

NETGROW

Enhancing the innovativeness of food SMEs through the management of strategic network behaviour and network learning performance

Project/Contract number: 245301

Call identifier: FP7-KBBE-2009-3

Funding scheme: Collaborative project

D 5.1.

Synthesis Paper on key issues in network performance

Due date of deliverable: May, 2011

Actual submission date: May, 2011

Start date of project: 1 May 2010

Duration: 48 months

Organisation name of lead beneficiary for this deliverable: IFAU

Prepared by: UGent in collaboration with IFAU and TEAG

Revision: Final

| Project funded by the European Commission within the Seventh Framework Programme (2007-2013) | | |
|--|---|---|
| Dissemination Level | | |
| PU | Public | X |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

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1 INTRODUCTION

The purpose of this paper is threefold. It aims at:

- providing an overview of the different types of network and their characteristics
- highlighting network performance indicators at the network and organizational (firm) level
- identifying critical success factors and barriers for network performance with a focus on the network level

Each section is initiated with a literature review and followed by examples from case studies. The paper is based on scientific literature and findings from case studies conducted in Denmark, Ireland, Belgium, Canada, and Vietnam in the scope of WP2 of the Netgrow project. The aim of the case studies was to analyze the dynamic of network learning and understand the factors influencing it. For each case study, around 10 in-depth interviews were undertaken with the different network actor types (i.e. triple helix actors –business, public body, research institute). It should be mentioned that the networks selected for the case studies were very diverse (see below for more details about the diversity of the selected networks).

A complete list of sources is given in List of References. The paper is prepared in cooperation between UGent, Teagasc and IFAU.

2 NETWORK DEFINITIONS AND NETWORK TYPES

A network is defined as a set of actors (also called nodes or players) connected by a set of repeated interactions of formal and/or informal ties (also called links). The words in *italic* will be defined in the following paragraphs.

Fombrun (1982) states, that actors or nodes of a network may refer to individuals, groups of individuals, organizations (i.e. firms including competitors, suppliers, customers, auxiliary businesses, etc.; knowledge centers including universities, research centers, etc.), communities, and/or even nation-states. The ties or links are the relationships between the actors. Following Cova et al (2010), ties between actors may be described according to the following characteristics amongst others:

- (1) They can be described according to their duration, the level of trust between actors, the degree of interdependence, the specificity of assets exchanged, and mutual gain to be had by each of the actors involved
- (2) They can be described according to their vertical or horizontal nature
- (3) They can be described according to their intensity, the degree of reciprocity, the clarity of expectations and the multiplex nature of relationships

In this paper, formal ties refer to contractual or institutionalized relationships between actors while informal ties refer to non-contractual or institutionalized relationships between actors. It should be mentioned however that formal networks might turn to be in fact closer to informal networks than formal networks when the informal collaborative activities between the network members exceed the original network formal activities (Alajoutsijarvi et al., 2001; Van Aken and Weggeman, 2000).

Based on the above definition, a network, in terms of inter-organisational exchanges, can be described as a set of relationships within a **minimum of three organisations** interchanging tangible (e.g. money) and/or intangible assets (e.g. assets like R&D, education costs, intellectual capital)

(Hakansson et al, 2009) with expectations of benefits, whether it is financial, technical, social, etc. Ojasala (2004) brings the issue of critical mass into the discussion of network size, i.e. it is not possible to have a network without critical mass in terms of quality and quantity of relationships. Another issue that is relevant for defining a network is the dimensions of time and geographical coverage. Networks are dynamic and change over time. Hence, a network can for example be in the pre-relationship phase, the early phase, the development phase, the institutionalized phase, and the break-up phase. The geographical coverage ranges from local to global. For some networks there may be clear geographical boundaries whereas other networks may not have clear borders.

Networks systematically operate through a set of rules with each organization bearing (a) certain role(s), however, the execution of the network and these rules differ according to the type and configuration of those networks, i.e. formal vs. informal networks, as well as the industry, geography and the internal governance of individual actors in those networks.

