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### **Determinants of innovation network performance: the case of selected SME focused networks in the agro-food sector**

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#### I. INTRODUCTION

Innovation, defined as the successful exploitation of ideas into new products, new processes, new forms of organization and new markets (Lundvall 1995; Pittaway, Robertson et al. 2004), is widely recognized as being an important strategic tool for small and medium enterprises (SMEs) to achieve competitive advantage (Gellynck and Kühne 2010). Innovation is traditionally viewed as taking place within a single enterprise (Lee, Park et al. 2010). However, since knowledge is increasingly getting specialized and distributed across organizations, the innovation process tends today to be located in the networks in which the enterprise is embedded (Powell, Koput et al. 1996). Through participating in networks, enterprises access to new technologies, know-how and resources, vital for developing innovations and hence sustainable growth, shorten innovation time, increase the flexibility of their operation, reduce transaction costs, enjoy economies of scale and share risk and uncertainty among network organizations (Powell, Koput et al. 1996; Kale, Singh et al. 2000; Hallikas, Karvonen et al. 2004; Lee, Park et al. 2010). In such a perspective, having access to well-performing networks is of utmost importance for enterprises, and especially for SMEs as they often lack the necessary resources and capabilities to successfully innovate by sole means of in-house activities (Nooteboom 1994; Narula 2004; Hausman 2005). However, it is recognized that not all networks are equally performing (e.g. Dyer and Nobeoka 2000). Network performance has therefore started to receive attention in literature (e.g. Beamon 1998). Still, studies on whether and under what circumstances networks perform well are scarce, especially these which have as a unit of analysis the network itself as opposed to the actors participating in the network (Provan, Fish et al. 2007; Kenis and Provan 2009; Lefebvre, Molnár et al. 2010). Moreover, the concept of network performance remains poorly defined as scholars generally focus on different conditions contributing to performance without defining or operationalizing the concept properly (Kenis and Provan 2009). Hence, the objective of this paper is two-fold. It aims at developing a framework to assess network performance at the network level and at analyzing its determinants.

The term network is being used to refer to a wide range of phenomena. Authors have focused on social networks, public sector networks and business networks including supplier and marketing or distribution networks, technological-innovation and product-development networks, and different competitive coalitions (Möller and Svahn 2003; Westerlund, Risto et al. 2008; Kenis and Provan 2009). In this paper, we will focus on networks which refer to any group of organizations formally interconnected in relationships through membership aiming at exchanging knowledge and/or developing innovation. The decision to focus on this particular type of networks, which we will call innovation networks in the

rest of this paper, was justified by the fact that many European countries have started to support their establishment and development with the aim of encouraging innovation in SMEs and hence economic growth and employment (e.g. Hoffman, Parejo et al. 1998; Capron, Cincera et al. February 2000).

The paper is structured as follow. Section II reviews the relevant literature on network performance based on which a framework to assess network performance is developed. Next, section III presents the methodology of the empirical research. Section IV focuses on the findings of the empirical research. Finally, section V highlights the main issues related to our findings and provides direction for future research.

## II. LITERATURE REVIEW

### II.1. Network performance

Performance is known to be a complex concept, especially concerning its measurement. Authors in different disciplines have generally different views on which criteria, defined as standards on which to base a judgment (Kenis and Provan 2009), performance should be assessed on and on what performance indicators, used to measure what a criterion is in its operational terms, should be included in the performance measurement system. As a consequence, a large number of performance indicators are used in literature. These are usually of different nature (i.e. qualitative vs. quantitative) and refer to different categories of measures (e.g. financial and operational), to different levels of performance (e.g. process, organization and supply chain levels) and finally to different performance criteria (e.g. efficiency, goal attainment, equity, quality, productivity, growth, survival, profit, stability, resilience, learning) (Beamon 1999; Aramyan, Oude lansink et al. 2007; Fabbe-Costes and Jahre 2008; Kenis and Provan 2009). Following Beamon (1999) who focuses on measuring supply chain performance, there are however a few characteristics a performance measurement system should include in order to be effective. These characteristics relate to *inclusiveness* (measurement of all pertinent aspects), *universality* (allow for comparison under various operating conditions), *measurability* (data required are measurable) and *consistency* (measures consistent with goals).

Network performance has started to receive attention in literature in the last few decades. Like for any type of performance, scholars have proposed different ways to evaluate it. When considering papers focused exclusively on business networks (which include innovation networks), network performance seems often to have been reduced to the performance of the enterprises participating in the network (Provan, Fish et al. 2007; Lefebvre, Molnár et al. 2010). In other words, a network performs well when it enhances the performance of the enterprises participating in it. Following Provan, Fish et al. (2007), this organizational view might be explained by the fact that the performance of business networks at the network level appears to be less important than the performance of its members, these networks being often bottom-line oriented and members' goals driven. Network performance has therefore been associated with the performance of the enterprises participating in the network which is measured in some papers, in terms of economic outcomes (e.g. Rowley, Behrens et al. 2000; Goerzen and Beamish 2005; Zaheer and Bell 2005; Koka and Prescott 2008; Fortuin and Omta 2009) and in others, in terms of learning and/or innovation outcomes (e.g. Kale, Singh et al. 2000; Beckman and Haunschild 2002; Ritter and Gemünden 2003; Wincent, Anokhin et al. 2009). Common indicators of economic, learning and innovation performance are presented in table 1. Although the focus is mostly on the organizational level when considering network performance, there are some scholars who have started to consider the performance of the whole network, but they often do so at the conceptual level (e.g. Dyer and Singh

1998; Provan and Kenis 2007). Still, some papers do it empirically. Huggins (2000), for example, examined through the analysis of four case studies the processes and causes of network success and failure, defined in terms of the ability of the network to become a sustained and valued form of business activity for its members.

