSR conducted in France, from a network as a whole as well as from a firm level. Finally the network effects are synthesized, according to our analytical framework.

Case study methodology and research protocol

In the study of a dynamic process involving several actors, it is necessary to implement a research setting in the spirit of a theoretical sampling (Eisenhardt, 1989) and a case study methodology (Yin, 2009). Consequently the approach of the case study adopted is in line with those developed by Yin (2009), Le Goff (2002), Dubois and Gadde (2002) and Eisenhardt (1989). For Yin (2009) the abductive approach to case study is well suited when the phenomenon to be studied is unclear. An exploratory research by the case allows making sense of complex situations. For Le Goff (2002) the heuristic quality of the case study approach is 'likely to update elements deviant or surprising. The case study allows the detection of new phenomena' (Le Goff, 2002). Another key element of the methodological approach adopted is the posture of back and forth between theory and the field, called 'systematic combining' as developed by Dubois and Gadde (2002). For these authors, the case study is simultaneously a tool and a product. In contrast to deductive and inductive approaches, this approach allows to discover new variables and new relationships between these variables, creating a 'fruitful cross-fertilization where new combinations are developed through a mixture of

Table 1. Network effects in innovation process (based upon Conway and Steward (2009), Pittaway *et al.* (2004), Podolny and Page (1998), Coulon (2005), Powell *et al.* (1996), Agarwal *et al.* (2012)).

Structural	Interaction	Cognitive
density	intensity	memory
diversity	nature of relationship	organizational culture
size	symmetry/reciprocity	creation of tacit knowledge
complementarity	multiplexity	norms
position	trust	legitimation
connectedness	formality	sensemaking
pooling of resources		
geographical proximity		

established theoretical models and new concepts derived from the confrontation with reality' (Dubois and Gadde, 2002). Finally we have developed this case study approach as it is well adapted to the context of managerial innovation (Pitsis *et al.*, 2012).

In practical terms, the data were collected from questionnaires and interviews designed as part of the research protocol of the FP7 European project called NetGrow. In this project the data collection is done through two complementary approaches: one focusing on the approach of the global innovation network, and the other on the approach of a focal company (called ego network). The actors of the global network are classified into four categories: network coordinator, business firms, governmental bodies, research organizations. The network centred on a focal firm is approached through four sections: identification of key phases of innovation, identification of partners (individuals and organizations), nature of trade (knowledge, finance, etc.), and nature of interactions (social relations, flows of trade, knowledge, information and resources).

For the case study, this is a total of six semi-structured centred exploratory interviews (Romelaer, 2005) that were conducted face to face. Two interviews were done with the network coordinators, an interview with a government representative, and interview with an expert (considered as a research organization and knowledge transfer centre) and two interviews with members of one food SME (quality responsible and production responsible). After taking into account the specificities of the case, the research protocol of the NetGrow project was adapted. The nature of information collected by type of actors is specified in Table 2. The interview guide of this research highlight the actors involved in learning and the means of the learning. Then, we characterize the learning phenomena as well the means for interaction, their support and their content. The categories of actors contacted are the coordinator of the network, a company, a public body and the experts. Each actor has been interviewed during one hour. The interviewing protocol has two stages: the first one concerned the network manager, the second one focused on the SMEs.

Context and main characteristics of the case study

The field of our case study investigation is developed simultaneously at two levels: firstly at the network level called 'Destination Développement Durable' (Sustainable Development Destination; 3D) in the Aquitaine region in France and secondly hand at the SME level with a SME member of this network, the company Vignerons de Buzet (VdB).

3D is born from the initiative in 2005 of the Regional Federation of Agricultural Cooperatives in Aquitaine (FRCAA) and the French Association for Standardization (the French branch of ISO, the International Organization for Standardization: Afnor). The 3D network is formalized by a contract of partnership between these two entities (Abdirahman and Sauvée, 2012; Abdirahman *et al.*, 2013). This collective effort has allowed thirteen food companies to embark on the path of sustainable development and to be accompanied constantly in their will the set up CSR principles, mainly based upon the ISO 26000 standard defining CSR guidelines for companies (Abdirahman and Sauvée, 2013; Capron *et al.*, 2011; Perera, 2008, 2009). This new ISO 26000 standard has been launched internationally in 2010 and translated for the French food sector by Afnor

Table 2. Nature of information collected according to the categories of actors.

Subjects in questionnaires	Categories interviewed			
	Coordinator	Company	Public body	Research center
Network profile	X			
Network inception	X		X	
Network activities and members	X	X	X	X
Network and member evolution	X		X	
Network configuration and links	X	X		X
Network governance and management	X		X	
Performance	X	X	X	X
Innovation phases		X		

and professional bodies in 2011, creating a strong dynamic in the sector around this issue.

Thus a group of companies was created with common values and shared ambitions to structure a wide range of actions in coherence with their priority stakeholders (mainly consumers, buyers, local authorities, insurance companies, environmental groups, etc.).

At the 3D network level, the main drivers in Aquitaine were, with the participation of agribusiness, to anticipate the evolution of regulations and prepare for the new constraints of CSR rather than suffer afterward without taking the time to prepare. But the food SMEs were lacking at that time of sufficient knowledge, of internal resources such as human resources devoted to CSR issues. More importantly, the food SMEs in the Aquitaine region were not aware of the new values and social norms that such an approach necessitates.

Progressively the 3D network has several important roles. Mainly the key pivotal role of 3D network is to provide the 3D tool. It is essentially the creation of common services built around three themes:

1. The training, for SME managers, in the preparation of the process of implementing CSR principles.
2. The availability of a diagnosis tool linked to a pool of specialized experts that leads to the offer of the comprehensive consulting services for SMEs taking into account the principles of CSR synthesized in eight criteria. The consultants are trained in CSR by the network drivers to become 3D experts.
3. The communication (website, brand name, communication tools vis-à-vis stakeholders).

VdB is a wine cellar cooperative founded in 1953 and located in the Lot-et-Garonne district in the South-West of France. This is an SME which includes 234 growers and has 88 employees. The activities of the cave are from the grapes production to the marketing of wine bottles. To do this, the cooperative has two winemaking sites, two aging cellars and two packaging lines. The annual production is around 90,000 hl. Much of the production (estimated at 80%) is devoted to France; the remaining 20% are exported to European countries, Japan, Russia and Canada. The SME is engaged in the 3D network and this initiative is in line with all strategic actions already taken by the company in terms of certification (Agri Confiance®, a quality and environmental standard set up by French cooperatives based upon ISO 9001 and ISO 14001 standards). The antecedents of the SME in terms of certifications and their former collaborations with the network drivers in the case of AgriConfiance® certification are factors of maturity and most trusted determinants for their decision to adopt CSR principles through this network. The lack of resources, including financial, is a constraint requiring the implementation of a strategy to support new practices (Berger-Douce, 2007). SMEs benefited, like other companies, of funding from the governmental body (DIRECCTE) via the 3D network and also received complementary funding from the Aquitaine Regional Council.

The issue of CSR brings three major challenges for any food business (Abdirahman and Sauvée, 2013; Hartmann, 2011): (1) the creation of a pool of specific resources; (2) the need to communicate its sustainable practices with stakeholders; (3) the creation a community of practice (in the sense of Wenger, 2000) leading finally to the creation of an organizational culture. In this sense, the 3D network can be seen as a virtual place that matches a learning platform for food SMEs, a communication tool with stakeholders and a set of resources that provide the socio material basis for this community of practice. Thus this collective learning process creates a dynamic favouring the appropriation, at the firm level, of social and environmental issues.

Table 3 summarizes the main basic components found at the network (whole network) and individual (ego network) levels. These building blocks are differentiated in two parts. First of all one should consider the resources that have been developed in house. These resources are mainly virtual (embedded in the intranet system) but are also found in the specific human expertise of CSR consultants. The 3D network is a bundle of specific resources exclusively available to its members. But, more importantly, the 3D network is also an infrastructure of communication channels that can be activated by the network managers and the members. In other words the communication channel of the network brings an opportunity of communication, which is, as we will see, conditional to the expression of networks effects.

Network effects in CSR implementation

In order to delineate precisely the network effects that occur in CSR implementation, it is necessary to proceed in two steps. The first step identifies the main qualitative phases of CSR implementation, each of these phases being considered as a specific contextual environment with regard to the mobilization of formal network(s) and of networking activities; the second step crosses these phases with the network dimensions and their main identified effects on innovation processes.

Table 3. The main resources and communication channels for CSR implementation in the 3D network.

Levels	Resources for interaction and learning	Modes of interaction/exchange
Organizational	3D website sustainable development reports identification guide of the stakeholders human resources: pool of CSR experts	formal intranet adhesion by members elaboration and diffusion through website web diffusion to 3D members direct interpersonal exchanges
Individual	specific knowledge on CSR (3D experts) CSR training resources cross auditing	self-training through common resources training sessions: external (in the community of practice); internal (in the companies) interpersonal exchanges

The processual dimension of CSR implementation: the phases

The identification of distinct phases which have been chosen for the 3D case study is based upon previous researches on CSR and on quality standard implementation (Abdirahman and Sauvée, 2012; Henson and Humphrey, 2009, 2010; Maon *et al.*, 2009). Concerning CSR, Maon *et al.* (2009) propose four phases, based on a critical review of literature articulated with case studies: awareness, challenge, set in motion, re-appropriation, each of these phases differing itself in successive steps, which are identified by analogical comparison with the management standard implementation (Abdirahman and Sauvée, 2012). Phase 1 includes a single stage at which the organization seeks to increase its awareness in the value of CSR to define its business strategy. The key role of the leader is often mentioned, that it responds to external partners (stakeholders such as NGOs, market pressure ...) or internal partners (increased weight of the values held by certain employees or groups of pressure within the company). This phase will be labelled as the antecedent phase in the case study. Phase 2 will lead to the decision to implement CSR (decision phase in the case study) and differs in four steps. First the company must question the meaning of its commitment to society and to its relationship with key stakeholders. In particular it is necessary to identify what are the social issues specific to these stakeholders and what are the critical resources involved. In a second step the company must develop its own vision and a concrete implementation of this vision. A third step is the audit as such, where the company, for each of the three CSR pillars, compared with those of competitors and the expected standards. Finally a fourth step is the establishment of integrated strategic plans for the implementation of CSR principles. Phase 3 called set in motion is divided into three steps. This phase will be identified as the 'set up' phase in the case study. The first step is the actual implementation of actions to be taken, a step that involves active networking in order to acquire the necessary material and immaterial resources. The second step covers all activities of internal and external communication for the implementation of CSR. The third step is the one to evaluate the results obtained from the dashboard of indicators. Phase 4 consists of a single step called institutionalization: this is the post evaluation phase of the case study. For Maon *et al.* (2009) this crucial phase should provide answers to the question of the sustainability of the action. Given the constraints, including competitive pressures, market risks or demotivation of employees that could result in medium term to a questioning of the strategy, the organization must have a clear commitment of resources, incentive mechanisms and official permanent controls leading to a continuous quality improvement.

Crossing phases and categories of network effects

We decrypt the phenomena of complex learning processes of adopting the principles of CSR of one food SME called VdB. We have highlighted the phenomena in considering, according to our analytical framework, the three categories of network effects, namely structural, interactive and cognitive. We focus successively on the four main phases as defined previously: antecedents, decision, set up, post evaluation. From a global point of view, the implementation of CSR can be interpreted as a collective process of creation, transfer, adaptation and dissemination of primarily explicit knowledge contained in the CSR principles into tacit and adapted knowledge at company level. As summarized in Table 3, the learning phenomena at the core of the CSR implementation are the existence of a pooling of assets coupled with various networking activities: in the 3D case study, the resources are put in common for all SMEs joining the network, allowing the creation of cumulative

effects for the learning of CSR new practices. From an analytical point of view, it is possible to delineate according to our framework the network effects of the process of implementing the principles of CSR, which are in practice intertwined at the individual/organizational level and at the level of the network as a whole (cf. Table 4 for a synthesis).

- The structural effects
  The idea of structural effects is to put forward the nature, diversity, position of actors (individuals and organizations), involved in the process, and the content of the links between them. During the antecedent phase the main structural aspect is the existence of community

Table 4. Network effects of CSR implementation in a dynamic perspective: a synthesis.