Other organizational structures could also be considered as networks. Examples are companies' vertical and/or horizontal integration, strategic alliances, organizations as well as geographical agglomeration of actors with a common scope (often referred to as clusters). Further to this list, you may also find networks existing internally in an actor (e.g. a company), vertical networks, inter-market or opportunistic networks (Achrol and Kotler, 1999).

This broad definition of "networks" implies that many different types of networks exist depending on the goals of the network, its members and the nature of the ties between them, and its governance. In table 1, a list of the different existing network types which are important for knowledge exchange and innovation is given, together with a description of the characteristics of these types. This list is based on the article "Network types and their importance for knowledge exchange and innovation in the agri- and horticultural sector" of Evelien Lambrecht which will be presented at the IFAMA conference in June 2011 (Kuhne, Lambrecht et al. 2011). It is important to underline the difference between a network and other organizational structures involving more actors. It should be emphasized that these are indicative characteristics and that in practice clear distinctions may not be evident between the different types of networks, i.e. there is some overlap in the characteristics of different network types.

Table 1: Network types

| Network types | Definition | Characteristics |
|----------------------------|--|--|
| Personal or social network | <ul style="list-style-type: none"> - Network linking firms through inter-personal relationships among them. - Relationships may be at several organisational levels of the actors (Grandori and Soda 1995) | <ul style="list-style-type: none"> - Informal ties - Decentralized - Might be the basis for generating other, more institutionalized forms of inter-firm coordination (Aldrich and Glinov 1990) - The coordinator or a small group of members are key players driving the network |
| Business network | <ul style="list-style-type: none"> - 3 or more firms establishing relationships to enhance exchanges of assets leadings to increased company performance (Fombrun, 1982) | <ul style="list-style-type: none"> - Formal and informal ties - Purpose is a common goal such as legislative issues, reduce salt, animal welfare or business development - The actors are not part of the same organization |
| Business club | <ul style="list-style-type: none"> - (informal) platform where responsible people or representatives of organizations can meet each other with the aim to learn from each other by gathering, talking, listening and exchanging experiences | <ul style="list-style-type: none"> - Typically initiated and run by a partnership of interested organisations such as local councils, utility companies, government business and technical support organisations, regulators and universities, with expertise in specific areas of relevance to most members of the business group - Important conduit for the development of informal relationships |
| Research network | <ul style="list-style-type: none"> - Group of firms, companies, associations, research and governmental institutions entering into voluntary arrangements to do research and innovation | <ul style="list-style-type: none"> - Research put forth as the primary objective for the collaboration - Often set up set up by government. - Formal and informal ties |
| Designed network | <ul style="list-style-type: none"> - Member based network with a formal structure linking different individuals together with a common goal or purpose | <ul style="list-style-type: none"> - Formal and informal ties - The purpose defines the network structure (e.g. its centrality) - Coordinator plays a central role - Projects may be key to network development |
| Extension network | <ul style="list-style-type: none"> - Group of (non-profit)organizations supported by the government focusing on educational activities towards a specific sector | <ul style="list-style-type: none"> - Centralized (government) |

3 NETWORK PERFORMANCE

3.1 Literature review and definitions

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 judgement (Kenis and Provan 2009). Also which performance indicators, used to measure what a criterion is in its operational terms that should be included in the performance measurement system have troubled many scholars. As a consequence, a large number of performance criteria and indicators are used in literature.

Among the networks types important for knowledge exchange and innovation listed above, business networks have received by far the most attention regarding performance (e.g. Kale, Singh et al. 2000; Rowley, Behrens et al. 2000; Goerzen and Beamish 2005; Koka and Prescott 2008); but it should be mentioned that the performance of research networks (e.g. Ritter and Gemünden 2003; Wincent, Anokhin et al. 2009) has also been looked at . Although scholars have proposed different ways to evaluate network performance, a common characteristic of all performance measurement systems proposed is the focus on the firm or organizational level. Table 2 provides examples of the common indicators for network performance at firm level. 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). This is in line with the findings we have in table 3. In other words, a network performs well when it enhances the performance of the enterprises or members participating in it.