*Table 1: Common indicators of network performance at the organizational level (business networks)*

Performance criteria	Performance indicators	Sources
Economic	Improvement of competitive position	Wincent, Anhokin et al. 2009
	Reduction of costs	Wincent, Anhokin et al. 2010
	Market share	Zaheer and bell 2005
	Growth rate	Fortuin and Omta 2009
	Productivity (sales per employee)	Koka and Prescott 2008
	Return on assets	Rowley, Behrens et al. 2000; Goerzen and Beamish 2005
	Return on sales	Goerzen and Beamish 2005
	Sales	Fortuin and Omta 2009
	Return on capital	Goerzen and Beamish 2006
Learning	Acquirement of some new or important information through the network	Kale, Singh et al. 2000; Beckman and Haunschild 2002
	Acquirement of some critical capability or skill through the network	Kale, Singh et al. 2001
	Enhancement of enterprise' existing capability or skill thanks to the network	Kale, Singh et al. 2002
Innovation	Product innovation succes	Ritter and Gemünden 2003
	Process innovation succes	Ritter and Gemünden 2003
	Improvement of products or services	Wincent, Anhokin et al. 2009; Fortuin and Omta 2009
	Development of new products	Wincent, Anhokin et al. 2010
	Enhancement of effectiveness of R&D efforts	Wincent, Anhokin et al. 2011

It is worthwhile to mention that the tendency to focus on the organizational level when assessing network performance disappears when considering performance of networks in the public sector. Networks in the public sector are characterized by a multitude of different agencies ranging from governmental to non-profit and for-profit organizations aiming at providing jointly a particular service to the community. Public networks are therefore set up in order to reach a goal that goes beyond the ones of each individual organization within the network. In such a perspective, the outcomes at the network level prevail over the organizational ones. Hence, depending on whether the outcomes refer to tangible items (such as plans, projects and range of services offered) or to the effects these items have on the community, performance of public networks is either measured at the network level or at the community level but rarely at the organizational one (Provan and Milward 1995; Koontz and Thomas 2006; Provan, Fish et al. 2007; Herranz 2010). Still, some authors acknowledge the importance of considering the organizational level when evaluating performance of public networks as the individual interests of the network members need to be at least partly fulfilled in order to assure a certain stability to the network and hence its performance (e.g. Provan and Milward 2001).

Last, performance measurement systems of business networks focus essentially on one type of network stakeholders i.e. the organizations within the network. In comparison, performance measurement systems of public networks, by including different levels of analysis, generally integrates the views of different network stakeholders which usually can be classified within three broad categories: the *principals*, who monitor and fund the network and its activities, the *agents* who work in the network both as administrators and service-level professionals and the *clients* who actually receive the services provided by the network (Provan and Milward 2001).

## II.2. Determinants of network performance

There is a wide variety of factors which have been studied by scholars as influencing network performance, some of which relating to the characteristics of the network, others to the external

environment in which the network evolves (for an extensive review see Lefebvre, Molnár et al. 2010). Regarding first the factors related to the characteristics of the network, one can classify them into two groups: the *exogenous factors* i.e. factors that cannot be instrumentally managed by the network itself and the *endogenous factors* i.e. factors that can be instrumentally managed by the network itself (Kenis and Provan 2009). Within the exogenous factors, researchers have been interested in investigating the *governance forms of the network* (i.e. participant-, lead organization- and network administrative organization governed networks including network board's characteristics), its *inception* (i.e. mandated versus voluntary) and its *development stage* (e.g. Provan and Kenis 2007; Kenis and Provan 2009; Wincent, Anokhin et al. 2009). Within the endogenous factors, some authors have studied elements of the *structural dimension of the network* which refers to the physical characteristics of the network. These elements are usually of three types. The first refers to *network configuration* defined as the pattern of linkages among network members and which includes network sparseness (e.g. Rowley, Behrens et al. 2000), network density (e.g. Soda, Usai et al. 2004), pattern of direct and indirect ties (e.g. Gulati, Nohria et al. 2000) and centrality (e.g. Koka and Prescott 2008). The second refers to *network membership* which relates to the composition of the network and includes the number of network members (e.g. Ritter and Gemünden 2003) and the type of members described for example in terms of innovativeness (e.g. Zaheer and Bell 2005) and knowledge resources (e.g. Rodan and Galunic 2004). Finally, the third type of elements of the structural dimension of the network relates to *network tie* which describes the characteristics of the relationships between network members and includes the strength of ties (e.g. Rowley, Behrens et al. 2000) and network multiplexity (e.g. Beckman and Haunschild 2002). Other authors have studied elements of the *structuring dimension of the network* which relates to the policies and activities occurring within the network that prescribe or restrict the behavior of network members. These elements can usually be classified into two types. The first concerns *network management* which refers to the managerial and behavioral components that facilitates the execution of joint action across the whole network. Such components are for example conflict management (e.g. Kale, Singh et al. 2000), development of shared goals (e.g. Huggins 2000; Inkpen and Tsang 2005) and development of network or shared culture (Pitsis, Kornberger et al. 2004; Inkpen and Tsang 2005). The second type of elements of the structuring dimension of the network refers to *network governance* which involves the use of institutions and structures of authority and collaboration to direct, administrate, and control joint action across the whole network. Network governance has often been studied in terms of formal (e.g. contractual and equity arrangements) and informal (e.g. reputation and relational capital referring to mutual trust, respect and friendship that reside at the individual level between network members) network governance mechanisms (e.g. Dyer and Singh 1998; Kale, Singh et al. 2000). It should be mentioned that many of the elements of the structuring and structural dimensions of the network are recognized to be in the hands of the network orchestrator, also labeled as network broker or facilitator, which is the primary actor engaged in the design and management of the network (Dhanaraj and Parkhe 2006). Common functions of the network orchestrator which have been studied for their impact on network performance evaluated in terms of innovation outputs are: *demand articulation* i.e. diagnosis and analysis of problems and articulations of the needs (Howells 2006), *network construction* (also referred as *network brokerage* or *design*) i.e. construction of the network by scanning and selecting appropriate collaborating partners, and *network management*, which in innovation networks, usually refers to three tasks (Dhanaraj and Parkhe 2006; Batterinck, Wubben et al. 2008; Lee, Park et al. 2010). The first involves ensuring knowledge mobility, defined as "*the ease with which knowledge is shared, acquired and deployed within the network*", by enhancing knowledge absorption, reinforcing network identification and enhancing interorganizational socialization. The second task involves managing innovation appropriability, referring to the "*ability of network members to capture the profits generated by an innovation*", through the use of appropriate