Network effects	Phases			
	Antecedents	Decision	Set up	Post evaluation
Structural	• Size and origin of the SME community (agricultural cooperatives in Aquitaine region) • Geographical proximity of founding members (FRCAA and Afnor Aquitaine)	• Organizations: small size and diversity of core members (SME, FRCAA, Afnor) • Individuals: SME managers and network coordinators at FRCAA and Afnor Aquitaine	• Organizations: Increase of the size and of the diversity of the network: 13 SMEs, 3D experts, network coordinators, external consultants • Individuals: extension of interpersonal networks both inside and outside the company	• Informal network of the 3D community of SMEs and affiliated partners (mainly external consultants) • Dyad organizational network between VdB and certification/evaluation body
Interaction	• Previous exchanges between members around common projects • Proximity exchange at local/regional levels • Previous communication channels and interactions with consultants in environment • Formal meetings to increase awareness about CSR issues	• Interactions between 3D network coordinator and VdB managing director • Interactions between managing director and quality responsible	• External exchange workshops (VdB, other SMEs, consultants) • Internal exchange workshops (employees, directors) • Cross audits between SMEs including VdB • Direct communication and shared experiences around 3D tools • Training periods with 3D experts • Evaluation audit with Afaq	• Permanent internal interaction between employees, quality responsible, managing director at VdB • Frequent interactions with other SME managers within the 3D community • Exchange in occasional CSR seminars
Cognitive		• Adhesion to the 3D charter (explicit knowledge about CSR)	• Memory: accumulated explicit knowledge about CSR practices (sustainable reports) • Progressive emergence of a 3D organizational culture shared experiences	• Cumulative phenomena: – accumulated knowledge by 3D experts – accumulated knowledge through real experiences shared by SMEs – deepening of the organizational culture through emergence of a community of practice

of agri-food companies constitutive of the FRCAA, the regional federation of agricultural cooperatives of the Aquitaine region. This professional community, already formally organized, is the basic component of the network. Then the formal agreement between FRCAA and Afnor creates a dyad of institutional actors, well balanced between the two as the initiative has been launched commonly. The geographical proximity of all actors, all of them installed in the Aquitaine region, is also to acknowledge.

During the following phases, the pivotal role of the 3D experts is the main structural effect. Indeed, at the individual level, 3D experts are involved in this phase because they accompany SMEs in the implementation of CSR principles. They play a key role in ensuring the essential functions of the translation of the standard (Abdirahman and Sauvée, 2012; Brodhag, 2011) in that they facilitate the passage of a normative content of its implementation in the actual practices of SMEs, as we will see below. Another important structural aspect is the existence of formal links between experts who have a contract with the network coordinator. Thus there is a collective and structured interface between experts and all SME members of the 3D network, which will form the basis of networking activities: this is the complementarities of the two facets, as emphasized in the literature (Berthon *et al.*, 2007; Conway and Steward, 2009).

Concerning the position of the VdB company within the network, it evolves during the process from peripheral to central: from a position as an undifferentiated member of the federation, the company is progressively moving toward a status of singular actor during the emergence and development of dedicated exchange with experts.

- The interaction effects

  As shown by authors such as Pawlowsky (2003), interactions form the basis of learning and as such must be carefully investigated. In the antecedent phase, previous important projects conducted within the federation (such as AgriConfiance®) has led to significant interaction activities with various consultants in the domain of environment, opening the path for other innovative projects. Concerning the CSR project in itself during the antecedent phase, the VdB company has received mainly information and soft knowledge about awareness to CSR issues and the broad content of CSR principles. At this stage, the SME uses intranet and is not challenged to do more. Therefore the type of learning is single loop, by drawing an analogy with the works of Argyris and Schön (1996), because at that stage the changes involved are absent or limited. The decision to implement CSR occurs through exchanges at the individual level between the network coordinator and the VdB managing director, and between the managing director and the quality responsible.

  During the set up phase, 3D experts, strongly in interaction with SMEs involved in the process, have played both roles of adapters and of diffusers of the CSR principles. At the individual level, the quality manager is the appropriate partner for 3D experts. In our case study, the VdB company learned through these interactions. The company also learned thanks to the cross audits within the 3D community, by adaptation/translation of its practices. As such, the company has progressively identified its sustainable practices internally and corrected or gave rise to other practices referring to the 3D tool. These practices have involved changes or creation of new procedures, instructions and staff training on certain themes of CSR. In this case we have an example of the double-loop learning, in the sense of Argyris and Schön (1996): the company sets up procedures which will induce deep changes in the managerial practices and in the strategy.

  During the post evaluation phase, the company wants to obtain recognition of CSR practices internally via AFAQ, an evaluation/certification organization. The AFAQ 26000, a CSR assessment tool, is applied in interaction with the company through a formal auditing activity, in order to meet the requirements of the evaluation. It is to be noticed also that during this phase the permanent improvement process is backed up by an intense interpersonal networking activity between employees of the company, exchanges orchestrated by the quality responsible.

  The interactions are mainly done through informal relationships (or virtual direct contacts between business leaders and quality managers) that will induce a phenomenon of imitation and emulation. This interaction effect put forward the key role of the constitution of informal social networks which roles should be more clearly acknowledged in the future. The main interactive mechanism at the company level is mimicry, defined as observation, comparison and self-evaluation of strategic behaviours. We will see that these mechanisms will lead eventually to the creation of a common organizational culture and shared values.

- The cognitive effects

  Not surprisingly, the cognitive network effects are mainly identified at the 3D network level, where the major resources are found. We have seen that the FRCAA organization has created a website called 3D in which companies can download and communicate their

sustainability reports. The companies also have access to the 3D tool developed by FRCAA in collaboration with Afnor, and to the identification guide of stakeholders.

First of all, the cognitive dimension emerges through the creation of an organizational memory within the network. Indeed the establishment of this collective memory is permitted by the publication of SME sustainable reports on the 3D website, thus open to the public. In parallel, the creation of the common intranet contributes to the emergence of a virtual centre accessible simultaneously to all members of the 3D network. This intranet platform reduces the risk of opportunistic capture of the resource by members in placing them at the centre of the network.

The cognitive dimension of the 3D network is also found in mass and cumulative effects: knowledge is progressively stored on the intranet and thus accumulates over the years. Finally a community of practice (Wenger, 2000) encompassing the SMEs involved in the 3D network has emerged, through a common use of 3D tools, the development of shared values and norms, the identification of the companies to the brand name. It induced a creation of an organizational culture which can be considered at its early stage of development.

5. Some managerial implications and concluding comments

We propose in this article an analytical framework of the implementation of CSR in food SMEs which aim is to identify the main network effects. From a literature review, we highlight the key components of the CSR implementation, in their structural and processual aspects, starting point for the construction of this framework. This framework is then applied to an example of a collective initiative of CSR implementation in a food SME in the Aquitaine region in France.

The proposed framework has two major advantages. Analytically, our research allows a better understanding how organizational and individual variables actually fit together and explain the implementation of CSR principles in a particular SME context.This framework is also an analytical tool useful to identify and to characterize the functions of different groups of actors: indeed it reveals synergies and complementarities at different levels. In doing so, from a managerial point of view, this framework constitutes the embryo of a learning tool, highlighting the strengths and weaknesses of formal networks as well as of networking activities. Indeed, SMEs are often identified, because of their size, isolation or lack of resources, complexities of rules and procedures, as experiencing difficulties to implement CSR. In the spirit of the NetGrow project, it could be further developed in the future for accompanying SMEs in their will to implement CSR. More precisely the analytical framework could help to better characterize objectively the role and place of SMEs within their web of partners and to identify resources and skills having a greater impact on the process, in relation with the critical phases.

Considering the perspective of research, this exploratory approach must be complemented by a replication to similar situations of other SMEs in the 3D network, and to other situations of managerial innovations in collective initiatives (such as other ISO standards, organic farming labels, private standards like IFS and BRC), in order to reinforce the value of these preliminary results.

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The role of prior experience, intellectual property protection and communication on trust and performance in innovation alliances

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Abstract

An important concept in innovation literature is open innovation, where firms may use knowledge of other companies to develop new products or processes. However, there is a tension between the desire to be open, to profit from the knowledge of others, and the desire to be closed to prevent others from making use of the firms own profitable knowledge. Formal and non-formal intellectual property (IP) protection mechanisms may protect the company in an innovation alliance, but are often costly and may hinder flexibility and creativity. In the present paper the role of formal and non-formal IP protection arrangements and communication on the building and maintenance of trust and ultimately on performance has been investigated. A survey questionnaire was combined with semi-structured interviews of CEOs and R&D managers of seven companies and two commercial research organizations in the seed sector, one agrifood company, one commercial research organization in the agrifood and one commercial research organization in the high-tech sector. Thirty-three innovation alliances were investigated in total. It was found that for companies active in an innovation alliance it is important to understand how prior experiences, IP protection and communication influence the level of trust in an alliance, and that the level of trust is positively related to innovation performance. Recommendations are given for open innovation managers how to make optimal use of the innovation potential of the alliance partner(s), by fostering communication within the alliance and by using formal IP protection arrangements as a platform to create trust within the alliance.

Keywords: open innovation, intellectual property protection, trust, innovation alliance, innovation performance

1. Introduction

Innovation can be defined as 'the implementation of a new or significantly improved product (good or service), process, marketing or organizational method …' (OECD and EUROSTAT, 2005). Although this definition is very general and broad, it is clear that innovation is about improvement of the current situation by applying novel knowledge in novel ways. Novel knowledge often results from the interaction between actors (being people or companies or even countries) that differ largely from one another and do (therefore) not often interact with one another, e.g. Granovetters concept of weak ties (1973, 1983). In contrast to earlier research, which ascribe the practice of technological innovation to a corporate R&D lab embedded in a vertically integrated commercialization infrastructure (e.g. Burgelman and Rosenbloom, 1997), the concept of Open Innovation, introduced by Chessbrough (2003) postulates that firms can and should use external as well as internal ideas, knowledge and technology if they want to be successful in innovation. Chessbrough and Rosenbloom (2002) emphasize that a prerequisite for successful commercialization of innovations, whether ranging from internal or external sources, is that these need to be aligned to the firms strategy and business model (cf. Fortuin, 2007; Zott, *et al.*, 2011).

There are different ways in which firms access the knowledge and technology needed to complement their own internal resources available for innovations. Where some companies

look for technology sourcing and acquisition (Arora *et al.*, 2001; Nicholls-Nixon and Woo, 2003), others will go for strategic alliances with external suppliers of technology (Narula and Hagedoorn, 1999), or prefer a collaborative R&D joint venture (Peck, 1986). Next to these more linear inbound and outbound modes of open innovation, Enkel *et al.* (2009) conceptualize the two-way interaction between firms and innovative actors outside the firm as the coupled mode of open innovation. The present paper focusses on the latter form of open innovation. In the review paper on open innovation, West and Bogers (2013) conclude that although the value creation potential of open innovation is consistently established in many studies, more research is needed on how value from such sources is captured.

The great challenge of this open innovation paradigm is how to retain value for one's company. How can one make sure that knowledge (or at least: its commercially applicable outcomes related to one's own business) remains exclusively one's own property – and thus valuable? How do companies protect knowledge so that they can enjoy the fruits of their own research (Omta and Van Rossum, 1999)? The opener one is, the larger the amount of new knowledge that can be accessed from others, but also the larger the chance that other firms will benefit from one's private research investments. A balance has to be found, and in the background lies the permanent pitfall for innovation: that firms lock themselves up in their R&D-laboratories and do not share ideas and licenses that may be valuable to others and hence to the economy at large.

Formal intellectual property (IP) rights, confidentiality agreements and other kinds of institutional arrangements to prevent knowledge being stolen by other firms, may offer a solution here. But these arrangements are often expensive in terms of time, knowledge and money, and vulnerable for power differences in negotiations (Ozmel *et al.*, 2013), which may make them especially difficult to apply for small and medium sized firms (SMEs). Furthermore, every arrangement has its specific characteristics that make it more or less suitable for different situations (Denolf, 2010). For example recipes cannot be protected by patents, but are very valuable for many producers of consumer goods in the agrifood sector. Another example is that patents are published in an open database, and can thus reveal important information about a company's strategic R&D choices to competitors. Finally, these arrangements may turn out to put a lag upon innovation, as they are rigid and hence hinder creativity and flexibility, which is especially important in the case of innovation, which is per definition an uncertain process (Tepić *et al.*, 2014).

A solution to this tension might be found in building (in case of a new alliance partner), or maintaining (during the alliance trajectory and in case of prior experience with a partner) trust that one's partner(s) will not abuse one's vulnerability when one is open with one's information. In this way, trust may substitute or compliment IP arrangements (Barney and Hansen, 1994). However, just knowing the role of trust is not enough, because trust is not a static concept, being either present or absent in a certain relationship. It is a dynamic concept: trust can be present in different levels, and the level of trust in a relationship may increase or decrease over time. Hence it is important to improve our understanding of the way in which trust develops. Once the factors leading to higher levels of trust are better understood, they can be used to advice managers how to foster trust in the uncertain world of innovation alliances.

The present study aims to improve our insight in the role of the interplay of past experience, IP protection and communication on trust and on the performance of innovation alliances. A survey questionnaire was combined with semi-structured interviews with the managers of 5 companies and of 5 commercial research organizations that are centrally involved in one or more innovation alliances. Questions were asked about possible previous experience with (successful or failed) innovation alliances, the IP protection methods used, the communication level and the building and maintenance of trust within the alliance and this was related to the perceived innovation performance of the alliance.

The remainder of this paper is organized as follows. Section 2 contains the theoretical background and the conceptual model underlying the empirical research carried out for the present study. In Section 3 a description of the research methods (questionnaire construction, data collection and data analysis) is given. In the results Section 4, a PLS model that shows the relations between the different constructs will be discussed. In Section 5 the conclusions and the limitations of the present study are presented and in Section 6 recommendations for innovation managers are provided.