It could be argued that performance indicators should vary according to whether the network is formal or informal. Where exchange is based on a contract between the parties which relies on well defined property rights, the number of patents for example may be useful performance indicator. However where there is bilateral information trading on an informal or less formal basis, measuring performance based on the number of patents does not seem to be appropriate. Furthermore, the time dimension is also relevant for network performance, i.e. considering long term as well as short term aspects of performance. This means, knowledge flow and acquisition could be a short term performance issue whilst its conversation into IP or a commercial product could be relevant for a long term measurement.

Table 2: Common indicators of network performance at the firm /organizational level.

| 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 |
| | 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 |
| | 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 or firm level when assessing network performance disappears when considering performance of networks focusing on fields other than exchange of knowledge and innovation such as networks set up in order to improve

environmental conditions (e.g. Koontz and Thomas 2006) or health or human services (e.g. Provan, Fish et al. 2007; Herranz 2010). Following Provan, Fish et al. (2007), these networks are characterized by a multitude of different agencies ranging from governmental to non-profit and for-profit organizations aiming at jointly providing a particular service to the community. They are therefore set up in order to reach a goal that goes beyond those 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 such 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).

3.2 Case studies results

From the case studies, it appears that there is no such thing as one common system (i.e. performance criteria and performance indicators) for measuring network performance. The core issue is that the performance measurement system varies according to the type of network and its characteristics but also according to who is actually performing the evaluation (e.g. network member, network coordinator, funding organizations). This statement is supported by findings from the case studies. Similarities in the performance measurement systems can however be found for the same types of networks and evaluators (**table 3**). Attention should also be drawn to the fact that the choice of performance indicators may not be consistent between network coordinators or network members. Support organizations may be keen on using the network's economic performance as an indicator whereas a network coordinator may be more reluctant to use growth in number of members or funded projects as performance indicators.

Other indicators which are not included in table 3, but are highly relevant for measuring network performance, are aspects of the innovation process, implications on network members' costs (for e.g. R&D or reduction in labour costs), increased productivity, improved competitiveness, or the creation of value added goods and services. For a research led network an important indicator for performance measuring could be bibliometrics (Wixted and Holbrook 2008). Furthermore, indicators at "lower levels" such as improvements in quality of products and/or services, reduction in costs etc are relevant for discussing network performance, but are also very hard to assess in quantitative terms.

Table 3: Examples of performance criteria and indicators at network level from the case studies

F: Funding/support organization – C: Network coordinator – B: Firm member of the network – R:

Research institute member of the network

| Network type | Network name | Performance criteria | Performance indicators | Evaluator |
|------------------|---------------|---|--|---------------------------------|
| Research network | WagrALIM (BE) | Organizational level: - Economic performance | Organizational level: - Number of patents created - Number of licenses created - Number of jobs created - Increase of turnover - New export markets | C/B C/B C/F C/F C/F |
| | | Network level: - Overall member satisfaction - Management effectiveness | Network level: - Number of members - Increase of projects number | C C |
| | | Community level: - Economic development of | Community level: - % of firms of the region being member | F |

| | | the region | of the network | |
|-------------------|------------------------------|---|--|---------------------------|
| | Flanders' FOOD (BE) | Organizational level: - Economic valorization and innovation potential | Organizational level: - Scope of potential valorization of project results (Scope) - Quality of the offered services (Output) - Economical importance of innovation in relation to the support (Outcome) - Complementarities of the activities (Synergy) - Efficient organization | F F F F B |
| | | Network level: - Quality of the initiative | Network level: - Size and clarity of the innovation goal - The competence and expertise of coordinators - The involvement of the companies - Quality of organization - Project results | F F F/C F F/C |
| | | Community level: - Sustainability - Global cooperation | Community level: - Contributing to sustainability - Interregional or international character | F F |
| | Food for Health Ireland (IR) | Organizational level: - Economic performance | Organizational level: - Number of new projects initiated - No of new products developed - Cost, knowledge and resource sharing - New business leads - Increase of turnover | |
| | | Network level: - Economic performance - Management effectiveness - - - Capabilities transfer | Network level: - Number of patents created - Number of licenses created - Number of spin-off ventures - Additional sources of funding - Number of new projects - No of marketing events - Level of PR activities - International reputation - No of products transferred from academic to industry - No of processes transferred from academic to industry | |
| | | Community level: - Contribution to the knowledge based bio economy | Community level: - No of personnel employed - No of MScs/PhDs funded - No of MScs/PhDs completed - No of publications - Impact factor of publications (quality of publications) - Number of training courses attended - Number of workshops and educational events held - Secondment taken - Number of outreasearch activities | |
| Business networks | Rice | Organizational level: | Organizational level: | |

