

**International comparison of product
supply chains in the agri-food
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determinants of their competitiveness and
performance on EU and international markets



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Keeping Open Innovation Networks Vital

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Abstract

Previous studies indicate that there is some understanding about how organizational actors build or establish networks, but that there is a shortcoming in the existing body of knowledge when it comes to understand how to manage networks. The objective of this study is to contribute to the knowledge of network management, and to provide a guideline of how to keep a network vital. The focus of this study is on open innovation networks in the food and beverage industry, with Company X¹ as a case study. A literature study and case studies results in a framework of six conditions that influence the vitality of an open innovation network. This list is used in an action research which results in more knowledge about how the conditions work in practice. The data from the literature and empirical evidence are compared, and differences and similarities are discussed. Trade-offs and synergies between the conditions are also explored.

Keywords: Network management, network conditions, network vitality

¹ We have anonymised the name of the company due to confidentiality issues.

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Summary

Despite much progress made by researchers studying networks of organizations over the past 15 years and more, there is still a knowledge gap about the influence of certain network conditions (e.g. trust, number of network participants) on the outcomes or effectiveness of a network. Previous studies indicate that there is some understanding about how organizational actors build or establish networks, but that there is a shortcoming in the existing body of knowledge when it comes to managing networks. These knowledge gaps can explain why the failure rate of networks is so high. By understanding the concept network management and the conditions under which a network is vital, managers can improve a firm's ability to manage their network of relationships effectively. Therefore, the goal of this study is to contribute to the knowledge of network management, and to provide a guideline of how to keep a network vital. This goal is specified into a certain context, namely open innovation networks from the perspective of a large cooperation in the food and beverage industry, Company X.

A literature study and case studies were done to obtain a list of conditions and gain more knowledge about the influence of certain conditions on the vitality of a network. After designing the list of conditions that influence the vitality on a network, an empirical study is conducted to validate the framework of conditions. The empirical study is designed to learn more about how the conditions found during the case and literature study work in practice. The form of this empirical study is action research. The different types of data are compared and discussed per condition.

From the case and literature study a theoretical framework of six conditions that have an impact of network vitality is formed. This framework contains the conditions (1) network openness, (2) trust, (3) formal governance, (4) sharing knowledge, (5) leadership, and (6) network diversity. When comparing the data from the literature and the case studies with the empirical data, the following conclusions can be drawn: **Openness:** Seen the fact that there are different findings about the right level of openness of an innovation network in previous studies and in this study, the right level probably differs per network or per context the network is in. **Trust:** Trust is a very important aspect within open innovation networks, and that trust based on previous interactions or experiences is the strongest kind of trust. It is important to maintain this trust by interacting with the other network members and prevent misunderstandings and a decline of trust resulting from insufficient monitoring. **Formal governance:** It is important to make formal agreements about certain basics like the business model, but it is also important to not devote too much time to setting up the contract. **Sharing knowledge:** This is the key to generate new value, probably the reason why the network is set up in the first place. Make knowledge digital, accessible, and keep it up to date. **Leadership:** An important lesson about leadership is that actors should not try to control the network, but guide or lead the network. **Network diversity:** As it is the case with the openness of a network, there is not a right level that applies to every open innovation network. Actors should find a balance between diversity and homogeneity. The different types of actors should be willing to share their motivations with each other, be willing to understand each other, and go for the same goal. A recommendation would be to use this list of conditions as a guideline for managing an open innovation network. Think of the current state of the open innovation network and think about what should be changed per condition.

Also, relationships between the different conditions were explored. Some conditions are positively related, like synergies, while other conditions are negatively related, like trade-offs. So when a company wants to change a certain condition of the network, think about the consequences for the other conditions and try to prevent negative ones by taking measures.

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1 Introduction

In this study we analyse network management challenges in agri-food open innovation processes, using Company X as an informative case. Particularly we have explored and analysed how (business) relationships and network formation and management have been used by Company X to develop and foster an open innovation approach.