2. Theoretical framework

Open innovation can be carried out in different governance forms, each with different characteristics related to the communication channels used for knowledge sharing, the incentives used to actuate the innovation partner(s) and the types of property rights used (Felin and Zenger, in press). One of the governance forms is called partnerships, alliances and CVC (corporate venture capital). This type is

well suited in case of moderately complex problems that need significant knowledge exchange to be solved, while the information needed for a solution may be hidden from the problem owner (Felin and Zenger, in press). It is this type of governance that the present paper will investigate, as due to the problem complexity complete IP protection arrangements are impossible to achieve and communication between the partners is normally rich.

In an innovation alliance, as we will call this governance form, the actual (open) innovation is carried out. Here different companies with different expertise come together to share knowledge and experience, to make use of technologies of the other(s) and to create an innovation that would not have been feasible for them alone, or at least not at that speed, low costs and with that quality. However, in an innovation alliance collaborating parties are vulnerable. They open themselves up to the partner(s), and they share their technologies, knowledge and experience, but they do not want the partner(s) to benefit from it outside the purposes and boundaries of the innovation alliance itself. Furthermore, one can suffer from opportunism from the side of the other party, for example if a partner leaves the alliance before the results are reached, or does not invest in the alliance as agreed upon in advance. Hence, it is important to make sure that one can be secure of each other within the alliance. This should be guaranteed at the inception of the collaboration. Hence this research can be placed in the first phase of the model how firms profit from external innovations, as proposed by West and Bogers (2013), namely the phase of obtaining innovations from external sources.

In literature, different means to establish this security within collaboration have been discussed. The concepts of control (which we will call IP protection) and trust are often key in these discussions, while also communication between the partners seems to be of special importance. And not only may these factors influence each other (e.g. some argue that IP arrangements can be a prerequisite for trust), but they also may influence the innovation performance of the alliance itself, which of course is the ultimate goal of starting any innovation alliance, while IP and trust are only means towards this goal. To describe these different concepts and how they may be expected to influence each other, first the concept of trust will be introduced, than the relation between trust and IP and the role of prior experience and communication will be discussed. Finally concepts will be brought together in a framework of the innovation alliance.

Trust can be defined as 'the mutual confidence that no party to an exchange will exploit anothers vulnerabilities' (Sabel, 1993, in Barney and Hansen, 1994: 176). Within the concept of trust we can make two important distinctions. The first is between psychological and behavioral perspectives on trust (Poppo, 2013). From a psychological perspective, trust is related to expectations and beliefs, in other words: attributes ascribed to the other partner. From a behavioral perspective, trust is observed in actual behavior and builds through ongoing cooperative interactions. The second distinction is between intentional and competence trust. Intentional trust is trust in the good intentions of the partner(s), especially related to opportunism. Competence trust is trust in the technical, cognitive, organizational and communicative competences of a partner (Klein Woolthuis *et al.*, 2005: 814). The difference is thus between willingness and ability of the partner, and both may be difficult to grasp before one starts a collaboration.

Trust can be a source of competitive advantage (Barney and Hansen, 1994), as trust may substitute for costly governance costs to prevent opportunism; and trust may open new options for partners in the exchange, because these options would not be economically feasible if governance costs would have to be made to prevent opportunism. Furthermore, one could argue that in case of trust one can find new possibilities to cooperate, as one does not have to keep information away from the partner and new possibilities for synergy may be found. However, it is difficult to know if the partner is trustworthy, especially as (nearly) every company may fall prey to opportunism if the golden opportunity comes by, or if a bankruptcy is close (Nooteboom, 2006).

Our main interest lies in the role of prior alliance experience and IP protection on building trust. As Poppo (2013) shows in her review on interorganizational trust, prior experience with a partner (in her words 'the shadow of the past' (p.134)) has been shown to build trust. From a psychological perspective, this can be explained by trusting beliefs becoming stronger over time as these beliefs are confirmed. Here the psychological and the behavioral view on trust overlap, as these beliefs are confirmed by actual behavior in interactions with the partner.

The other important factor related to trust, IP protection, can be described as the process by which entrepreneurs can retain the uniqueness and value of their technological competences (MacEvily *et al.*, 2004: 714), while 'intellectual property, often known as IP, refers to creations of the mind: inventions (patents), literary and artistic works, symbols, names, images, designs used in commerce' (EU Copyright Office; www.eucopyright.com/en/what-is-intellectual-property). IP is important, as 'the owner of intellectual

property can control and be rewarded for its use, and this encourages further innovation and creativity to the benefit of us all'. There is a big debate in literature about the relationship between trust and IP protection (or in literature terms: control, e.g. Poppo, 2013). Three different relations have been proposed (Klein Woolthuis *et al.*, 2005). The first stream, stemming from transaction cost economics, regards IP as a basis for trust, as IP arrangements make opportunistic behavior more difficult. The second view conceptualizes IP in conflict with trust, as the setting up of IP arrangements might be regarded as a sign of distrust by the partner(s); IP arrangements may then even evoke conflict. Hence it is argued that IP negatively influences the level of trust. And thirdly, there is the notion that trust precedes IP arrangements and thus decreases the need for formal arrangements; the relation is embedded in trust.

Empirical evidence has shown that trust and IP can be both substitutes and complements to one another (Klein Woolthuis *et al.*, 2005). On the one hand, trust can substitute for IP as a high level of trust has been found to reduce the need for contracts and monitoring (Das and Teng, 1998). On the other hand, trust and IP can be regarded to complement each other, as they are found hand in hand (e.g. Luo, 2002) or preceding contractual arrangements (Larson, 1992). Omta and Van Rossum (1999) found, in their study of twelve failed alliances, that distrust (and related: fear) were important in seven of these alliances. They even report that (in two cases) the IP negotiations between (specifically: European and American) partners were made much longer and more difficult because the American partners started the negotiations with 'corporate lawyers and fist-sized contracts' (Omta and Van Rossum, 1999: 6). However, the question remains how and why IP and trust sometimes complement and sometimes substitute each other.

An important distinction in IP protection is between formal and non-formal IP (Bönte and Keilbach, 2005). Building on Denolf (2010), in Table 1 we provide an overview of formal and non-formal IP protection methods. Denolf argues that IP protection methods are often used complementary to one another. Furthermore, industries differ in which IP protection methods they apply most. Here, the kind of innovation that one wants to protect is important. For process innovation confidentiality and for product innovation speed of gaining market share are often regarded as the most effective way to protect the innovation. Also the size of the company matters. Smaller companies tend more to speed, trade secrets and confidentiality and larger companies more to formal IP protection methods. It can be expected that the IP protection status of a company is of influence on the innovation performance of alliances, e.g. a company is expected to be more inclined towards cooperation with (potential) competitors if the company is sure one's own intellectual property is well protected. It may be expected that the experience a company has with previous alliances has an influence on future alliances, as well. For example, if a company has experienced a failed alliance, one may expect that this company will take more precautions to prevent a new failure by making more specific arrangements about IP and the deliverables.

Communication is also expected to play a role in the alliance, both in its performance as well as in the development of trust. This could be perceived as an intermediary role: it is not the communication itself that increases performance or trust, but it is the means through which novel knowledge travels or a trustworthy impression may develop. Communication may build trust, at least if the partner(s) is/are indeed trustworthy (Becerra and Gupta, 2003). Trust starts off with the general propensity to trust of the trusting party (the trustor) and the impression the trustor has about the party to be trusted (the trustee). More communication gives the trustor more information about the trustee and whether or not the trustee can be trusted, or in terms of Poppo (2013), knowledge-based trust is built. And indeed, Becerra and Gupta (2003) find a positive relation between the amount of communication and the evaluation of trustworthiness. Hence we expect to find that communication builds trust within an alliance. A different reason to assume a positive relation between communication and trust, is that communication offers a means for monitoring the arrangements made, or that one is less inclined to betray a person with whom one has a personal relationship (which is built by frequent contacts, Nilsson, 2008). Finally, communication is related to the

Table 1. Formal and non-formal intellectual property (IP) protection methods.

Non-formal IP protection	• confidentiality, trade secrets • complexity of the product design or technology platform • quick standardization, speed of gaining market share • use of passwords • limitation of the internal mobility of personnel (glass walls)
Formal IP protection	• patents, copyrights, trademarks, design rights • contracts (e.g. collaboration agreements) • non-competition clauses in contracts of employees

innovation performance itself. Here it is again useful to turn to Granovetter (1973, 1983). He shows, in his theory of the strength of weak ties, how communication is important in the spread of ideas. Novel information, which much more often leads to innovation than familiar ideas do, ranges most often from social groups relatively distant from oneself (as otherwise, the information would be familiar already). Hence, especially the relationships (the ties in a network) between people relatively distant and different from one another are important. As these people are more different, they are more likely to dwell in different social groups and hence to have access to different knowledge. Thus, these weak ties are thought to be a very valuable source of new ideas and thus of innovation.

The above considerations result in the conceptual model presented in Figure 1. Within the innovation alliance prior experience, IP protection and communication are expected to play important roles in building trust. As was argued, prior experience can be positively or negatively related to IP protection, depending if the company has positive or negative experiences in earlier innovation alliances in general, or with a specific partner in particular. As argued above, IP can also be positively and negatively related to trust, and it will therefore be analyzed separately if, and if so, why in certain instances the relation is positive, while in other instances it is negative. Intensive communication is expected to increase trust, and trust, in turn, is expected to be positively related to innovation performance.

3. Research methods

A survey questionnaire was combined with semi-structured interviews of CEOs and R&D managers of seven companies and two commercial research organizations in the seed sector, one agrifood company, one commercial research organization in the agrifood and one commercial research organization in the high-tech sector. The number of employees in the Netherlands ranged from 20 to 500 full time equivalents (ftes) for the research organizations and two of the companies. In the other companies 500 to 1,200 fte were working. The R&D intensity (R&D fte/total fte) was high with a mean of 83.5% (SD: 19.9%) for the research organizations and 25.2% (SD: 16.9%) for the companies. Data were gathered about 33 innovation alliances: 29 successful and 4 failed alliances. Nineteen alliances were reported by the companies and 14 by the commercial research organizations.

The survey questionnaire was based on existing questionnaires, developed by Fortuin (2007), Tepić *et al.* (2014), Garbade *et al.* (2013a,c). Furthermore, questions

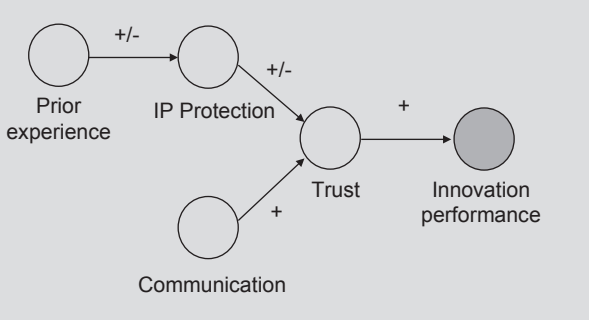

Figure 1. Conceptual model.

from the annual effect measurement of Food Valley NL (Omta and Fortuin, 2013), were used. Questions were raised regarding IP arrangements and the intensity of communication, the level of trust within the alliance and the innovation performance. The interview guide was extensively discussed with an expert in the field and tested in a pilot interview. The operationalization of the key concepts is presented below.

Prior experience was operationalized by asking the respondents if they had experienced alliance failure in the past. It can be expected that a company that has experienced a failed alliance will try to prevent alliance failure in the future, e.g. by making more tight IP arrangements. The respondents of 17 of the 33 innovation alliances reported to have experienced alliance failure.

To measure IP protection, three questions were asked, using 7-point Likert scales (ranging from 1. not at all to 7. to a very large extent) namely:

- In this alliance patent and/or technology mapping was used.
- At the start of the cooperation arrangements were made regarding:
  - confidentiality;
  - property rights of outputs and/or results.

The respondents have been asked to indicate the importance for the company of each formal and non-formal IP protection mechanism as shown in Table 1 using 7-point Likert scales (ranging from 1. not at all important to 7. very important). Only the respondents of seven companies and two commercial research organizations could answer (part of) this question, so n is lower than 33 (Table 7).

Communication has been measured by asking the respondent how often there has been contact between employees of their company and employees of any of the partners in the alliance, divided over three types of

media: e-mail, face-to-face and telephone. The level of communication was measured using a 7-point Likert scale, ranging from 1. more than once a week to 7. less than once a year. Trust was measured using four 7-point Likert scale questions (ranging from 1. completely disagree to 7. completely agree), namely:

- In a new project I certainly want to cooperate with this partner again.
- We would be willing to do extra investments in this alliance, if this might be needed.
- In this alliance opportunism appears/appeared to be a problem.
- This partner always does what he promises.

Innovation performance was measured using two 7-point Likert scaled questions (ranging from 1. not at all to 7. very much):

- In this alliance products were developed that were new to the company.
- In this alliance new production processes were developed that are new to the company, or these have been greatly improved.