formal and informal network governance mechanisms. Finally, the third task refers to ensuring network stability by enhancing reputation and building multiplexity.

Regarding the factors related to the external environment in which the network evolves, the focus has especially been on the *institutional and policy environment*. The institutional and policy environment is recognized to play a role in facilitating the development of networks by shaping the cultural conditions and infrastructure for networking but also by assisting in brokering relationships and acting as intermediaries. Moreover, the institutional and policy environment is also recognized to play a role in shaping network configurations, and hence network performance, as it influences inclinations towards trust, legal contracting, opportunism and self-interests (e.g. Pittaway, Robertson et al. 2004; Thorpe, Holt et al. 2005).

Although the above mentioned factors have all been investigated to a wider or lesser extent for their impact on network performance, often no general conclusion can be drawn concerning the nature of the link between these factors, especially the ones related to the structural dimension of the network, and network performance. Three reasons have been given to explain such a situation. First, the impact of a certain factor on network performance, usually measured at the organizational level, might change with the performance criteria considered e.g. innovation vs. economic performance (e.g. Kenis and Provan 2009; Lefebvre, Molnár et al. 2010). Second, the benefits of a certain factor might be contingent on the external environment and especially on its stability (e.g. Dyer and Nobeoka 2000; Rowley, Behrens et al. 2000; Koka and Prescott 2008). Finally, and most importantly, these benefits might also change depending on the strategy developed by the enterprise towards the network (e.g. Gemünden, Ritter et al. 1996; Koka and Prescott 2008); or in other words, there is no such thing as a perfect network as a network regarded as well-performing by a certain enterprise can be regarded as poorly-performing by another.

### II.3. Towards a conceptual framework of innovation network performance

From the literature review of network performance and its determinants, it appears that no *universal* network performance measurement system has been proposed to allow the comparison of different innovation networks. Since these, as already mentioned, are often supported by public bodies, the need for such a measurement system is pressing as it would assure the appropriate allocation of public funding towards the most performing networks (Hoffman, Parejo et al. 1998; Provan and Kenis 2007; Capron, Cincera et al. February 2000). As already suggested above, the difficulty in developing a universal performance measurement system for innovation networks might partly lie in the choice of level at which the performance has so far been evaluated. Network performance at the organizational level is too context dependent. Hence, we propose to develop a performance measurement system at the network level, which we will describe in the following paragraph.

Similarly to the approach developed by Provan and Milward (1995; 2001) to assess the effectiveness of public networks, we used a multi-stakeholder perspective in order to identify possible indicators for innovation network performance. From a network level standpoint, four types of stakeholders can be distinguished in innovation networks: *funding organizations*, which are usually reduced to the government; *member organizations*, which are enterprises including SMEs but also research centers, universities, etc.; *network orchestrator*, which is often not another organization member of the network providing its own services, but an entity established for the exclusive purpose of network governance (Provan and Kenis 2007; Lee, Park et al. 2010); and the *business public* which are enterprises that are not member of the network. Keeping in mind these four types of stakeholders and the interests they might

have in the network, we propose to assess network performance through three different ways which all have been suggested to a lesser or greater extent to measure performance of public networks (Provan and Milward 2001; Herranz 2010). First, we propose to assess network performance in terms of network membership growth. Innovation networks are usually set up in order to enhance the economic growth and employment in a region through enhancing learning and innovation within member organizations. Hence, the more enterprises join the network, the bigger the impact of the network will be on the region. Second, we propose to evaluate network performance in terms of membership length. A network is able to retain its members only if it satisfies the interests of its members. Third and finally, we propose to assess network performance in terms of the level of interaction between network members, where level of interaction refers to the extent to which strong ties among network members exist within the network. Out of the three ways which we have proposed to measure network performance, the last one is the only one referring to the main goal of the networks under study which relate to the exchange of knowledge and/or development of innovation. Strong ties, which are differentiated by a high frequency and intensity of interaction embedded of trust, are recognized in the literature to facilitate the exchange and transfer of information and knowhow across the network (Kale, Singh et al. 2000; Rowley, Behrens et al. 2000). Hence, a network performs well if it is characterized by a high level of interaction between its members.