Relationships are one of the most valuable resources that a firm may have, and therefore a firm is often embedded in a network of inter-organizational relationships (Ritter et al., 2004). A network can be defined as “a set of actors connected by a set of repeated interactions of formal and/or informal ties” (Garcia Martinez, 2013, p.193). The ties, or relationships, can be contractual and institutionalized (formal) or more social and trust-based (informal). Actors can be firms, individuals, knowledge centres, governments, and other organizations (Garcia Martinez, 2013). Being a member of a network has multiple benefits, for example having access to knowledge, technologies, markets and financial resources (Ahuja, 2000; Ritter et al., 2004). Networks can also provide enhanced learning, more efficient use of resources, increased capacity to solve complex problems, greater competitiveness, and better services for customers (Brass et al., 2004; Provan & Kenis, 2007). However, maintaining networks appears to be a difficult task. There is a high percentage of failure of partnerships, between 60% and 70% (Das & Teng, 2000; Ritter et al., 2004), and this high failure rate probably also goes for networks since they exist out of relationships. The high percentage of failure is problematic for companies and other actors. If a network is not managed properly, networks fail and can deplete the resources of a company (Rampersad et al., 2010).

Rampersad et al. (2010) indicate that the importance of network management has been noted in several streams of the marketing literature, but that further work is necessary to improve the management of networks so that their potential benefits can be fully realized. That the importance of network management is acknowledged more and more can be seen in the growing number of scientific articles about this topic. When using the searching term ‘network management’ in different marketing and management journals², it can be observed that as time goes by, the number of articles about network management increases (figure 1). This shows that network management is a trending topic these days.

² International Journal of Network Management, Industrial marketing management, Industrial marketing management: the international journal for industrial and high-tech firms, and Journal on Chain and Network Science

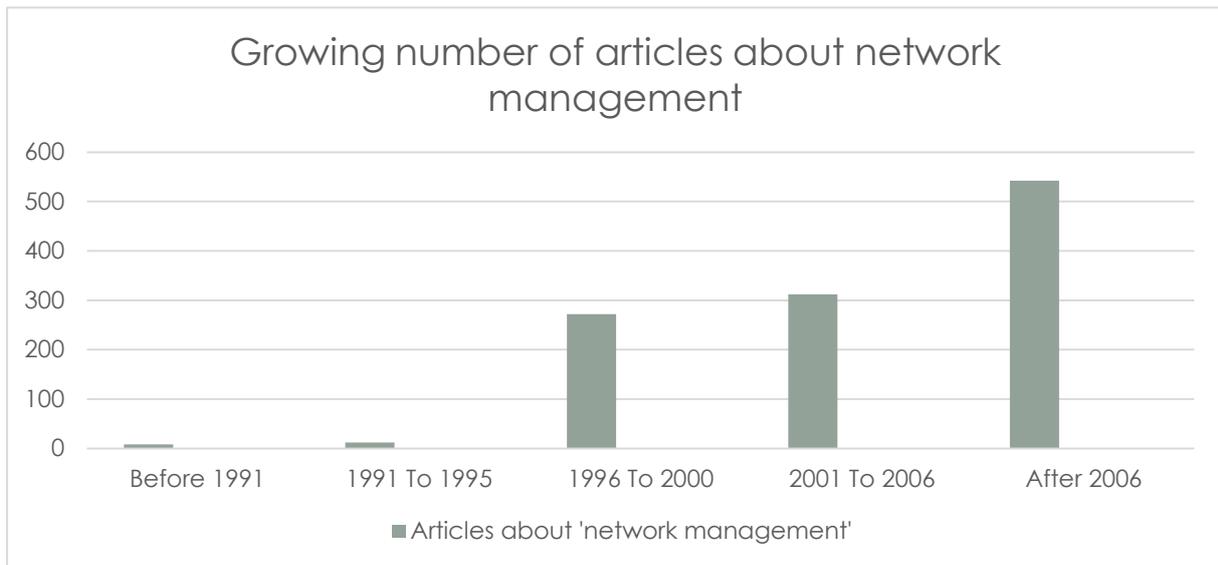


Figure 1: Trend of the number of articles about network management

Source: Author's presentation.