Data collection started with contacting the respondents, and sending them the interview guide in advance. The interviews were thoroughly prepared, by reading information from the website of the organization, reading annual reports and by looking up public data, e.g. in the patent database. The interviews took 1 to 1.5 hours; detailed transcripts of the interviews were made, and were sent to the respondents to be checked. With their remarks the final version of the transcript was made.

The quantitative data are based on the 7-point Likert scale questions, except for the general data about the company (e.g. turnover, employees, number of patents). As it turned out that the data were not normally distributed, non-parametric methods of analysis were used. The data were investigated on their general characteristics, using explore and descriptive statistics in SPSS. The correlations between the formal and non-formal IP protection mechanisms and the different trust variables were analyzed using Spearman Rank correlation.

The conceptual model was tested by PLS modeling (Garbade, 2013b) using t-tests of the path coefficients (between the latent variables) and the outer loadings (the loadings of the constituting variables on the latent variables). The significance of the interaction effects uncovered with PLS was tested with bootstrapping, a cross-validation method. It is a resampling procedure, which yields the same number of cases as in the original sample. As the bootstrapping is based on trial and error it gives slightly different results every time it is used for the same model. The number of resamples was chosen to be 5,000, far exceeding the 200 indicated as minimum.

4. Results

The conceptual model presented in Figure 1 describes the relation between prior experience, communication, trust, IP arrangements and innovation performance. As discussed in Section 3, to test the validity and reliability of the model we followed Garbade *et al.* (2013b). For the Individual item reliability again each variable should have a cross-loading of at least 0.7 to its latent variable and all indicators should have their highest cross loading on the latent variable they are connected to.

In Table 2 the cross loadings can be found. It becomes clear that every indicator has a cross-loading of minimally 0.83 to its own variable, and hence the 0.7 criterion has been fulfilled. Also there are no indicators with a higher cross loading on another latent variable than the one they belong to (although for communication – face-to-face the cross loading to the latent variable Communication is as high as Trust, which may show the special importance of face-to-face contact for building trust). The convergent validity of the latent variables, the internal consistency, can be measured using the composite reliability measure. Hulland (1999) proposes a cutoff point: 0.7 is the minimum. As can be seen in Table 3, all three latent variables score far above this minimum.

The discriminant validity is a measure to see if the different latent variables in the model do really differ from one another. The square root of the average variance extracted (AVE) should be higher than the latent variable correlations. Furthermore, the AVE should be 0.5 or higher.

Table 4 shows that the AVEs are far above 0.5. However, two correlations (underlined) are equal or higher than the SQRT AVE of one of the latent variables they belong to. The first is the correlation between Trust and IP, which is as high as the SQRT AVE of IP. As both are related in the model (IP loads on Trust) a correlation could have been expected. However, this correlation should not be higher (or here: as high) as the cohesion of the contributing variables in the latent variable IP. However, it has not been chosen to take the variable with the lowest cross loading in IP (IP protection – property rights) out of this construct, as more variables loading on a construct is important for the quality of the model (as this adds more variance to be explained to the model). The second, more problematic, case is the high

Table 2. Cross loadings performance model (in black cross loadings of the indicators on the latent variable they are connected to; e.g. the latent variable IP arrangements is based upon 3 indicators with cross loadings ranging from 0,83-0,94).

	Experience	IP arrangements	Communication	Trust	Performance
Prior experience – experience with a failed alliance	1.00	0.83	0.70	0.70	0.73
IP protection – patent/technology mapping	0.60	0.84	0.72	0.72	0.77
IP protection – confidentiality	0.80	0.94	0.87	0.87	0.91
IP protection – property rights	0.75	0.83	0.60	0.69	0.73
Communication – e-mail	0.60	0.74	0.96	0.81	0.77
Communication – face-to-face	0.75	0.91	0.93	0.93	0.97
Communication – phone	0.64	0.75	0.97	0.86	0.81
Trust – cooperate again	0.58	0.70	0.88	0.90	0.78
Trust – extra investments	0.71	0.90	0.87	0.98	0.97
Trust – keeping promises	0.71	0.90	0.87	0.98	0.97
Performance – new products	0.67	0.88	0.81	0.93	0.97
Performance – new processes	0.75	0.91	0.93	0.93	0.97

Table 3. Composite reliability of the performance model.

	Composite reliability
Prior experience	1.00
IP protection	0.90
Communication	0.97
Trust	0.97
Performance	0.97

correlation between IP and Performance. This indicates that it might improve the model by connecting IP protection to Performance. This was done and it indeed results in a significant path coefficient (0.41, t-value=2.21), while also the path between Trust and Performance remains significant (0.59, t-value=3.38).

The conceptual model has been tested using PLS. The t-values have been calculated using a bootstrapping procedure of 5,000 samples. All outer loadings are highly significant (Table 5 – the lowest value is t=7.98).

Figure 2 shows the PLS test of the conceptual model. It shows that significant and positive relationships are found between Failed alliance experience and IP protection, between IP protection and Trust (although only at alpha = 0.05 for a one-sided test), between Communication and Trust and, finally, between Trust and Innovation Performance. In the Table in the Appendix more precise information is given.

The fit of the PLS model has been evaluated using the R^2 value. Three of the constructs have an R^2 value (which measures how much of the variance of all contributing and latent variables on the variable is). Table 6 shows that all correlations are rather strong; IP has the weakest fit (R^2=0.69), which is still good. Furthermore, most of the

Table 4. Discriminant validity of the performance model (in gray the latent variable correlations).

	Performance	Communication	Experience	IP	Trust	SQRT AVE	AVE
Performance	1.00					0.97	0.95
Communication	0.90	1.00				0.95	0.91
Prior experience	0.73	0.70	1.00			1.00	1.00
IP protection	0.92	0.85	0.83	1.00		0.87	0.76
Trust	0.95	0.91	0.70	0.87	1.00	0.96	0.92
SQRT AVE	0.97	0.95	1.00	0.87	0.96		

Table 5. t-values of the outer loadings.

	Sample mean	Standard error	t statistics
IP protection – patent mapping	0.83	0.08	10.83
IP protection – confidentiality	0.95	0.03	29.95
IP protection – property rights	0.82	0.10	7.98
Communication – e-mail	0.95	0.03	29.15
Communication – face-to-face	0.93	0.04	25.14
Trust – cooperate again	0.90	0.06	15.61
Trust – extra investments	0.98	0.03	38.58
Performance – new products	0.97	0.02	40.92
Performance – new processes	0.97	0.04	27.60

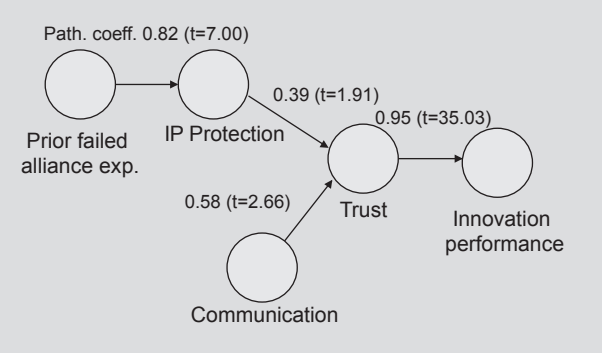

Figure 2. PLS test of the conceptual model.

Table 6. R^2-values of performance, intellectual property (IP) protection and trust.

	R^2
Performance	0.91
IP protection	0.69
Trust	0.86

variance in Performance has been explained, even though IP has not been connected to this construct, which shows that the model has not suffered too much from leaving out this possible linkage. The relation between Trust and Performance has been shown in this model. It turns out that this relation is strong (path coefficient = 0.95) and highly significant (t-value=35.03). Also if a path between IP and Performance would be included, still the influence of Trust is higher than the contribution of IP. Hence, the importance of trust in an innovation alliance should be emphasized.

It has been proposed that the role of Communication could be an intermediary one between IP protection and trust. If this is modeled (PLS model 2, not shown), the path coefficient between IP to Communication becomes 0.85 (t=14.32), while the path from Communication to Trust is 0.294 (t=22.38), with a model fit of R^2=0.88. This model shows that IP and Communication may indeed be related, and that in fact the significance of IP protection in the model is increased.

The relations between the trust variables and the formal and non-formal IP protection have been investigated. Only the respondents of 7 companies and 2 commercial research organizations could answer (part of) the questions, so N is lower than 33. Because of the central importance of IP protection, we decided to analyze the data using Spearman Rank correlation with pairwise deletion (Table 7).

A remarkable observation from Table 7 is that there is a very significant negative relation between formal and non-formal protection mechanisms. Another remarkable observation is that the level of non-formal IP protection is significantly and positively related to opportunism (more non-formal IP protection is related to more opportunism). This may imply that non-formal IP protection methods leave room for opportunism from the other collaboration partners, e.g. by abusing confidentiality arrangements.

5. Conclusions

It was the aim of the present study to improve our insight in the role of the interplay of prior experience, IP protection

Table 7. Spearman rank correlation of formal and non-formal intellectual property (IP) protection vs. trust using pairwise deletion; ** P<0.0l; *** P<0.001). Opportunism: non-reversed scale (n between parentheses).

	Non-formal IP protection	Formal IP protection	Keeping promises	Extra investments	Opportunism	Cooperate again
Non-formal IP protection	1.000	-0.498** (30)	-0.243 (29)	0.012 (29)	0.685*** (25)	0.049 (25)
Formal IP protection		1.000	0.66** (23)	0.254 (23)	0.043 (20)	0.341 (20)

and communication on trust and on the performance of innovation alliances. Three different relations have been proposed (Klein Woolthuis *et al.*, 2005). The first stream, stemming from transaction cost economics, regards IP as a basis for trust, as IP arrangements make opportunistic behavior more difficult. The second view conceptualizes IP in conflict with trust, as the setting up of IP arrangements might be regarded as a sign of distrust by the partner(s); IP arrangements may then even evoke conflict. Hence it is argued that IP negatively influences the level of trust. And thirdly, there is the notion that trust precedes IP arrangements and thus decreases the need for formal arrangements; the relation is embedded in trust.

The PLS model presented in Figure 2 shows the positive impact of prior experience, IP protection, communication on trust and via trust on innovation performance in alliances. The positive relationship between prior experience and IP protection may indicate that if respondents have experienced a failed collaboration, they might be less inclined to trust possible partners again, and make more use of IP protection in new collaborations. In addition, PLS model 2 shows that IP protection and Communication may indeed be related, and that this way the significance of IP in the PLS model is increased. These results suggest that communication might indeed play an intermediary role between IP and Trust. From this we conclude, in contrast to the three possibilities suggested above, that IP Protection may provide the platform for open communication, important to build trust in an innovation alliance. A different interpretation, however, might be that more IP protection will often be related to more intense collaboration, with hence more contact, or that the security IP offers may lead to more contact, as one is more secure that the partner will not be make inappropriate use of the information. This could be an interesting topic for further investigation.

Two remarkable observations stem from Table 7. Firstly, non-formal IP protection is positively related to opportunism. This may imply that non-formal IP protection methods leave room for opportunism from the other collaboration partners, e.g. by abusing confidentiality arrangements, while formal IP protection arrangements are positively related to the partner keeping promises, which may indicate that, apart from the influence trust may have, one's partners are more inclined to keep promises if one makes more use of formal IP protection mechanisms, maybe because they are more afraid to be taken to court. And secondly, there is a very significant negative relation between formal and non-formal protection mechanisms. This might indicate that these are not just different dimensions of an overarching concept, but completely distinct. The difference between formal and non-formal IP protection and the different influences these may have on innovation alliance performance is also an interesting topic for further investigation.

Interestingly, distrust has never been mentioned as a reason for alliance failure during the interviews, while Omta and Van Rossum (1999), who focused on failed alliances, discovered that this was the case in 7 out of 12 failed alliances. This could be caused by the fact that alliance failure is a sensitive issue. However, it could also be that there is an important phase before the alliance starts, some sort of a non-formal selection procedure in which trust plays an important role. Maybe if trust is not found or established here, the alliance does not even start. To find out how trust is built, this thus may be an important phase to investigate, as also Poppo (2013) proposed in her literature review. It could even be that this phase of getting to know each other and of writing the goals and agreements related to the alliance, are essential for building trust. This would mean that standard contracts, as some companies we interviewed used, may harm the trust building in the alliance, and thus its performance. This could explain the positive relation between alliance failure and the use of standard contracts we found in the few alliances where a failed alliance was reported (not presented in the results section).

It is important to be aware of the limitations of the present study. As only data of 33 alliances were available there is a risk of over-fitting the data. Because of the limited amount of data it was also not possible to incorporate other factors that could play a role, such as the risk on leakage of confidential information and the complementarity between the partners. Hence the collection of more data is recommended to gain a higher external validity. Also, the measurement of different constructs deserves attention. The high latent variable correlations may point at the fact that the different latent variables have not been measured sufficiently precise, and thus do not represent the different concepts, but rather an overall satisfaction with the alliance and its performance. However, as the model confirms the relationships expected based on literature and also explains a number of failed alliances, the results of the model can be considered reliable taking these limitations into account.