| | | | | |
|------------------|----------------------------|--|---|------------|
| | producers cooperative (VN) | - Economic performance - Effectiveness | - Increase of incomes of members - Increase of wellbeing of members | C/B C/B |
| | | Network level: - Effectiveness | Network level: - Range of service provided to members - Turnover | C/F C |
| | | Community level: - Effectiveness | Community level: - Increase of wellbeing of local communities | F |
| Social network | Food Club (DK) | Network level: Economic self-sustainable Viability Members' participation in activities Member satisfaction and commitment | Network level: Number of members participating in activities | C/B |
| | | Organizational level: Ties and personal relationships Provides new knowledge Commitment | Organizational level: Number of members participating in activities Range of activities meet members' demand | C/B |
| | | Community level: Good relationship to local administration | Community level: Representatives from local administration involved in the network | C/B |
| Designed Network | Plato Ireland (IR) | Organizational level: - Economic performance | Organizational level: - Increase in new business contacts - Increase in new business - Increase in turnover | |
| | | Network level: - Effectiveness | Network level: - No of meetings per month - No of hours of meetings attended by SMEs - No of hours given by facilitators - No of hours of interaction - No of B2B collaborations | |
| | | Community level: - Contribution to local economy | Community level: - Increase in employment | |

4 SUCCESS FACTORS AND BARRIERS FOR NETWORK PERFORMANCE

4.1 Literature review

There is a wide variety of factors which have been studied by scholars as influencing network performance, some of which relate to the characteristics of the network and its components, others to the external environment in which the network evolves. In the following paragraphs, we will first list the success factors and barriers for network performance at the organizational level. We will then list the ones recognized as having an influence on network performance at the network level.

It should be mentioned that regarding network performance at the organizational level, the "dark side" of network participation needs to be acknowledged (Patzelt et al, 2011 and Alajoutsijarvi et al 2001). Ritter, Wilkinson and Johnston (2004) recognise that firms are embedded in a network of ongoing business and non-business relationships that both enable and constrain the firm's performance. Being involved in networks can have a negative impact on performance if for example

companies persist with R&D projects that under-perform (substantial financial costs and benefits not realised). Furthermore there are opportunity costs to being involved in networks. Loss of autonomy regarding decision making is also an issue. While many business managers may perceive that they are in total control most inevitably discover that they themselves are subject to control and the influence of others. Christopher and Gaudenzi (2009) also state that being involved in a network can result in reputational damage through actions of other network members. More generally Cova et al (2010) argue that networks have down-side aspects including bureaucratisation, opportunism, extension, modification, specialisation, strategic drift or autarchy or group thinking.

Success factors and barriers for network performance at the organizational / firm level

Network configuration

The influence of network configuration on network performance has received a lot of attention in literature: authors have looked at network sparseness (i.e. weak connectedness between the network members of a firm), network density (i.e. high connectedness between the network members of a firm), pattern of direct and indirect ties (i.e. pattern of ties that an organization has with its network partners and ties that the same organization has with the partners of its network partners) and centrality (i.e. extent to which a network revolves around one single firm in the network) (Gulati, Nohria et al. 2000; Rowley, Behrens et al. 2000; Tsai 2001; Sporleder and Moss 2002; Rodan and Galunic 2004; Soda, Usai et al. 2004; Zaheer and Bell 2005; Koka and Prescott 2008). Although widely investigated, authors did not come to an agreement about the optimal network configuration as they recognized that the benefits of a certain type of network configuration vary according to the situation.