From the literature review of determinants of network performance, it appears that network performance at the organizational level is contingent upon a variety of determinants which, for the majority, are dependent on the ability of the network orchestrator to design and manage the network. Hence, we propose that network performance at the network level is mostly contingent upon the ability of the network orchestrator to design and manage the network. We will therefore focus on the analysis of this particular determinant and its different components in the next sections of this paper where we will focus on the second part of the objective of this paper, namely the analysis of the determinants of innovation network performance at network level.

### III. METHODOLOGY

A case study approach was used in order to reach the second part of the objective of this paper concerning the analysis of the determinants of network performance at the network level. This approach was chosen as it allows, following Yin (2009) and Eisenhardt (1989), to study a contemporary phenomenon which is difficult to separate from its context, and its dynamics.

Two selection criteria were used to sample the case studies. The first one was related to our definition of innovation networks: only networks aiming at fostering exchange of knowledge and/or innovation and presenting a defined membership were selected. Second, in order to enhance the comparability of the cases, the selected networks needed to include a majority of SMEs as network members and to be oriented to a certain extent towards the agri-food sector. At the end of the selection process, two networks were selected in Belgium. Six in-depth interviews (using semi-structured questionnaires) were conducted with key actors of the selected networks (network orchestrators and SMEs). In addition to the interviews, complementary documents were collected in order to increase construct validity. All interviews were tape recorded and entirely transcribed. The transcripts were sent by e-mail to the interviewees for review which contributed to their validation. For each network, a detailed case description was developed. A cross-case synthesis was then performed in order to compare both networks and identify possible differences and similarities (Yin 2009).

## IV. CASE STUDY AND FINDINGS

### IV.1. Cases general description

NetA is a public-private funded regional network which was developed in 2006 through the initiative of the Walloon regional government. The network was created with the aim to foster the competitiveness of enterprises in the food industry and increasing business and employment in the sector by bringing enterprises together, developing the spirit of innovation, improving the profitability of food chains and encouraging the positioning of enterprises in growing market. To achieve this goal, NetA organizes five types of activities all revolving around the four priority development areas (i.e. health foods, innovative production and conservation technology, bio-packaging and the development of durable food industry networks) which have been defined by the manufacturers in the sector. First, it offers the possibility to its members to develop R&D projects together; projects which have to be initiated by enterprises and not by research institutes, which last to 3 to 4 years and which are partly funded by the Walloon Region and partly by the members taking part within the project. Second, it offers its support (e.g. technical advice, financial resources) to any enterprise (inclusive non members) having a technological project falling in with one of the four priority development areas mentioned above. Third, it proposes different training programs e.g. training in nutrition to any person interested. Fourth, it organizes one-day length information meetings and seminars on different topics open to members as well as non-members. Fifth and finally, it provides its members with up-to-date information about international markets. The network counts at the moment 145 members, most of them being SMEs, who are asked to pay a membership fee which varies depending on the size of the enterprise. The network is managed by a board of directors, mainly composed of SMEs from the food sector, whose decisions are implemented by the operations unit made up of 4 persons.

NetB is a private funded regional network which was developed in 1999 through the initiatives of three SMEs having participated to a training program organized by an educational institute. During this training program oriented towards SMEs and their day-to-day managerial problems, a strong group dynamic was developed among the participants perceived as very beneficial but which was fading away soon after the program ended. The primary objective of setting up NetB was therefore to not lose this dynamic. The idea was that as soon as the program, organized every year, was finished, all participants were automatically becoming members of the network. Today, the network has for main objective to be a group of SME's managers of various sectors having participated in the SME-oriented training program and to develop network activities in line with the needs of SMEs. Activities organized by the network are of six types: symposia, conference and round-table events around certain managerial themes, company visits, short-length training programs on specific themes (such as finance and human resources), newsletters, and a virtual web space where members can have access to business offers among other. The network counts currently 735 members who are all SMEs. So far, there has not been a membership fee associated with the network but there will be in 2011. The network and its activities are managed by the educational institute offering the SME-oriented program who receives advice on the network orientation and its activities from a network committee. The network committee is made up of about ten network members, each of these members having participated to the training program in different years.

### IV.2. Determinants of growth

From the case studies, network growth is determined by two of the three functions of the network orchestrator: demand articulation and network construction. Demand articulation, considered especially

in the first case, refers to the identification of the needs and problems of the SME public and to their articulation within the strategy and activities of the network, while network construction, considered especially in the second case, relates to the identification of potential new members.

NetA emphasizes the importance of consulting SMEs outside of the network so their needs can be identified and eventually incorporated within the strategy of the network and its activities in order to encourage them to join the network. Moreover, NetA recognizes that there are differences between SMEs towards networking. Some understand totally the added value of networks, others more or less, while still others not at all. As the perception an SME has towards networking highly influences its choice of becoming a member or not of a network, NetA has developed different tactics to approach different types of SMEs in order to increase the chance that they ultimately join the network.

NetB uses different methods to identify potential new members. First, it develops links with other networks or associations and federations in order to attract their members to its network. Second, NetB organizes different promotional events in order to meet with new SMEs, such as “discovery-lunches” during which the SME-oriented program is presented by some of the network members themselves. Finally, NetB uses its own members to recruit new ones.