6. Recommendations

The present study shows that for innovation performance in innovative alliances, building and maintaining trust is of critical importance. Hence it is important to find (a) partner(s) one can trust and to feed this trust with communication to let it grow even further. To start with the selection of partners; it is important not only to select on complementarity, but also on trustworthiness. As a manager you could ask yourself if you know colleagues or experts that you trust, who can give you more information about the trustworthiness of your potential partner and the incentives and the IP protection measures that may stimulate the potential partners to act trustworthy. Furthermore, it is important to understand that there is a trade-off between familiarity and novelty. Novel partners may offer new knowledge, but may be difficult to understand (due to the cognitive distance, Nooteboom, 2006). Sometimes it may thus be better to choose a partner that is slightly less complementary to your company. Related to this, it may be important not to have too many partners, as it has been reported that especially large alliances with many partners suffer from opportunism and cognitive distance. With respect to familiarity, also the business culture of the partner may be important. Fortuin and Omta (2008), for instance, report the differences in dealing with contracts and IP between European and US-based companies. In addition, as communication is important, distance may be of influence, as larger distances can be expected to lead to less contact. Especially as face-to-face contact is important; it may be advisable to choose partners that are located nearby. And if a partner is located at far distance, frequent email, skype and phone contact is recommended to be sure that no misunderstandings occur. It is also good to note that it may be worth the efforts and costs to invest in one's relation with a potential partner before the collaboration is formalized. This may make the formalization easier, shorter and thus cheaper, and may increase the mutual understanding and thus also the insights in what arrangements need to be made.

When a partner has been chosen, IP arrangements have to be set up. The present study showed that making clear arrangements is very important for collaborations, not only as a legal mechanism, but also because contracts have three additional functions: 1. coordination; 2. safeguard for contingencies; and 3. as a sign of commitment (Klein Woolthuis *et al.*, 2005). It is important to realize that IP protection is never a goal in itself, but only a means towards building a secure platform on which trust can be build. Hence, the setting up of contracts and IP arrangements should be used to build trust and to foster communication. In this, ample care should be taken to adapt the use of IP arrangements to the problem complexity (Felin and Zenger, in press). Finally, it is important to understand the crucial role of flexibility and creativity in innovation. Only by allowing a certain degree of freedom in the alliance, high innovative performance can be expected. Hence IP protection should not be used to fixate all possible situations in advance, but to give direction in how to deal with certain contingencies. As one of our respondents stated: 'the best practice in collaboration is to make good arrangements in advance, but not to lay down too many things too precisely. In this way, one can switch quickly if things change or new opportunities occur.' And on our question how abuse could be prevented in such an open relation, he answered: 'by a lot of communication'.

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Appendix 1. t-values of the path coefficients of the PLS model.

	Sample mean	Standard error	t-statistics
Prior experience -> IP protection	0.82	0.12	7.00
IP protection -> Trust	0.39	0.19	1.91
Communication -> Trust	0.58	0.22	2.66
Trust -> Performance	0.95	0.03	35.03

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How to manage free riders in a network of competitors: the case of animal genetic selection industry in France

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Abstract

Setting up a network is considered as a key factor for the success of a small and medium enterprise (SME) to innovate and to create value through innovation. Moreover, there are difficulties in setting up such a network in the case of competing companies. Such 'coopetition' is based on knowledge transfer and resource sharing. But this kind of partnership may be used in an opportunistic way by some partners. The objective of this paper is to focus on these difficulties in managing a network of competing SMEs in order to manage an innovation whilst avoiding opportunistic strategies, using the analysis of the animal genetic selection industry in France.

Keywords: innovation, coopetition, cooperative

1. Introduction

Technical innovation is one of the main sources of value for companies (Audretsch *et al.*, 2002; Link and Scott, 2001). Small and medium enterprises (SMEs) are considered more reactive than big companies to exploit these innovations. This is due to their small size and the simplicity of their line management (Bhattacharya and Bloch, 2004; Link and Rees, 1990). Nevertheless, innovation and its integration into the production process can be difficult to manage for an SME. This is because a wide range of knowledge and resources is needed to manage and incorporate innovation (Dhanaraj and Parkhe, 2006). Creating networks or cooperation are a successful alternative for SMEs to manage innovation. This cooperation can be formalized through joint ventures aimed at sharing R&D efforts (Belderbos *et al.*, 2004; Fukugawa, 2006). It is thus possible for these companies to share their own resources or to access a common resource. Such cooperation between SMEs is regarded as the main success factor of innovative SMEs (Zeng *et al.*, 2010). It mainly happens with companies involved in the same industrial sector or those with a client/supplier relationship (Miotti and Sachwald, 2003). Such associations between competitive SMEs are very rare as innovation is a factor in differentiation. Nevertheless they have been observed in the Japanese automobile supply chain. In this case they are due to the incentive to collaborate from automobile companies to their suppliers (Sako, 1996).

It is possible to identify two factors in the success of such industrial networks (Veflen Olsen *et al.*, 2012):

- The importance of a central coordination structure (Hanna and Walsh, 2002) which should be a neutral third party.
- The importance of trust between members that they all are willing to share knowledge (Fuller-Love and Thomas, 2004).

With these two conditions it is possible to set up democratic governance allowing transparency and legitimacy in the management decisions (Cotta, 2001). Nevertheless, this democratic governance can have several disadvantages due to the similarity of the network members (Assens, 2013). This can lead to inertia in the collective's decisions (Miles and Snow, 1992). Conflict may also arise between members who are heavily involved in the network and some free riders who try to take advantage of it without sharing their resources. The risk of such a strategy is greater when there are important changes in companies' environment.

In this paper we aim to focus on such free riders' attitude in the sector of genetic selection in animal production. One

of the characteristics of the French agricultural sector is the importance of cooperative companies. At the moment these companies are trying to cooperate for innovation and to achieve a critical size in a specific market (Lewi and Perri, 2009; Thomas, 2008). This cooperation is formalized through the creation of cooperative unions, which are cooperatives of cooperatives. In this case the members of a union cooperate for several actions but can still compete in other domains.

2. Theoretical aspects of coopetition

Coopetition is a paradoxical strategy of cooperation between competitors. Because of this cooperation each competitor can increase its profits (Ritala, 2012). This cooperation between competitors allows to strengthen the performance the innovation capacity of each company, specifically in open innovation (Chesbrough, 2007). This strategy can take the shape of research and development consortium, the creation of common subsidiaries, suppliers networks, sharing of supply chain,… (Luo, 2007). Nevertheless, coopetition doesn't aim to eradicate competition, but on the contrary to locally standardize competition behaviours in the industry sector (Hunt, 1972). This strategy can be considered as a mutual agreement in order to concentrate the all sector on a reaction against a threatening regulation or a technological risk (Dagnino *et al.*, 2007). Coopetition is so based on the sharing of resources between competitors. There is so a risk that the benefit of this strategy will be one-sided used when the competition take place again. The main problem is so in deviant behaviours when the cooperation hides specific interest. Such strategy can so lead to conflict of interest if it is not possible to balance between competition and cooperation (Bengtsson and Kock, 1999). This balance can be broken up by opportunistic behaviours of competitors (Das and Rahman, 2010). It is possible to manage such behaviours taking into account the type of coopetition. These types depend form the timing of the process (sequential or simultaneous) and of the fact that the process is internal or external of one company (Table 1). Theses dysfunction risks and the way to manage them were shown for three of the four coopetition forms. In the case of simultaneous competition and cooperation, which is external of the firm, there is few management tools proposed in the literature. The case that we present in this paper allows to explore this kind of coopetition.

3. The research methodology

This research on deviant behaviour in coopetition is based on a case study on a network of cooperatives companies. This is the good scale to study coopetition as underline by Hunt (1972):

Table 1. Type of coopetition.

	Internal coopetition inside the company	External coopetition: between competing companies
Sequential cooperation and competition process	Deviant behaviour risk surrounded by the legal and financial boundary of the company: • multipoint competition; • separate cooperation and competition steps depending of the creation value process. Separate teams in charge of cooperation and competition to avoid conflict of interest (Bengtsson and Kock, 1999)	Risk of deviant behaviour, bounded by market norms and regulation or by a neutral intermediary (Wilhelm, 2011)
Simultaneous cooperation and competition process	Risk of deviant behaviour bounded by three principles: • distinguish the resources coming from the cooperation with the ones owned by the company; • cooperating on support activity of the value chain and competing on operational activity; • work on complementarity to avoid substitution at the end of coopetition (Bengtsson and Kock, 1999; Luo, 2005).	Risk of deviant behaviour can't be bounded by law as the competitor are independent. Market regulation are insufficient to manage coopetition (Bengtsson and Kock, 1999; Lado *et al.*, 1997; Luo, 2007).

> … analyses competitive rivalry at an intermediate level, between the industry level and the firm level, making it possible to grasp differences that exist within an industry. It is at this intermediate level that networks and relationships between competitors can be observed and analysed.

This network is formalized through a specific cooperative, the UNCEIA, which is the national union of animal selection companies. In 2010 the UNCEIA employed 43 staff: it is a federation of 36 companies carrying out animal artificial insemination and 11 animal genetic selection companies (9 for cattle, 1 for goats and 1 for sheep). The goal of this federation is to support the interests of the animal insemination sector, to innovate and invest in order to improve the selection programs and to give advice to the members of the federation. To do so, a 2 million euro budget is devoted to R&D. This research was funded by UNCEIA while we organized the general assembly of the network in 2011 on coopetition. This case study is based on interviews with several employees of UNCEIA. We then cross checked (Jick, 1979) the information with interviews with agricultural journalists and with suppliers. We also used other data, such as reports on activity, financial data, and articles from the professional newspapers. The case was then submitted to the UNCEIA CEO as suggested by the 'feed-back Survey' principle (Crozier, 1963) which recommends validating the case with the actors involved. It is thus exploratory research to highlight the competitive advantages of the cooperative union and how they should regard the 'free rider' behaviour of several members of the union. The people we interviewed are shown on Table 2.

4. Coopetition in the case of UNCEIA

The UNCEIA: a cooperative of cooperatives

UNCEIA is a union of agricultural cooperatives which federates genetic selection companies and artificial insemination companies in the animal genetic selection sector and specifically for cattle, goats, sheep and pigs. As a network company, its budget comes mainly from the subscriptions of its members. In return the UNCEIA provides technical and legal advice, offers lobbying services to the animal genetic sector and shares the financial and technological R&D resources in order to improve livestock breeding.

'Pure and perfect' cooperation: a boom in open innovation

Artificial insemination of livestock dates from the 40s. Its aim is to increase animal production by genetic selection. This selection is based on the analysis of descendant performance, which takes 7 years. The use of this technology has been encouraged by French government policy since the Second World War in order to increase animal production and to ensure animal race traceability for public health reasons (Labatut, 2009). During this period (from the 40s to 2000) the development of artificial insemination was based on a shared learning process (Hatchuel, 1994) between the technicians of the insemination centres, livestock cooperatives and the suppliers linked to the animal sectors such as POLYCEM or IMV. Each French department had its own insemination centre.

Table 2. People interviewed (semi structured intervies, 2 hours average duration).

Job of interviewee	Company
chairman	UNCEIA network
general manager	UNCEIA network
deputy director in charge of communication	UNCEIA network
general manager	company member of the network
general manager	company member of the network
deputy director	
agricultural journalists	insemination newspaper 'Bulletin technique de l'insémination animale', agrapresse hebdo
agricultural journalists	agricultural newspaper pleinchamps
agricultural journalists	agricultural newspaper typex

The insemination technique develops as an open innovation (Loilier and Tellier, 1999): a collaborative process with sharing of the property rights between the actors of the sector (Chesbourg, 2003; Le Masson *et al.*, 2006). There are several reasons for this development:

- The insemination centers consider that the technological innovation of selection is very far from their main activity.
- The absence of commercial risk in the open innovation favours collaboration (OECD, 2008).

Moreover the legal context favours such innovation. Scientists from the different insemination centres collaborate, comparing the different outcomes. Such collaboration between peers is easy as the insemination centres have a monopoly within their territorial zones. This monopoly is granted by the government because of the public service rendered by the insemination centres. Thus, the livestock law published in 1966 allows every farmer to access artificial insemination under the same conditions anywhere in the French territory. The cooperatives have to provide high quality insemination material to any farmer in exchange for the monopoly in their territorial subdivision. During this period the French agricultural ministry tasked the UNCEIA to federate the insemination cooperatives. The selection techniques used between 1960 and 1995 were based on the 7 year period of observation, with performance monitoring of the animals. Improvement in the techniques has allowed the UNCEIA to work with public agronomic research organizations such as INRA and the livestock institute.

Competition within the cooperation: the end of the open innovation

At the end of the 90s two changes disturbed this harmony between the partners of the UNCEIA: technological change and a legal one.

The selection technology changed radically with the use of genomics. The qualities needed in a good breeding animal can be predicted in advance and the results are then refined using the statistical data collected from farmers. The success of the prediction are thus related to the number of the farmers who provide their data. The skills needed to increase competitiveness (statistical knowledge, molecular biology, etc.) change and are no longer owned by the insemination centres but by the UNCEIA. One of the main challenges is the building of a statistical database by the UNCEIA and INRA. This database includes 90,000 farmers and can be used to analyse the genetic traits of 4 million cows. In order to refine the predictions the UNCEIA started collaboration with companies from other European countries. The federal role of UNCEIA thus reinforces this technology and the collaboration with public research (INRA, Institut de l'Elevage, CNIEL, INTERBEV).