The impact of one type of network configuration on performance seems to depend first on the type of performance under investigation. As an example, a business unit's centrality in its intra-organizational network is recognized in Tsai (2001) as positively and significantly influencing innovation performance while it does not have any impact on the economic performance of the business unit. Second, the benefits of a certain network configuration on performance might be triggered by environmental changes. In e.g. Koka et al. (2008), it is shown that, following a legislative change, a firm centrally positioned in a network will exhibit lower economic performance while a firm occupying a bridging position in a sparse network will achieve higher economic performance. Third and last, it is not solely a particular network configuration which influences performance but rather a combination of this particular network configuration with a certain firm strategy. Vanhaverbeke et al. (2009) for example argued that a network with high levels of redundant ties might be more suited to a firm pursuing incremental innovations, while firms engaged in radical innovativeness might benefit most from networks with more non-redundant ties.

Network membership

Regarding network performance, network membership has especially been investigated in terms of diversity whether it is in terms of scope of activities of network members (Pittaway, Robertson et al. 2005), number of unique relationships with the focal firm and number of unique industries of partners (Goerzen and Beamish 2005), past experiences (including good/bad and limited/extensive experiences), network members' size (Beckman and Haunschild 2002), and heterogeneity of knowledge (Rodan and Galunic 2004). It is interesting to notice that in the articles concerned with innovation and/or learning performance (Beckman and Haunschild 2002; Pittaway, Robertson et al. 2005; Rodan and Galunic 2004), support is given to the idea that there is a positive link between network diversity and performance while the articles focusing on economic performance do not support such a link (Goerzen and Beamish 2005).

Network ties

Cova et al (2010) identify 3 types of characteristics to describe the nature of ties or relationships between actors in a network. The first: according to their duration, level of trust between participants, the degree of interdependence, the specificity of assets exchanged and mutual gains. The second: a function of their vertical or horizontal nature, and the third: relative complexity and reciprocity of relationships.

Network strength (i.e. amount of time, emotional intensity, intimacy and reciprocal services which characterize the tie) is the aspect of network tie the most studied (Granovetter 1973). Strength of ties has especially received attention in the context of learning and the benefits of strong/weak ties seem to be contingent on the environment. Strong ties (or close relationships), associated with trust and fine-grained, tacit and informal information exchange between partners (Freeman, 1991), lead to higher economic and learning performance than weak ties in stable environments where an exploitation strategy is used (Dyer and Nobeoka 2000; Rowley, Behrens et al. 2000). On the contrary, weak ties, through which novel information is accessible, lead to higher economic performance than strong ties in uncertain environments where an exploration strategy is used (Rowley, Behrens et al. 2000). The quality of relationships and ties can be influenced by a number of factors including organisational cultural norms, levels of integration, interpersonal relationships, collaboration, compatibility of network partners, dependency levels, power, reputation, satisfaction and trust (Rese and Baier, 2011; Jonsson and Zineldin, 2003; Harrison and Carroll, 2002; Cullen et al., 2000).

Network management

Two aspects of network management, which refers to the managerial and behavioral components that facilitate the execution of joint action across the whole network, have been investigated for their impact on network performance: conflict management and incentives to encourage transparency and discourage free riding. In Kale, Singh, and Perlmutter (2000), it is shown that integrative conflict management, i.e. joint management of conflict with mutual concern for “win-win” for all concerned, is positively linked to the learning performance of the firm. Following Dyer, and Singh (1998), incentives to encourage transparency and discourage free riding are also positively linked to the learning performance of the firm.

Network governance

Two aspects of network governance have especially been investigated regarding network performance: the relational capital (or social capital), an informal network governance mechanism, which can be understood as the mutual trust that resides at the individual level between network partners, and the network board independence (i.e. extent to which the board members are independent of current management in member firms). It seems that, whether performance refers to economic, learning or other types of performance (including performance at the network level), there is a consensus among authors that relational capital lead to higher performance than formal network governance mechanisms (i.e. use of contractual arrangements -third-party enforcement of agreements- and equity arrangements or financial hostage -self-enforcing agreements-) (e.g. Dyer and Singh 1998; Dyer and Nobeoka 2000; Gulati, Nohria et al. 2000; Huggins 2000; Pitsis, Kornberger et al. 2004; Pittaway, Robertson et al. 2005). Wincent, Anokhin et al. (2009) support the idea that board independence is negatively related to the innovation performance of the firm.