Table 2: Raw data concerning determinants of growth

Case	Respondent	
NetA	Network broker	<p>“Last year, we prospected heavily for new members.”</p> <p>“I think there are three types of SMEs. SMEs belonging to the first type understand right away the benefits and advantages of being a member of a network such as ours. They therefore come to our network by themselves. SMEs belonging to the second type understand more or less the benefits and advantages of networking but they do not participate actively in networks as they don’t see networking as a priority ... Finally, SMEs of the third type do not understand at all what networking is about. So the way the network approach a SME as a potential new member depends on the maturity of this SME, its strategy but especially on its readiness towards networking. If this SME falls under the first type, we do not do anything actively to push this SME to become a member of a network. If the SME is of the second type, we will need to make it understand what the added value of the network is, that it will be able to develop faster its existing projects and develop new ones and that it will have access to a critical mass of means to develop innovations and other things ...Finally, if the SME belongs to the last type, the network will not approach it by directly speaking about the collaboration and networking aspects ..., rather the network will approach it with more concrete aspects like by proposing support for a very specific problem that faces the enterprise ... In general, the SME will then ask for another type of support from the network, and a third one, and so on, to at the end realize the importance of having a networking approach towards innovation ...”</p> <p>“... Before taking important decisions within the network, the board of director consult <i>its members but also enterprises</i> who are not members of the network. Consulting them is important as it helps to understand why they are not members of the network and what new aspects should be included in the strategy and activities of the network in order that they join us”.</p>
NetB	Network broker	<p>“We encourage SMEs to participate to our SME-oriented training program.”</p> <p>“It is sometimes difficult to find every year a sufficient number of participants for our program ... so we need to look actively for participants.”</p> <p>“It is important to have links with other networks, associations or federations active in the industrial sector in the region in order to find new participants ...”</p> <p>“We decided to work with another network in another region to meets the needs of the SME in that region. Together with that network, we organize today a shorter version of our training program for these SMEs”</p> <p>“We organize discovery-lunches with our partners in order to present our SME-oriented training programs to their members and attract new participants. These lunches are usually really effective as we invite managers of SMEs who previously participated in our program to present it and the benefits they got from it.”</p>
	SME	“Sometimes we are asked to look for potential new participants for the program who would fit with



		the idea of the concept of the program and the network ..." "I would not participate in a network if I would need to travel 200 km to participate in it."
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### IV.3. Determinants of membership length

From both case studies, demand articulation is the function of the network orchestrator which influences the most membership length. Demand articulation refers here to the identification of the needs and problems of the network members and to their articulation within the strategy and activities of the network. As it is made explicit by both cases studies, demand articulation is a dynamic function. In order to assure that network members do not drop out of the network, the network orchestrator needs constantly to keep an eye on the needs of the members and update the strategy and the activities of the network as soon as these needs shift. This dynamic dimension implies that the network must show certain flexibility. A network too static or too stiff in terms of its goals, strategy and activities will probably exhibit a lower membership length as it does not allow changes.

In NetA, the enterprises are central; hence the consideration of their needs is of utmost importance and is assured through different ways. First, enterprises make up in majority the board of directors who define the strategy and the objectives of the network. Second, besides the board, the task forces in charge of making the network strategy operational and planning the different network activities is also in majority made up of enterprises. Finally, enterprises are consulted in order to assess the different network activities such as the training programs.

The network orchestrator of NetB is really concerned about developing a network strategy and activities along the needs of its members. These are mainly identified through the network committee, whose members are in charge of informing the network orchestrator about the needs of the SMEs members. The network orchestrator of NetB acknowledges that the needs differ among network members and as a consequence emphasizes the importance of offering different types of activities in order to satisfy everybody. Moreover, in order to check whether these activities do actually suit the needs of its members, the network orchestrator of NetB will soon organize sessions with some of its members in order to assess its activities.

*Table 3: Raw data concerning determinants of membership's length*

Case	Respondent	
NetA	Network broker	"Everything that the network does is directed towards the enterprises. The enterprises are also there to define the network strategy." "The board of directors, made up in majority of industries, define the strategy and the objectives of the network." "There are different task forces, made up in majority of industries, who have the task to think about the development of the 4 priority development areas of the network" "The training programs are usually offered during 2 to 3 years ... Their content sometimes changes depending on the experiences we got ... it changes because it did not suit the needs of the enterprises."
NetB	Network broker	"The network committee was updated in 2009. We chose its members in order to assure the diversity of the committee in terms of sectors and personalities ... The members of the committee are chosen for two years, but the system is very flexible so that being a member of the committee does not become a burden." "The members of the network committee, around one for each year during which the training program was organized, play a central role in the network as they are in charge of relaying the information from the participants of their session. They also are in charge of informing us about the needs of the SMEs ... We meet around 3 to 4 times a year to discuss the actual trends, the needs of the SMEs, the potential new themes for the training programs and the needs for organizing conferences and other events."

	<p>“The president of the network committee is there as a consultant, he doesn’t take decision concerning the network but advice us. We take the decision concerning the network”</p> <p>“Our short-length training programs are created based on the needs of the SMEs and their managers ...”</p> <p>“We develop the activities of the network in consideration of the needs and demands of the SMEs ...”</p> <p>“There are different types of members. For example, some members are more interested in activities which are friendlier while others are more interested in activities which tackle very specific themes and issues. It is important therefore to offer different types of activities to satisfy everybody ...”</p> <p>“Next year, we will organize a meeting of around 1 hour with 10 to 15 members of the network in order to discuss what they have used so far from the network, what their expectations are concerning the network and its activities and whether the current activities suits their needs ...”</p>
SME	<p>“I am participating in activities organized by the network if there is a triggering factor ... such as an interesting theme or interesting speakers. But this is me. I am interested in participating in activities which are rather elitist. But I know that there are other members who have another opinion. They prefer for example friendlier events ...”</p> <p>“I am participating less and less in the network activities because first most of the participants come from another region than me and second because I don’t have so much in common with the other participants as they usually work in totally different sectors than me. As a consequence, I can’t do business with them. The only things I can gain from the network are making new friends and learning from their experiences”.</p> <p>“I would stop to be active in the network if a lack of interest in the activities proposed would appear ...”</p>