At the same time some of the members of the UNCEIA are becoming free riders and try to leave the union, as explained by the UNCEIA CEO:

> Our cooperatives union, UNCEIA has nowadays some difficulties linked to completion in the animal insemination sector. During the past period the UNCEIA invested in genomic research. The insemination centres get a lot of profit from these investments because of the simplification and the increase of efficiency due to genomic. But in order to allow this collective effort to go on it is necessary to preserve cooperation between cooperative companies even if the economic environment incites them to compete.

The changes in French legislation in 2006 explain the emergence of free riders. Before 2007, the cooperative companies were protected against competition in their territorial zone. But since 2007, with deregulation, any cooperative can operate in the territorial zone of another. Meanwhile the activity of the cooperatives decreased because of the milk and meat crisis. Insemination cooperatives were therefore tempted to stop the sharing of innovation within the UNCEIA as this innovation can provide a competitive advantage.

Due to these changes the cooperatives joined together in order to maintain their competitiveness by decreasing their costs. This concentration led to the emergence of 4 selection cooperatives instead of nearly 11. These cooperatives represent 71% of the subscriptions of the UNCEIA, giving them great power in the decision process. Taking their size into account these companies are tempted to insource the R&D in order to gain a competitive advantage against their competitors which are also members of the UNCEIA. At this point the free riders' strategies emerge and affect the activity of the UNCEIA. Some of the 4 think of developing their activity outside of their territorial zone, competing directly with other members of the UNCEIA. This would tend to increase the free-riding behaviour in the UNCEIA, with some cooperatives beginning to compete with the other members and using the technology developed by the UNCEIA. The first step of this strategy is to convince the insemination centre to change from one selection cooperative to another, which led to tension between selection cooperatives. Another one is to buy one of the common suppliers. This led to difficulties for the others

to access this supplier. Such deviant behaviour leads to a decrease of UNCEIA's R&D ability. This is an unsatisfactory situation as no one cooperative in the network has the critical size to manage the innovation process on its own.

The case analysis: the management of coopetition

The management difficulties of the UNCEIA are great: is it possible to control the deviant behaviour of some actors that cannot be ignored in the strategic decision without legal or capital power? How is it possible to preserve cooperation and solidarity between the members of the network when some of them are free-riders? To answer these questions it is necessary to look at the organization of the UNCEIA: a network company with a democratic governance and involved in an open innovation process. The UNCEIA is developing its technology using the principle of open innovation between peers (Chesbrough, 2007; Loilier and Tellier, 1999) which is similar to the development to open source software. But the sustainable management of such good is not so easy as it is not possible to exclude somebody from the use, even free riders. It is thus necessary to make rules in order to avoid deviant behaviour among peers. Such regulation has to balance between too much authority and too much permissiveness:

- A use of too much authority could lead to a lack of innovation, which occurs when the members strongly involved in the innovation process try to reinforce their power of decision in the network. This could lead to decreasing interaction between the members which could lead to a loss of serendipity (Katz and Gartner, 1988) between the members of the network.
- Too much permissiveness could lead to a breaking up of the network because the members are no longer able to absorb the social rules in place. Therefore most of the members will have a peripheral position in the network. They will need to build relation with intermediary actors in order to have an influence in the network. The relation with the other members will then become less formal (Granovetter, 1985). The risk is therefore a widening social gap between the members that could lead to conflict between them.

Hence the innovation process is hard to manage when self-management is no longer able to provide the balance between social cohesion of the network and the ability of the network to adapt itself. Members' action to preserve this balance works against it as it tends to increase the inequilibrium while the network is increasing. Hence we find that small networks with keen members take the place of bigger ones that increase too fast (Fourcade and Torrès, 2003). It is possible to avoid these management difficulties of such networks and innovation processes if a bigger company takes care of the process.

In the case of the UNCEIA the open innovation process involves competing companies. The management therefore has to take into account the coopetition regulation mechanism (Bengtsson and Kock, 1999):

- To split up cooperation and competition, taking into account the nature of the market: companies can cooperate in some markets and compete in others. This allows conflict to be avoided.
- To split up cooperation and competition taking account the stage of the creation of value process. It is therefore recommended to cooperate in the upstream stages and to compete when close to the consumer.
- To split up the two kinds of relationship (cooperation and competition) in the companies, with some people involved in the cooperation process while the others are involve in competition.

Hence it can be useful to separate cooperation and competition, taking into account the kind of strategic challenge (Bengtsson and Kock, 1999).

For the UNCEIA, the main point is to manage the cooperation in the network in order to develop and to preserve a competitive advantage in Europe while the members of the network are competing in France, as long as this competition does not affect the European advantage.

Regulation of free-rider behaviour in the coopetition

It is possible to use several regulations in order to avoid behaviour that compromises the coopetition (Hannachi and Coléno, 2012): peer regulation, a trusted third party, a contract and a mediation structure (Table 3). Deviant behaviour can be managed through tacit agreement and by peer reciprocity between the members of the UNCEIA. A normalization of the deviant behaviour can be ensured by collective pressure. If this solution fails or in case of conflict a third party could provide mediation. Moreover a good practice bill in the UNCEIA defines the right and duty of all the members. The definition of the rules to gain access to the common technology will avoid free riding. Other structures like a joint venture could be used as a mediation structure when reaching new markets or in the case of new cooperative projects. Finally, sharing of employees, technologies and capital could reinforce the relationship. Cross participation on the boards of the other members can reinforce cooperation (Lomi, 1999).

Table 3. Management of deviant behaviour in the coopetition.

Peer regulation	Tacit agreement and reciprocity rules between competitors
Trust referee	A neutral third party can solve conflicts between competitors
Bill of good practice	Rules on rights and duties of the members
Mediation structure	Joint venture and cross participation between competitors

5. Conclusion

This work on cooperatives illustrates the need for competing companies to increase the value of their complementarity. The success of a company is not only linked to its ability to develop on its own but also on its ability to collaborate with competitors in industrial, commercial and R&D domains. Nevertheless cooperation between competitors is not simple to manage as shown by the UNCEIA case. The desire to cooperate with competitors is not natural (Bengtsson and Kock, 1999). It depends on the place the company has in the market. If a company dominates the market it will try to take advantage of this position. On the other hand, if a company needs to access an external resource to gain a competitive advantage it will be tempted to adopt cooperative behaviour. So coopetition emerges when a company is dominating the market and is in need of external resources. Nevertheless, the dependence of the different companies involved in the coopetition could change in the course of time and so can the balance of power. For example, in the UNCEIA case, the expansion of a selection company changes the equilibrium between the members of the network. This increases the risk of free riding.

This work on the UNCEIA could be generalized to other cooperative network-companies such as banks or insurance cooperatives when there is a governance crisis.

To remedy such a crisis it is therefore necessary to introduce more consistency into the company statutes, trying to strike a balance between how much members receive and how much they share. The more a member is involved in the network-company, the more he should get from the network. Conversely, when a member decides to be inactive he should get less from the network and be free to compete with other members. This balance should give more consistency to the governance of the network, avoid free riding and increase the confidence of the members (Veflen Olsen *et al*., 2012). So the longevity of a network-company is based on adaptable governance, going from informal cooperation at the beginning to a more formalized one later (Benson-Rea and Wilson, 2003). The aim of this formalization is to set up distribution rules and to recognize the role of a third party coordinator.

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Research and development project of innovative food products from an inter-organizational relationship perspective

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Abstract

The objective of this research is to analyse the motivations and barriers to develop an innovative food product from the perspective of the two main participants in a development project. The perceptions of a Brazilian food co-operative and a Technological Centre were analysed throughout a case study. The results indicate the existence of a complex dyadic relationship between them and also that the food innovation network is still in its early stages in south of Brazil. The main motivation for the Technological Centre is to contribute to the national development policy. On the other hand, for the company there is the possibility to obtain partial funding for products development. The company is venturing while bringing to the food market an innovative product. Yet, it is clear that these kinds of inter-organizational collaborative efforts can bring benefits to food networks in general.

Keywords: inter-organizational project, motivations and barriers, food networks

1. Introduction

The constant economic world changes have been modifying issues such as industrial organization, innovation, research and development (R&D). While globalization brings opportunities for industries to access international markets, it also threatens the survival of some sectors in specific countries (Paiva and Vieira, 2010). The integration of global markets and dispersion of production in different countries (Gereffi *et al.*, 2005) has lead companies and their supply chains to adapt to fast and radical changes in the market. An example is the food industry, which is undergoing a restructuring due to constant market changes, and beginning to seek cooperation with other companies and actors rather than just compete with them.

While cooperation seems to be the essence of the relations within organizations, the competition seems to be, in a prevailing view, the essence of inter-organizational relationships (IORs). This boundary between cooperation and competition, however, does not necessarily coincide with the legal boundaries of a firm. There may be cooperation and competition between firms within them – two dimensions that intersect themselves (Jarillo, 1993). An efficient way to compete is through the creation of strategic alliances, i.e. short or long voluntary arrangements between different organizations. These arrangements enable organizations to gain or sustain competitive advantages over competitors, by optimizing operational costs and minimizing coordination costs.

The formation of alliances, partnerships, networks and other formats of IORs has been adopted by organizations as a strategy for the development of innovative products with greater quality, speed and low cost. In addition, the relations between organizations also enable the combination of skills, sharing costs and risks and investment in R&D. Generally speaking, competition between organizations has, as one of its effects, led to high specialization, as the organization seeks to focus its activities on their best skills. Therefore, it is necessary to form strategic alliances, linking up with other organizations with complementary skills, aiming to better serve their customers. There are two ways of understanding IORs established for innovation. One is normative and focuses on the knowledge that can be more easily managed. The other is interpretative and deals with tacit knowledge and social capital. This paper is focused on the first one, also characterized as network capital (Huggins *et al.*, 2012),

which is a calculative and rational form to achieve economic returns by developing an innovative product.

An inter-organizational project, according to Jones and Lichtenstein (2008), appears as a kind of strategic alliance, or a strategic network. Multiple organizations work together in the same activity for a period of time. They appear as an alternative to coordinate processes, products and services in an environment of high uncertainty and competitiveness. This type of IOR has been seen in sectors such as movies, construction, fashion and computing.

As an example, one can cite the case of the partnership between Disney and Pixar in favour of industry transformation of animated films in the United States. In this case, there was a clear possibility of complementarily in the following areas: cartoons creation; power distribution; technical skills. Furthermore, the emergence of new forms of organization between actors of the beef chain has been identified in the Brazilian' food sector. Research conducted in this sector showed that these initiatives are related to the association between farmers, slaughterhouses and retailers, predominantly named marketing alliances. This kind of alliance seeks to increase product value through differentiation strategies (De Barcellos *et al.*, 2006).

However, the development of products aiming to add value appears as one of the most complex processes within the food sector, due to financial resources involved (Brannback and Wiklund, 2001), as well as technological and management capabilities (Thamhain, 2003). Different kind of information and skills are needed, so it must involve a multidisciplinary team. Accordingly, an inter-organizational project appears as a viable alternative to the development of a new product.

Due to the growing concern among consumers related to the food quality and lifestyle (health), and also the safety of the products offered (Grunert, 2002), the development of innovative food products appears as a priority for the industry. The World Health Organization and Food and Agriculture Organization stated that feeding patterns and changes in lifestyle reduce risk factors for diseases. This has led consumers to new consumption trends, increasing the demand for healthier food products. The food industry has promptly reacted and health and wellness market segment has been growing since then. Until November 2013, it has reached global value sales of US$ 733 billion, which represents 7.2% of growth-rate for the year 2012/2013 (Euromonitor, 2013b). The Brazilian health and wellness food market is growing and the *per capita* spend in this food category reached the amount of US$ 188.7 in 2013 (Euromonitor, 2013a).

The health and wellness market segment have distinct food categories, such as: 'better for you', 'naturally healthy', organic, intolerance (e.g. casein, lactose), vitamins and dietary supplements, traditional herbal products, slimming products, sports nutrition and the fortified and/or functional foods (FF). In Brazil, all the food or ingredient that claim functional properties, besides the basic nutritional functions, will also trigger beneficial health effects and should be considered safe for consumption without any medical supervision.

FF represents one of the most interesting areas of innovation in the food industry and it has an important role in the current socio-economical context (Annunziata and Vecchio, 2013; Betoret *et al.*, 2011). The category is driven by the society's contemporary needs, such as the growing middle-class demand for greater functionality coming from food and beverages. Indeed, Brazil's Health and Wellness market over 2012/2013 is expected to be the third strongest globally, being followed by China and the US (Euromonitor, 2013a)

From the perspective of the food industry, the development of new products is an important source of innovation, differentiation, added value (Matthyssens *et al.*, 2008) and competitive advantage in the global agri-food scenario (De Barcellos *et al.*, 2009). In fact, FF R&D is considered a complex, risky and expensive process when compared to conventional ones (Siró *et al.*, 2008). Thus, as Matthyssens *et al.* (2008) state, the R&D processes requires some extra efforts, such as a more open and flexible approach so that the products can be successfully launched. In that sense, large companies seek for closer ties with suppliers and other partners, in order to extend control over the supply chain. With that kind of strategy such companies can achieve greater efficiency in the transaction chain, aiming at cost and uncertainty reductions in order to foster the innovative product development.