Success factors and barriers for network performance at the network level

Network inception, development and sustainability

Network specific factors at inception and during the course of development influence its performance. For example, the degree of under or over formalisation of networks exert a strong influence on their effectiveness and contribution to learning and innovation (Coles et al., 2003). Uncertainty amongst members regarding a network’s role, objectives, and activities were also found to exert a negative influence on network performance (Pittaway et al., 2005; Cullen et al., 2000).

Indeed, the contribution of networks to innovation performance was found to be low where learning was not an explicit objective of the network, and where systems and procedures to manage knowledge flow were also lacking (Scozzi et al., 2005).

The level of investment in relationships and the commitment of network members are an important determinant of performance as they are considered important antecedents to building trust and cooperation within networks. Trust and cooperation are necessary to foster a greater willingness to share resources and knowledge, minimise potential for opportunism, and enhance innovation through inter-firm collaboration (Rese and Baier, 2011; Hoang and Antoncic, 2003). Most recently, a study of 271 networks across medical, IT and engineering and biotechnology sectors revealed that trust, commitment, dependency of network partners on each other, compatibility and ability to cooperate were important success factors for innovation within networks (Rese and Baier, 2011). In contrast, unreliability, unfairness, opportunistic behaviour, inter-organisational conflict, external disruption and lack of network infrastructure can all have a negative effect on network performance (Pittaway et al., 2005; Coles et al., 2003; Cullen et al., 2000).

Network membership

Like for network performance at the organizational level, network membership has been investigated in terms of diversity for its influence of network performance at the network level. In Huggins (2000), where the focus is on the sustainability and effectiveness of networks, it is concluded that the higher the number of network members the poorer the performance. This statement is not proven valid for all case studies in our project. The joining into a network is perceived by the members as a mechanism for fast and efficient access to complimentary skills and resources. This is the beneficial effects of networking activities, and as well as a precursor to development of innovations and patents (Patzelt et al, 2011).

Network configuration

The structure of a network and the quality of relationships between members are believed to have a significant impact on learning and knowledge diffusion between firms, and are considered important determinants for the proper functioning of networks (Caniels and Romijn, 2008). In particular, close relationships are considered especially essential for the sharing of tacit and informal knowledge between members of a network (Freeman, 1991). In social network theory, the connectionist view of networks stresses that dense networks can potentially lead to improved innovation performance since they are expected to promote knowledge and learning more effectively than less dense networks (Borgatti and Foster, 2003). This is based on the premise that better-connected networks facilitate knowledge diffusion more rapidly where members with high levels of direct relationships have greater opportunities to access a larger pool of information. In contrast, the structuralist view of the network stresses network configuration as a determinant of network performance with open networks generating more diverse ideas and ways of thinking than dense networks (Borgatti and Foster, 2003). However, Pittaway et al. (2005) argue that consensus has yet to be reached on the optimal network configuration that can positively contribute to the development of innovations within firms. Instead, a more strategic view of the role of networks suggests that network configurations can potentially change and adapt according to the requirements of members, the actions that the network structure seeks to facilitate, and the context in which networks operate in (Pittaway et al., 2005; Ahuja, 2000).

Network management and governance

Two aspects of network management have been investigated for their impact on network performance at the network level: shared goals and network culture. Following Pitsis, Kornberger et al. (2004), shared goals among network members and a strong network culture is positively linked to the success of networks in general. From Ojasalo 2004, *“the better the goal serves the interests of all the companies in the key network the more fluent the cooperation is likely to be. If the degree of goal*

congruence is not high enough, the focal firm will fail in building up a key network in the first place or the key network will dissolve prematurely through lack of viability”.

Like for network performance at the organizational level, relational capital and network board independence have been investigated for their impact on network performance at the network level. In contrast to Wincent, Anokhin et al. (2009), Provan and Kenis (2007) have a more moderate idea about the relationship between board independence and performance and suggest that the impact of board independence on performance is contingent on the level of trust between network members, the number of network members, the degree of goal consensus and the need for network-level competencies.