#### IV.4. Determinants of level of interaction

From the case studies, network construction and network management are the two functions which influence the most the level of interaction among network members. Network construction, especially dealt with in NetB, relates to the identification of new members whose culture or mindset fits with the culture and values of the network. Because it has been recognized in literature that a reduced cultural distance between two entities or organizations assures the development of strong ties between them (Parkhe 1993; Pitsis, Kornberger et al. 2004), such network construction certainly contributes to the enhancement of interaction between network members, and hence network performance.

The network orchestrator of NetB invests a lot of efforts in the selection process of new network members. A visit is paid to every potential new member in order to check whether they present a certain degree of openness, one of the three core values of the network; the other two being respect and ability to listen. Moreover, the network orchestrator of NetB also prevents cultural mismatch between network members by encouraging them to look themselves for new network members in their surroundings.

Network management, addressed in both case studies, refers to the managerial and behavioral components that facilitate the development of strong ties between network members. In the networks under study, these components include strategies to enhance interorganizational socialization, strategies to develop a network culture and shared goals, mechanisms to prevent and solve conflicts and methods to assure transparency.

Interorganizational socialization is recognized in literature to increase relational capital, and hence the development of strong ties (Dhanaraj and Parkhe 2006). In both NetA and NetB, enhancing interorganizational socialization is a core task. Both networks give the opportunity to their members to meet each other through the organization of different common activities. As examples, NetA offers the possibility to its members to develop R&D projects while NetB organizes round-table events around

specific themes. It should be mentioned that the interorganizational socialization is also enhanced through informal activities organized by the network members themselves.

Both shared goals and network culture provide shared meaning and understanding between the network members; shared goals represent the extent to which network members share a common understanding and approach to the achievement of network tasks and outcomes while network culture refers to the extent to which norms of behavior govern relationships (Inkpen and Tsang 2005). As such, both shared goals and network culture are known to affect the development of strong ties, an impact which we found back in the interviews with the SMEs especially. In NetA, the development of shared goals among network members and the development of network culture are especially assured through the R&D projects it organizes as these are characterized by contracts where the objectives of the project are defined and where the tasks lying with each of the participants as well as the expected outcomes are communicated. Not only these contracts contributes to the development of strong links through shared goals and network culture, but they do so also through facilitating communication between partners, a factor recognized as an antecedent of trust, and hence of strong links, in literature (Batt and Purchase 2004). It should be mentioned that because not all network members are involved in all projects, network members in NetA are organized in clusters around the projects in which the dynamic of interaction is very important and between which the dynamic of interaction is very low. In NetB, the development of a network culture is especially triggered during the SME-oriented program. In order to encourage newcomers to adopt the network norms such as openness, respect and confidentiality, the network orchestrator first favors “human-oriented” courses to create a state of mind of introspection. Second, it often invites some of the “older” network members as speakers during the program so they can show the “good example” to new comers.

The degree to which conflicts are prevented to arise or solved significantly impacts the degree to which relationships are embedded with trust, and hence the development of strong ties (Kim and R. 1998). In order to prevent conflicts happening within the projects, the operational unit of NetA reminds constantly the network members of the objectives of the project in which they are involved. Moreover, when conflicts do occur, the operational unit uses its outsider position in order to resolve the conflict in the most equitable way possible. In NetB, a preventing strategy in regard to conflicts that could arise between competitive enterprises is used at the level of the network construction.

*Table 4: Raw data concerning determinants of level of interaction*

Case	Respondent	
NetA	Network broker	<p>“The links between the members are especially strong among the members who participate to the same project”</p> <p>“Each project are partially funded by the partners involved in it ... to make sure that the project really interest them so they really get involved ...”</p> <p>“In order to avoid any problems, contracts are established between the members of the network who work on the same project. In these contracts, the way the outcomes of the project will be shared among the partners is explained as well as the rules which need to be followed during the whole length of the project”.</p> <p>“When a project is finished, the idea is to use the network of partners who was developed around this projects to set up a new one ... the idea is to have a network dynamic through projects because they are structuring”</p> <p>“Within the projects, different organs are set up in order to solve eventual problems”</p> <p>“Sometimes, some members involve in a project come to us to solve a certain problem ... It is the advantage of not being the coordinator of the project. We can stay more neutral and play a role of a mediator.”</p> <p>“It is important to offer different types of activities. Some firms join the network to participate in one kind of activities while other firms join for other kind of activities ... The art is to make them discover</p>