Yet, for small and medium enterprises (SMEs), cooperation may be the only alternative for the development of a new product – due to the risks associated with this type of product. As shown by Balestrin *et al.* (2008) in a network of SMEs in the clothing business, the collaborative strategies implemented have brought benefits, such as improvements in production processes, costs reduction, own brand construction, as well as the socialization of the best practices among all actors involved. Corroborating with that view, Khan *et al.* (2013) afirm that in the context of FF it is imperative for companies to maintain and sustain reliable IORs with diferents partners; to reach it, companies also need new management skills. As it can be seen, the establishment of appropriate partnerships and the

efficient management of a product development project are important for reaching success.

The formation of relationships between organizations and how they occur has been the focus of attention for some researchers. The reasons that led for the existence of those relationships, the barriers encountered and the results achieved in partnership arouse interest among researchers, as illustrated by Oliver and Ebers (1998), Brass *et al.* (2004) and highlighted by Cropper *et al.* (2008).

Serenko *et al.* (2010) highlight the lack of communication between academics and practitioners in this field of research. In that sense, this study seeks to answer the following question: 'what are the main motivations and barriers perceived by the actors/members involved in an inter-organizational project of new food product development?' To answer this question, this research aims to investigate the dyadic relationship between a Brazilian food co-operative and a technological centre. The authors tried to identify, through the perception of the actors involved, the motivations and barriers faced in establishing this type of IOR. Nieto *et al.* (in press) found that family firms are more averse to risk and less innovative than non-family firms. In our study, a rural food cooperative, which consists of small family producers, could be considered even less innovative, where innovation process is basically incremental and there is no formal R&D department. In this way, this study gives a contribution highlighting the motivations for IORs in this kind of organization, which is traditionally not used in developing relationships with actors outside the supply chain (Huggins *et al.*, 2012) in a mature food area such as dairy sector. This study can also contribute to bridging the current research with the Brazilian food sector reality, which consists mainly of family business and co-operatives formed by small producers. The establishment of IORs is still new in this business context.

In addition to this introduction, this paper is organized as it follows: section two presents the theoretical background. Section three presents the methodology. The following section presents the case study. Section fifth shows the results and conclusions while the sixth and last sections present some suggestions for further researches.

2. Inter-organizational relationships

The number of studies about IORs is continuously growing, providing theoretical and empirical issues to be explored (Brass *et al.*, 2004; Cropper *et al.*, 2008). The study of Brass *et al.* (2004) shows that the establishment of IORs, such as networks, enable an information transfer that provides similarity, imitation and the generation of innovations; it mediates transactions between organizations and cooperation between people, and also provides differentiated access to resources and power. Wubben *et al.* (2012) highlight the positive effect of incoming knowledge spill overs on innovation cooperation, especially for SMEs partnering with research centres and other actors.

For Gulati *et al.* (2000), the formation of strategic networks is defined as a composition of inter-organizational ties with strategic significance for those involved. They can provide the company with access to information, resources, markets and technologies, with the advantage of knowledge, scale economies, and enable organizations to achieve strategic objectives such as risk sharing, outsourcing stages of the value chain and the division of other organizational functions. Oliver (1990) shows in her study six contingencies considered critical for the establishment of IORs. Table 1 presents a summary of each of these contingencies.

Table 1 shows the necessary contingencies for the establishment of an IOR. They are all voluntary; the exception occurs in the Necessity contingence, which must be established based on legal or regulatory requirements needs. Among the six contingencies presented by Oliver and Ebers (1998) and Oliver (1990), three of them address the company's resources issue as a reason to form an IOR – referring to the Resource Dependency Theory. When performing a network analysis on IORs, Oliver and Ebers (1998) showed that this is the dominant theory in this field of study. Oliver (1990) provides a framework with five out of the six contingencies previously presented, illustrating its features on five types of relationships, among of them figure the joint projects, as it can be seen in Table 2.

Temporary working projects, as shown in Table 2, can be understood as inter-organizational projects. For Oliver (1990), this IOR exists when two actors work together to plan and implement a specific activity – a project – without forming a new organization (a NewCo, according to Dacin *et al.* (2008)). Yet, the author reinforces the idea that resource scarcity is a strong prerequisite for the development of IORs, because when the resources magnanimity in the environment is insufficient, the organizations do not have the capacity to generate them individually. Therefore, the establishment of IORs is an alternative to project execution.

Antecedents and motivations, results or consequences

The understanding of issues that precede the formation of an IOR is relevant to comprehend their barriers and outcomes. Brass *et al.* (2004) evaluated a series of researches performed

Table 1. Summary of the critical contingencies to form inter-organizational relationships (IORs) (adapted from Oliver, 1990).

Critical contingence	Description
Necessity	Legal or regulatory requirements may impel organizations to establish IORs
Asymmetry	The IORs which seeks the ability to exercise power over another organization/ resources (competition)
Reciprocity	The IOR is stimulated by a goal or a common interest (collaboration, cooperation)
Efficiency	Contingency internally oriented: the formation of IOR is focused on improving the rate of input/ output processes
Stability	The establishment of the IOR may be an adaptive response to the uncertainties imposed by the environment
Legitimacy	Institutional environmental pressures causing organizations incremental legitimacy, possibly through IORs

Table 2. Summary of the critical contingencies from inter-organizational relationship projects (adapted from Oliver, 1990).

Relationship	Critical contingencies				
	Asymmetry	Reciprocity	Efficiency	Stability	Legitimacy
Temporary working project	Larger control over resources access	To facilitate the exchange of customers or employees	Reducing the costs of social services	To share risks in the assembly of new projects	To show cooperation rules

within networks and organizations. The authors' analysis highlights the antecedents and consequences of networks separated by levels of analysis (see Table 3 for inter-organizational level). They point out inter-organizational projects as a form of IOR.

As it can be seen in Table 3, the antecedents of inter-organizational networks basically involve the motives, learning, trust, norms and monitoring, equity and context (Brass *et al.*, 2004). The highlighted motives are the acquisition and access to resources, the uncertainty involved, the need for legitimacy, the achievement of collective goals (consistent with Oliver, 1990), access to markets and technologies, economies of scale and scope, learning shared, the reduction of opportunism and risk sharing (Gulati *et al.*, 2000). Mutual learning and the experience obtained through it, is seen as a way to get attention in the network. The trust, in its turn, is considered a key factor for the success of IOR. Having norms and monitoring can be useful within IORs, since controlling come from both (or more) sides. Equity appears as antecedent considering that the similarity may facilitate the partnership. Finally, the context (historical, institutional, and cultural) as in most of the relations, also receive attention when sign up for an IOR.

As a consequence, Brass *et al.* (2004) points the imitation, innovation, survival and firm performance. The imitation

Table 3. Summary of the antecedents and consequences of inter-organizational networks (adapted from Brass *et al.*, 2004).

Networks	Antecedents	Consequences
Inter-organizational	• motives • learning • trust • norms and monitoring • equity • context	• imitation • innovation • firm survivor • performance

appears as a consequence because it is facilitated by this type of inter-organizational configuration. Innovation is stimulated by the sharing of information, especially among companies that cooperate but do not compete. Authors argue that the formation of IOR not only affects innovation as a result, but also the internal innovation such as the investment in R&D. The survival of the organization is also considered a consequence for being favoured by the exchange of knowledge, access to information and resources, among others. Finally, authors highlight the performance: the sharing of different aspects among IOR participants favours the achievement of better results of individual organizations.

Inter-organizational projects

There are different kinds of knowledge involved in inter-organizational projects. Bhagat *et al.* (2002) propose that there is a knowledge *continuum* that is easily interpreted, systematised, communicated and managed to another level of knowledge – that is more difficult to manage, communicate and transfer. This *continuum* moves from tacit to explicit knowledge. In this paper, inter-organizational projects can be defined as projects involving two or more organizations to jointly achieve individual goals and/ or collective, creating a product. This partnership occurs for a limited period of time, between a client and a contractor. The contractor, in turn, may hire subcontractors as needed (Jones and Lichtenstein, 2008). IORs for projects differ from other forms of coordination projects (such as joint ventures and alliances) exactly because they are temporary; the relationship to reach the common goal has a pre-determined period.

For Jones and Lichtenstein (2008), in this type of IOR, organizational actors can be both dependent and independent. The activities are coordinated only during the lifetime of the project, according to their temporal dynamic. This dynamic influences collaborative activities between independent organizations. Authors state that the understanding of collaboration between organizations can be performed from the perspective of an inter-organizational project. These, therefore, can be analysed in two dimensions: temporal and social embeddedness. The concept of embeddedness (Granovetter, 1985) concerns to the importance of relationships – personal and concrete – and networks of relationships, seeking to generate confidence, expectations, besides creating and enhancing norms.

According to Granovetter (1985), the social embeddedness focuses on reducing opportunistic behaviour. From the theoretical viewpoint, the overlapping and trust creation in relationships are important for the transfer of tacit knowledge, a kind of knowledge present in most emerging technologies, in which the uncertainty level is larger. According to Jones and Lichtenstein (2008), both embeddedness dimensions are used to reduce the uncertainty involved in performing IORs. Social and temporal embeddedness of projects provide techniques for managing uncertainty, improving their ability to adapt to the collaboration. Other elements, such as the length of the project, the kind of relationship (contractual or informal) established between the organizations, the sector dynamics and the size of the companies might also influence the IORs. In this paper, it is suggested that small companies or co-operatives, that have scarce resources and high risk to develop R&D activities, would develop collaborative product development as innovation strategy.

Food product development projects

The development of new, original or innovative food products, or the improvement, modifications of products that already exist are tasks that the R&D team must strive to achieve. When technical knowledge is distributed across the borders of organizations, they seek to acquire technical capabilities through the establishment of IORs. They may not have enough knowledge about the service or technology to be accessed or absorbed (Cohen and Levinthal, 1990). Jones and Lichtenstein (2008) emphasize the importance of the uncertainty management, because temporary projects favour this condition.

In the global context in which competitive and transnational corporations – that seem to 'pull' the development of new products (Raud, 2008) – are inserted, one sees the internationalization of R&D projects. Multifunctional teams are geographically distributed and interact over the internet for the development and commercialization of products in different markets, and in different cultural realities. It is essential that this interaction may occur in a fluent and agile way, consistent with the evolution of consumer demand and competitiveness. Therefore, the management of product development is also an important question to the success of the new products research, development, and launching on the market.

Lima and Révillion (2006) identified through case study the competitive strategies of the dairy sector. According to them, the development of FF is motivated by the prospect of incurring lower investments in R&D. The authors also report a lack of integration between marketing and production sectors (or sometimes R&D), characterizing

the low encoding and transfer of technical and marketing informations.

Vieira *et al.* (2000) have studied cases of SMEs in Rio Grande do Sul (RS, the southernmost State in Brazil). They argue that the globalization of supply chain led to cooperation agreements – such as strategic alliances. These have become an important tool for competition empowerment. Furthermore, authors state that the different forms of cooperation (horizontal or vertical) can be considered an option for local businesses that have competitive difficulties due to the concentration of transnational companies in the agribusiness sector.

Finally, Cabral (2007) shows in his analysis of the Brazilian food industry that there are few partnerships for R&D between the private and public sector, although this variable seems to be very effective in leveraging the innovative activity of firms. Likewise, De Barcellos *et al.* (2009) suggest that Brazilian consumers are likely to try new products, and that the domestic industry should seize this opportunity to launch new food products.

3. Methodology

A case study was the methodology chosen for this research. Thereby, this study may contribute to provide empirical evidences regarding to the establishment of IORs for the development of innovative products, illustrating the type of relationship that can assist Brazilian small companies or co-operatives to compete with products launched by transnational companies. Given these objectives, the first step was to collect secondary data, followed by two semi-structured personal interviews that were made with both actors involved in the IOR. Both respondents were questioned about aspects involving the antecedents, motivation, risks and barriers to the establishment of inter-organizational projects, focusing on the development of innovative food products. Both interviews were crossed to analyse the dyadic perspective. A brief description of the interviewed actors is therefore presented.

Centre of Excellence in Advanced Technologies of the National Service for Industrial Apprenticeship – Regional Department of Rio Grande do Sul State

The National Service for Industrial Apprenticeship (SENAI) was created in 1942 as an initiative of the industrial sector. Its mission is not limited to professional and technological training, as the Centre also contributes to the competitiveness of Brazilian industry by developing innovative products and processes. The Centre of Excellence in Advanced Technologies (CETA) is a division of SENAI in the Regional Department of RS, which is responsible for bringing technological innovation to benefit the industry throughout collaborative efforts, promoting and contributing to the technological, economic and social development in South Brazil (SENAI, 2012).