Network external environment

Following Pittaway, Robertson et al. (2005) and Thorpe, Holt et al. (2005), the institutional and policy environment plays a role in facilitating the development of networks. Governments can shape the cultural conditions and infrastructure for networking but also can assist in brokering relationships and acting as intermediaries. Moreover, the institutional and policy environment also plays a role in shaping network configurations as it influences inclinations towards trust, legal contracting, opportunism and self-interests.

4.2 Case study results

Success factors of network performance at the network level

Table 4 provides a summary of network characteristics and critical success factors. Findings in table 4 are retrieved from the case studies (particularly interviews with the network coordinator for the network-level approach). This way, we have an opportunity to use information retrieved from each type of network and combine this information with network characteristics.

Table 4: Critical success factors for network performance at the network level per network type

| | Network type | | | | |
|--|--|--|--|--|---------------------------------|
| | Social or personal networks | Research driven network | Designed network with a certain purpose | Business club | Business networks |
| Example of network | Food Club (DK) Banff Pork Seminar (CA), Innovatech (BE) CAIS (IE) | WagrALIM (BE) Øresund Food (DK/SE) Flanders' FOOD (BE) Food for Health Ireland (IE) | AFM Net (CA) Plato (IE) | Réseau-Club ICHEC-PME (BE) | Rice producers cooperative (VN) |
| Network inception | Coordinator's comprehensive personal network and drive A topic of common interest Bottom-up approach Support agency cooperation | Funding Universities' and research institutions support and involvement Innovation projects Sub-networks for specific projects or themes | Funding A clear vision and a long-term strategy Goal congruence System to maintain confidentiality Companies' involvement Key individual's drive and vision | Start to build up the network from a group of organizations that already know each other => "common culture" | |
| Network development (and sustainability) | Activities meeting members' interests "Everybody else is here" Voluntary contribution of time and effort by membership Economic self-sustainability | Funding, projects and activities to drive the network Visionary management IP protection procedures in place Acknowledge differences in members' need for services, funding and activities Strategies for attracting | Funding, projects and services to drive research/industry cooperation Support to commercialization and start-ups Procedures for dealing with confidentiality | Face-to-face selection process assures that new members fit into the network culture Wide range of activities meeting the variety of members' interests Sub-networks for specific projects or themes | |

| | | | | | |
|---|---|---|--|-----------------|---|
| | <p>Network develops organically</p> <p>Sub-networks for specific projects or themes</p> | <p>new members – or strategies for protecting the network and its members (closed network).</p> <p>Find a balance between basic research and a goal of innovations meeting the network’s objective.</p> <p>Valorization is important</p> | | | |
| <p>Network configuration (centrality, density) and ties</p> | <p>Activities that promote inter-personal relations and builds trust</p> <p>Conflict resolution mechanisms</p> <p>Informal (loose?), build an environment of trust and common goals</p> | <p>Activities that promote interdisciplinary relationships and improved collaboration between organizations of different sizes</p> <p>Formal in projects, otherwise loose</p> <p>May have sub-networks (around an innovation project for example)</p> | <p>Activities that promote interdisciplinary relationships and relationships between actors of different sizes, level of experience and background</p> <p>Management aids finding contact persons</p> <p>Formal in projects, otherwise loose</p> | <p>Informal</p> | <p>High density</p> <p>Informal ties</p> <p>High level of relational capital among members toward the board</p> |
| <p>Network membership</p> | <p>A topic of common interest</p> <p>No obligations for members</p> <p>“Everybody else is here”</p> <p>Access to knowledge</p> | <p>Measurable benefits from cooperation (funding, PhD students, innovations etc)</p> <p>Access to knowledge and contacts</p> <p>Sub-network around one innovation project:</p> <ul style="list-style-type: none"> - No direct competitors in the sub-network | <p>Projects and funding</p> <p>Business support</p> <p>Access to knowledge, skills, resources and contacts</p> | | |