		the whole set of activities organized by the network”.
NetB	Network broker	<p>“We select the participants for our SME-related program. Before the program starts, we meet them and we check whether they have a certain degree of openness. They need to want to receive new information and exchange ... The selection process is important in order to assure a dynamic of exchange ...”</p> <p>“In the network they are some enterprises which are competitors ... in order to avoid any problems like conflicts we ask during the selection process if the presence of competitive firms is a problem or not ...”</p> <p>“The members speak really openly within the network ... People who have some experiences with other networks, usually do not find this in other networks ... SMEs within NetB really share their experiences. In order to obtain this results, the respect and the ability to listen and to share are essential”</p> <p>“Once trust has been established between the members, that they feel good and that they are on the same wavelength, then they start to exchange naturally ...”</p> <p>“People who spent 6 months together (<i>referring to the SME-related program</i>) share strong links ...”</p>
	SME	<p>“During one course of the SME-oriented program, a member of the network was invited to present his experiences about his enterprise. I was really impressed because he showed us all the day-to-day numbers of his company and not only an average. I was really impressed and it made me feel comfortable. Now I am more open as well ...”</p> <p>“During the SME-oriented program, there were a lot of courses about human resources ... these courses automatically pushed us to look at ourselves and analyze our own behavior ...”</p> <p>“If some members speak about something within the network that they would like to not be spread outside, it will not ... There is philosophy of trust and secret within the network.”</p> <p>“I was the only one in my session from the agri-food sector so it was difficult to find some points of synergy with the other members”</p> <p>“Recently, we became member of another network ... I think that this network will fit better with us and our company as the activities which are proposed by this network are closer from our core business than the ones proposed by NetB”</p> <p>“I might have got more out of the network if I would have arrived at a better moment of my carrier. When you arrive in a network with little experience like me, you can’t use the contacts and the information in an appropriate way ...”</p> <p>“I don’t have many contacts with the other members of the network who did not participate in the same year to the SME-related training program.”</p>

## V. CONCLUSIONS

The aim of this article was first to develop a framework to assess performance of innovation networks at the network level and second to analyze the determinants of such performance. This paper differs from the current literature stream on business network performance as it does not conceptualize network performance at the organizational level but at the network level. We believe that such an approach towards network performance is preferable as it gets around the problem of context dependency encountered at the organizational level, but also as it bypasses the challenge of disentangling the multiple interacting variables that are recognized to shape innovation, such as the knowledge, skills and capabilities of organizations, the organizational structure and the social integration mechanisms (Vermeire 2009); innovation which is often used as an indicator of network performance at the organizational level. Through an extensive literature review on networks and consistent with a multi-stakeholder perspective approach, we suggested three criteria for innovation network performance at the network level: network membership growth, membership length and level of interaction. Through a multi-case study approach, we analyzed the determinants of performance conceptualized in terms of these three criteria and found out that they relate, like for the network performance at the organizational level, to the three main functions of the network orchestrator i.e. demand articulation, network construction and network management.

## VI. REFERENCES

- Aramyan, L. H., A. G. J. M. Oude lansink, et al. (2007). "Performance measurement in agri-food supply chains: a case study." Supply Chain management **12**(4): 304-315.
- Batt, P. J. and S. Purchase (2004). "Managing collaboration within networks and relationships." Industrial Marketing Management **33**: 169-174.
- Batterinck, M. H., E. F. M. Wubben, et al. (2008). How do innovation brokers orchestrate SME-innovation networks in agri-food? 8th Chain Conference. Ede.
- Beamon, B. M. (1998). "Supply chain design and analysis: Models and methods." International Journal of Production Economics **55**(3): 281-294.
- Beamon, B. M. (1999). "Measuring supply chain performance." International Journal of Operations and Production Management **19**(3): 275-292.
- Beckman, C. M. and P. R. Haunschild (2002). "Network learning: The effects of Partners' Heterogeneity of Experience on Corporate Acquisitions." Administrative Science Quarterly **47**(1): 93-124.
- Capron, H., M. Cincera, et al. (February 2000). The National Innovation System of Belgium: the Institutional Profile. CESIT, Universiteit Antwerpen.
- Dhanaraj, C. and A. Parkhe (2006). "Orchestrating innovation networks." Academy of Management Review **31**(3): 659-669.
- Dyer, J. H. and K. Nobeoka (2000). "Creating and managing a high-performance knowledge-sharing network: the Toyota case." Strategic Management Journal **21**(345-367).
- Dyer, J. H. and H. Singh (1998). "The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage." The Academy of Management Review **23**(4): 660-679.
- Eisenhardt, K. (1989). "Building theories from case study research." Academy of Management Review **14**(4): 532-550.
- Fabbe-Costes, N. and M. Jahre (2008). "Supply chain integration and performance: a review of the evidence." The International Journal of Logistics Management **19**(2): 130-154.
- Fortuin, F. T. J. M. and O. S. W. F. Omta (2009). "Innovation drivers and barriers in food processing." British Food Journal **111**(8): 839-851.
- Gellynck, X. and B. Kühne (2010). "Horizontaal and Vertical Networks for Innovation in the Traditional Food Sector." International Journal on food System Dynamics **2**: 123-132.
- Gemünden, H. G., T. Ritter, et al. (1996). "Network configuration and innovation success: An empirical analysis in German high-tech industries." International Journal of Research in Marketing **13**: 449-462.
- Goerzen, A. and P. W. Beamish (2005). "The effect of alliance diversity on multinational enterprise performance." Strategic Management Journal **26**: 333-354.
- Gulati, R., N. Nohria, et al. (2000). "Strategic networks." Strategic Management Journal **21**: 203-215.
- Hallikas, J., I. Karvonen, et al. (2004). "Risk management processes in supplier networks." International Journal Production Economics **90**: 47-58.
- Hausman, A. (2005). "Innovativeness among small businesses: Theory and propositions for future research." Industrial Marketing Management **34**: 773-782.
- Herranz, J. J. (2010). "Multilevel Performance Indicators for Multisectoral Networks and Management." The American review of Public Administration **40**(4): 445-460.
- Hoffman, K., M. Parejo, et al. (1998). "Small firms, R&D, technology and innovation in the UK: a literature review." Technovation **18**(1): 39-55.
- Howells, J. (2006). "Intermediation and the role of intermediaries in innovation." Research Policy **35**(5): 715-728.