Its main activity is to conduct collaborative research with a focus on technological innovation applied to the Brazilian industry, based on the Fraunhofer model (Fraunhofer Society of Germany). Fraunhofer is an integrated network of intermediate research institutions in Germany that support industry and technology transfer as part of a national innovation eco-system (Reid *et al.*, 2010). A National Innovation System is the 'eco-system' of institutions, agencies, bodies, funding flows, technology and knowledge transfers, and channels, which supply a national economy with innovations. CETA promotes integration of science and technology institutions with the real needs of the industry. In this way, CETA also helps companies to submit projects to funding opportunities (i.e. funding from the Brazilian Service of Support for Micro and Small enterprises).

The greatest exponent of this kind of activity is the annual funding from the institution itself, called SESI SENAI Innovation Funding. They offer support for the promotion of research, process development, product innovation and social technologies (SENAI, 2012). Normally, in these situations, CETA proposes a partnership to develop these innovative projects. If it is approved, CETA usually manages the project and provides technical support.

Authors carried out a semi structured interview with the CETA Food, Beverage and Pharmaceutical Sector coordinator (named as Interviewee 2).

A south Brazilian dairy co-operative

The chosen dairy co-operative (named here as Coop.) is the oldest in activity in Brazil (ca. 100 years of activity). Currently, there are over four thousand members and over a thousand employees engaged in operating a supply chain that combines the control over the production of milk and meat. About 250 million litters of milk are manufactured annually. Of those, approximately 16 thousand tons correspond to dairy products. Today the Coop. manufactures 30 kinds of cheeses and over 206 refrigerated dairy products.

This Coop. is the first one to reach the ISO certification in Rio Grande do Sul State (RS). In addition, the Coop. won in 2010 a Top Marketing regional award on the food category. Their innovative dairy product was pointed as a milestone

for the dairy industry. Nowadays, the Coop. produces two functional food products already recognized by the National Health Surveillance Agency (ANVISA). Both of them have probiotic cultures that naturally benefit consumers' digestive health.

Authors have chosen this Coop. because it is the first, among the dairy industries from RS, to obtain recognition of functionality from the regulatory agency. It means it was the first Brazilian company to produce a cheese classified as functional. To reach the goal of this study, authors have interviewed the responsible of the Coop. R&D sector (named as Interviewee 1). Moreover, the Coop. is currently developing an inter-organizational project for the development of an innovative and FF product. This project is conducted in partnership with the CETA/SENAI-RS.

The project was approved by the SESI SENAI Innovation funding, obtaining financial support from SENAI (both National and Regional) for its development. In addition to financial assistance, CETA assists the Coop. in project management all the way from the planning stage until the product is launched and reaches the final consumer.

The proposal is to develop an innovative dairy product, savoury and functional, aiming to stimulate satiety and to help to control overweight. The innovation consists in the use of a functional ingredient (patented) that is supposed to suppress hunger sensation, increasing the period until the next meal and also reducing the amount of food ingested.

4. Results

Inter-organizational project: the development of an innovative dairy product

When asked about the reasons for the establishment of inter-organizational projects, the Interviewee 2 (CETA) says that the main motivation is to contribute to the technological, economic and social development. It is known, however, that each project established by funding projects brings financial gains to the technological centre. In Brazil, technological centres are related to the technical and scientific development system. It means that most R&D initiatives are linked to public funding, for example funding from the Brazilian Ministry for Science, Technology and Innovation (MCTI).

However, according to the perception of Interviewee 1 (Coop.), one of the main motivations for participation in an inter-organizational project is the ability to finance part of the costs involved, as can be seen in the report below:

> The development of an innovative product provides and requires investments in research and partnerships with educational institutions, for example. The Coop. has in its budget a certain amount for investment in development of new products, but that would not be enough to cope a project such these. Furthermore, the contact with universities is facilitated thorough the CETA, as it already has the contacts. Thus, the intention is to develop the product, joining forces and expertise in a multidisciplinary team, where experiences can be developed and exchanged – beyond the financial incentive. (Interviewee 1)

The reasons cited by the company are primarily linked to the economic aspect, but also to the knowledge – shared by the multidisciplinary team. As shown by Brass *et al.* (2004), the sharing of costs and reduction of uncertainty are considered the main reasons for establishing an IOR for a R&D project execution. Another prominent motivation is the access to technologies; considered by the Coop. as being easier through the partner.

In terms of project flow, usually firms show the interest to develop innovative products or process and thus the first contact with the CETA is made. The funding promoted by the institution itself creates a real opportunity for the viability of this type of project. However, Interviewee 2 states that many food companies still ignore this opportunity. There is, therefore, a lack in the communication of the ways to innovate.

When Interviewee 1 was asked if the innovative product in question would be among the company's priorities, even without the partner financial assistance, the answer was 'no'. The reason is because the functional claim from the innovative ingredient applied in this project is currently not recognized by the regulatory agency (ANVISA). To obtain it, it would be necessary to perform clinical trials (in humans). The Interviewee 1 completes: 'if by its own, the company should have to make large investments that would not be affordable'.

In addition, projects supported by funding proposals have requirements regarding the work schedule and accountability. In this sense, aspects related to the delay of outsourcing suppliers were reported as a barrier by both actors involved. Especially due to the financing modality of SENAI, most of the services required for a project development needs to be hired through competitive bidding, a highly bureaucratic and time consuming process.

That is the reason why the Interviewee 1, when asked about the barriers faced by Coop. with the IOR, reports performance aspects of the schedule: the slowness in the hiring process ultimately affects the project's progress. There is a deadline to be reached and extensions possibilities are rather restricted.

As pointed out by Brass *et al.* (2004), innovation is a consequence of the establishment of IOR. The Coop. claims to have a clear idea that innovation can help them to compete, but when asked about the possible gains with the IOR project, there are agency conflicts and firm internal barriers. The Interviewee 1 clearly sees the gains of the partnership, but the Coop. management was initially reluctant when the first partnership proposal was presented. This is due to an antecedent: the Coop. has a prior successful experience regarding the launch of an innovative product, without the establishment of an IOR.

However, although both projects are related to FFs and considered innovations in the Brazilian market, the functional ingredient used in the prior individual Coop. project had already a functional claim registered by the ANVISA before its development. This fact dramatically reduces the investment involved, because in this case is not necessary to perform clinical trials. On the other hand, the new ingredient, as stated earlier, still needs to be approved by ANVISA, which raises significantly the investment. When the project finishes, there is an expectation from the Coop.'s R&D sector of proving to the Coop. management how important the partnership was. Here we highlight the legal need as pointed out by Oliver (1990) as a contingency factor to propel the establishment of IORs.

Moreover, as a result, learning is seen by the Coop. as a positive consequence of the partnership with CETA. Sharing control techniques and practices of project management are highlighted by Interviewee 1 as an important issue in the IOR: 'I hope that the company agrees to continue working in this way', he argues. The Interviewee 2 also shares this reasoning, considering every project as an opportunity to inter-organizational learning.

The performance, suggested by Brass *et al.* (2004) as a consequence of the establishment of the IOR, is also seen by the Coop. as a gain. The company believes that the investment involved in the process of product registration will be compensated by the sales of the product. As Interviewee 1 states, 'the product has a clear market potential, considering the current conditions of the population. Furthermore, the launch of this product should enhance our brand value, provide healthiness, and show innovation and concern for the consumer'. For CETA, the performance can be considered the dissemination and consolidation of the services provided by the SENAI: all the technical disclosure (articles, brochures, etc.) of the new product should be linked to SENAI. A summary of the responses obtained in interviews with the actors involved can be seen in Table 4.

Dyer and Singh (1998) suggest that the critical resources of an organisation help them to measure the firm's boundaries and are embedded in resources and inter-firm routines. These authors argue that the relationships between businesses are important for understanding the competitive advantage. They identify four potential sources of advantage in inter-organizational routines: specific qualities of the relationship; fragmented knowledge of

Table 4. Summary of the interviews with the dairy co-operative and the technological centre.

	Dairy co-operative	CETA/SENAI-RS
Motivations	• sharing knowledge and efforts • funding partner for the project	• contribution for the technological development of the RS State • financial gain trough the projects' management
Barriers	• project deadlines • slowness in the process of hiring subcontractors	• firms do not know that funding possibilities exists • slowness in the process of hiring subcontractors
Results	• access to new practices of project management, learning • establishment of relationships with research institutions • new product with great market potential • expansion of functional products line	• access to new knowledge related to technology, learning • disclosure and consolidation of SENAI institution

routines, complementary resources and skills, and effective governance.

In this regard, it is worth noting a comment made by Interviewee 1, with regard to the absence of competitive advantage (failure) in the establishment of IORs for an R&D project: '...it is important to highlight in this kind of project that the results may be met or not', sometimes due to the lack of critical resources or mismanagement of the IOR. From a strategic perspective, the ability to have a relationship with other organization makes the competitive advantage to be no longer considered as a result of individual critical resources.

As showed in Table 4, there are some common objectives in the IOR, as well as a complementary relationship between the actors. It is also interesting to highlight that although both approaches (competition and cooperation) may reside together (Jarillo, 1993), in this case cooperation seems to be the essence of this relationship. This kind of IOR makes it possible to have a predominant orientation for consumer satisfaction.

5. Conclusions

Betoret *et al.* (2011) remind us about the necessary attention that must be given to investments in product development and failures in functional food product launches. Historically, as a consequence of some negative results, the main strategy in the food industry has been characterized by the parsimonious development of innovations. Many of them are based only on brand extensions, following the same line of products, which embraces lower risks (Grime *et al.*, 2002). However, studies conducted in Brazil (De Barcellos *et al.*, 2009; Cabral, 2007) found that the food industry could be missing a great market opportunity.

To change this scenario, as well to spread risks, the Coop. has established an IOR with CETA for the project development of an innovative food product. It is important to point out that the project received public funding, which is a characteristic of the Brazilian science and technology system. Basically, in this relationship, the company gives the working hours of their employees and also the raw materials. The technological centre, in turn, provides its expertise in management, in addition to technological solutions research to meet the project goal. CETA also provides working hours of his team, as well as part of its infrastructure.

Inter-organizational projects may be understood as projects in which organizational actors solve pressure problems regarding uncertainty in demands and transactions. The demands' uncertainty reverses on markets through rapid changes in consumer preferences and tastes – which turns into searches for advanced technologies for the development of new products that would overlap the existing ones (Jones and Lichtenstein, 2008). This form of uncertainty in demand underscores the need for more flexible and adaptable organizational structures.

Inter-organizational projects are an alternative as they offer flexibility, more than internal projects and individual organizations normally do. The empirical results from this research, analysed under the perspective of IOR, indicates that the Coop. is venturing by bringing to the market an innovative product that, thanks to the collaborative effort with CETA, can bring real benefits to this regional co-operative. The partnership reduces risks and costs by integrating research expertise with manufacturing and market knowledge. Such results contribute to the understanding of IOR and network capital (Huggins *et al.*, 2012) in the Brazilian food sector. In fact, food networks are still incipient in the country and therefore, initiatives aiming to increase knowledge and innovation by bringing development to the food market are certainly welcome.

Our findings are aligned to Huggins *et al.* (2012) study, where network capital is found in IORs with other organizations outside direct market actors. Abdirahman and Sauvée (2012) agree that innovation is a very complex and multifaceted phenomenon where different actors, knowledge and information flow must be involved. In our case study, the dyadic relationship is motivated by the national innovation system, but is still not adopted by many SMEs and co-operatives. There are several reasons for that: lack of communication/knowledge about this kind of IOR, bureaucracy, difficulties to manage the development project, distance between the location of the food companies/co-operatives (rural area) and research centres, among others.

In addition, it is well known that health is the most significant trend and is motivating innovations in the food and beverage world market. Brazil is one of the leading countries in food production and the FF market in the country grows 10% per year, three times more than conventional food products market (De Barcellos and Lionello, 2011). The problem of overweight and obesity in populations is also encouraging the development of functional and healthier food products. Hence, the launch of a healthy product that provides the feeling of satiety and helps in the control of obesity, contributes to the prevention of a public health problem. In this context, the ongoing project from Coop. and CETA fills an eminent market need.

Another indirect benefit from the launch of the new product lies on the market consolidation of the Coop. as supplier brand for functional and health products, facilitating the growth of the Coop. and the maintenance of more than 12 thousand direct jobs currently provided by the company. The regional development may also be considered a spill over of the IOR. The consolidation of the cooperative market contributes to social and economic development of its members who are small farmers in the mountain region of RS. The findings of this exploratory study might also help to promote and engage other small food companies in IORs aiming to develop innovative products.

Finally, it is suggested to further research this topic in other cultural contexts, analysing the results of cooperation strategies and pointing to other SMEs develop research projects and innovative product development. It is also suggested a comparative study of the strategies and processes of innovation in Brazilian companies with local operations that compete with multinationals (such as Danone and Nestlé), those which usually hold foreign capital for investment, large-scale production structures and different market knowledge. Empirical studies are useful to approximate academic knowledge and current practice, as suggested by Serenko *et al.* (2010).

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