| | | | | | |
|--|---|---|--|---|--|
| | <p>and contacts</p> <p>Access public services through achieving critical mass</p> | <p>- At least one big enterprise. Big enterprises usually have more resources to write the innovation project than SME</p> | | | |
| <p>Network management and governance</p> | <p>Small management group or 1 manager</p> <p>Supporting committee in which members participate</p> <p>Voluntary nature</p> | <p>Visionary management and board</p> <p>Scientific advisory committee in which industry and research people participate</p> <p>Sub-network around one innovation project: Dynamic and competent managers of projects and sub-networks to drive communication</p> | <p>Visionary management and board</p> <p>Scientific advisory committee in which industry, research and other partners participate</p> <p>Support functions in place for commercialization, IPR and confidentiality</p> | <p>Small management group</p> <p>Assuring the development of shared interests and a common culture in the network</p> | <p>High qualified staffs in the board</p> <p>Entrepreneurial staff</p> |
| <p>Network outcome</p> | <p>Improved and strengthened personal relationships</p> | <p>Projects, patents, innovations, new collaboration structures and economic growth</p> | <p>Projects, patents, innovations, new collaboration structures and economic growth</p> | | |
| <p>Network external environment (institutional and policy environment surrounding the network)</p> | <p>Not relevant for members in this type of networks</p> | <p>Relevant. Close dialogue between network coordinator and public funding sources needed.</p> <p>Sustainable funding a core issue for building and driving a viable network.</p> | <p>Relevant. Close dialogue between network coordinator and public funding sources needed.</p> <p>Sustainable funding a core issue for building and driving a viable network.</p> | | <p>Connections to other cooperatives and public organizations in the appropriate sectors</p> <p>Geographical position (access to market, land and information)</p> |

The different types of networks, the range of network characteristics and the many critical success factors for network performance (as presented in table 4) all underline the complexity of dealing with network performance at network level. It must be stressed that a critical success factor may be relevant for the performance of one type of network, whereas the same factor can be interpreted as a major barrier for the performance of another network. An example of this situation: For a social network with the aim of bringing people (industry) together most funding should be retrieved from companies and network membership fees. This is the funding structure of the Banff Pork Seminar and it secures involvement, commitment and support from the members. Government funding is not regarded as a good idea for this network as it would reduce the members' commitment to the network. On the contrary, since its inception AMFNet has been based on government funding and supplemental funding obtained from research projects. For AFMNet government funding has been crucial to start research projects and other activities, and as such must be regarded as a critical success factor for this network. These examples prove that the critical success factors differ from one network to another, and that performance on network level must be evaluated according to the particular type of network.

Barriers of network performance at the network level

The case study review showed that network coordinators list the following as the most important barriers for the networks' performance:

- Economic constraints and funding structure
- Disagreements between funding agencies' and network managements' visions and strategies for the network
- Managerial issues (responsibilities, network evaluation criteria, other)
- Difficulties in bringing different organizations to work together
- Lack of common vision and goals within the network

Generally the network coordinators are people with a strong personal drive, visionary and with a lot of commitment to building and running the networks. They claim that the largest concerns on network level are regarding contradicting strategies of the board and network management on the one side, and on government agencies (funding sources) on the other side. Furthermore, network management point to the lack of communication from funding agencies on such issues as changed evaluation criteria or political changes as the most important barriers for building and running networks.

Major barriers on firm level are naturally related to the nature of the company or rather the member organization. Members need to prioritize between networks as involvement takes time, money and efforts, which may result in opportunity costs and possibly loss of autonomy. The role of the gatekeeper in the member organization is therefore very important. He has to secure channeling the right information to the right people within the organization. Other barriers on firm level are more related to the particular organization and its internal procedures and practices for e.g. openness, involvement, commitment and innovation.

5 CONCLUDING REMARKS

This paper has summarized some findings from literature and case studies about different types of networks, identified network performance indicators at network and firm levels, and pointed to critical success factors for network performance. The core message is that networks differ very much, and that networks' performance must be considered according to the specific type of network. This is

the starting point for the development of the network performance measurement tool and its testing later in WP5 and WP6.

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