- Huggins, R. (2000). "The success and failure of policy-implemented inter-firm network initiatives: motivations, processes and structure." Entrepreneurship and Regional Development **12**: 111-135.
- Inkpen, A. C. and E. W. K. Tsang (2005). "Social capital, networks, and knowledge transfer." Academy of Management Review **30**(1): 146-165.
- Kale, P., H. Singh, et al. (2000). "Learning and Protection of Proprietary Assets in Strategic Alliances: Building Relational Capital." Strategic Management Journal **21**(3): 217-237.
- Kenis, P. and K. G. Provan (2009). "Towards an exogenous theory of public network performance." Public Administration **87**(3): 440-456.
- Kim, W. C. and M. R. (1998). "Pricedural justice, strtaegic decision making and the knowledge economy." Strategic Management Journal **19**(4): 323-338.
- Koka, B. R. and J. E. Prescott (2008). "Designing alliance networks: The influence of network position, environmental change, and strategy on firm performance." Strategic Management Journal **29**: 639-661.
- Koontz, T. M. and C. W. Thomas (2006). "What Do We Know and Need to Know about the Environmental Outcomes of Collaborative Management?" Public Administration Review **66**(Special Issue): 111-121.
- Lee, S., G. Park, et al. (2010). "Open innovation in SMEs - An intermediated network model." Research Policy **39**: 290-300.
- Lefebvre, V. M., A. Molnár, et al. (2010). Network performance: What influences it? International EAAE-SYAL Seminar, Spatial dynamics in agri-food systems: Implications for sustainability and consumer welfare. Parma, Italy.
- Lundvall, B. A. (1995). National systems of innovation: towards a theory of innovation and interactive learning. London.
- Möller, K. K. and S. Svahn (2003). "Managing strategic nets: A capaility perspective." Marketing Theory **3**(2): 201-226.
- Narula, R. (2004). "R&D collaboration by SMEs: new opportunities and limitations in the face of globalisation." Technovation **24**(2): 153-161.
- Nooteboom, B. (1994). "Innovation and diffusion in small firms - Theory and Evidence." Small Business Economics **6**(5): 327-347.
- Parkhe, A. (1993). "Strategic alliance structuring: A game theoretic and trasnaction cost examination of interfirm cooperation." Academy of Management Journal **36**(4): 794-829.
- Pitsis, T. S., M. Kornberger, et al. (2004). "The Art of managing relationships in interorganizational collaboration." Management **7**(3): 47-67.
- Pittaway, L., M. Robertson, et al. (2004). "Networking and innovation: a systematic review of the evidence." International Journal of Management Reviews **5/6**(3&4): 137-168.
- Powell, W. W., K. W. Koput, et al. (1996). "Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology." Administrative Science Quarterly **41**: 116-145.
- Provan, K. G., A. Fish, et al. (2007). "Interorganizational Networks at the Network level: A review of the Empirical Literature on Whole Networks." Journal of Management **33**: 479-516.
- Provan, K. G. and P. Kenis (2007). "Modes of Network Governance: Structure, Management, and Effectiveness." Journal of Public Administration Research and Theory **18**: 229-252.
- Provan, K. G. and B. H. Milward (1995). "A Preliminary Theory of Interorganizational Network Effectiveness: A Comparative Study of Four Community Mental health Systems." Administrative Science Quarterly **40**(1): 1-33.
- Provan, K. G. and B. H. Milward (2001). "Do Networks Really Work? A Framework for Evaluating Public-Sector Organizational Networks." Public Administration Review **61**(4): 414-423.

- Ritter, T. and H. G. Gemünden (2003). "Network competence: Its impact on innovation success and its antecedents." Journal of Business Research **56**: 745-755.
- Rodan, S. and C. Galunic (2004). "More than Network Structure: How Knowledge Heterogeneity Influences Managerial Performance and Innovativeness." Strategic Management Journal **25**: 541-562.
- Rowley, T., D. Behrens, et al. (2000). "Redundant Governance Structure: An analysis of Structural and Relational Embeddedness in the Steel and Semiconductor Industries." Strategic Management Journal **21**(3): 369-386.
- Soda, G., A. Usai, et al. (2004). "Network Memory: The influence of Past and Current Networks on Performance." Academy of management **47**(6): 893-906.
- Thorpe, R., R. Holt, et al. (2005). "Using knowledge within small and medium-sized firms: A systematic review of the evidence." International Journal of Management Reviews **7**(4): 257-281.
- Vermeire, B. (2009). Absorptive capacity and innovation in the agrifood sector: role of regional networking and uncertainty. Faculty of Biosciences. Ghent, Ghent University. **Doctoral Thesis**.
- Westerlund, M., R. Risto, et al. (2008). "SME business models in global competition: a network perspective." International Journal Globalisation and Small Business **2**(3): 342-358.
- Wincent, J., S. Anokhin, et al. (2009). "Network board continuity and effectiveness of open innovation in Swedish strategic small-firm networks." R&D Management **39**(1): 55-67.
- Yin, R. K. (2009). Case Study Research - Design and Methods Fourth Edition. Newbury Park (CA), Sage Publications.
- Zaheer, A. and G. G. Bell (2005). "Benefiting from network position: Firm capabilities, structural holes, and performance." Strategic Management Journal **26**: 809-825.