However, despite much progress made by researchers studying networks of organizations over the past 15 years and more, there is still a knowledge gap about the influence of certain network conditions (e.g. level of trust) on the outcomes or effectiveness of a network (Provan & Kenis, 2007).

Besides Rampersad et al. (2010), and Provan and Kenis (2007) calling for further research to improve network management and to find out more about the influence of network conditions, Paquin and Howard-Grenville (2013) also noticed a shortcoming in the existing body of knowledge. While many networks 'emerge' without a central organizational actor, a company that establishes and guides the network, other networks are intentionally established and partly managed by an organizational actor (Paquin & Howard-Grenville, 2013). According to Paquin and Howard-Grenville (2013) there is some understanding about how organizational actors build or establish networks, but there is limited insight into how a network can be managed properly over time. These knowledge gaps can explain why the failure rate of networks is so high. It shows that actors may know how to establish a network, but they have limited knowledge when it comes to maintaining or managing the network over time (Rampersad et al., 2010; Paquin & Howard-Grenville, 2013), and there is little knowledge about the influence of network conditions on network outcomes (Provan & Kenis, 2007). So research in this area is needed. By understanding the concept network management and the conditions under which a network is vital, managers can improve a firm's ability to manage their network of relationships effectively. This ability is also called a firm's network competence (Ritter & Gemünden, 2003). Different companies are at different stages in implementing and maintaining networks, and many are still learning about the process. Even in the more experienced companies continuous improvement is important for ensuring long-term success of the network.

Therefore, the goal of this study is to contribute to the knowledge of network management, and to provide a guideline of how to keep a network vital. This goal is specified into a certain

context. The first boundary is that it is about a specific type of network, namely an open innovation network. The second limitation is the application to a certain industry, the food and beverage industry. The final context is related to the perspective, which is the perspective of a large corporation. These boundaries are briefly discussed.

1.2 Open innovation networks

The type of network that is the focus of this study is an open innovation network. The overall goal of an open innovation network is to discover technologies, products, and services that are very hard to find for a company on its own (Almirall & Casadesus-Masanell, 2010). There have to be several partners working together to call the collaboration a network (at least three). When there is collaboration with just one partner, it is called an innovation alliance. This network collaboration does not have, like a more traditional collaboration, an endpoint. The open innovation network continues existing beyond the end of a certain project (Omta et al., 2014).

In the introduction some benefits of being a network member were mentioned, but not everyone is positive about open innovation networks. In a New York Times-article³ about sharing knowledge and technologies (open innovation) in the energy field, a manager of General Electric, Steve Fludder, was very negative about openly sharing clean technologies with other countries. Steve Fludder is the head of the green 'Ecomagination' division of General Electric, a division that planned to invest \$1.5 billion in research and development. According to The New York Times Fludder said: "Why would we invest \$1.5 billion a year in innovation that just slips through your fingers? I mean, why would anybody invest in anything that they would have to just give away?" (Revkin & Galbraith, 2009).

The downsides of open innovation networks can be considerable. Some examples are resources being made available for others to exploit, intellectual property difficult to protect, and it can be difficult to capture value (Dahlander & Gann, 2010). Another drawback is the time and resource input that is needed to set up and maintain an open innovation network (Garcia Martinez, 2013). However, with open innovation actors do not have to give away anything without having some benefits for their own organization. Open innovation networks can be very beneficial for several reasons. One of the reasons is that open innovation enables quicker, more sustained new product development (NPD). Because firms make use of external inputs, IP, and ideas/knowledge, problems are resolved quicker and more effectively and innovations are developed faster (Sisodiya et al., 2013). Open innovation networks increase the inputs for NPD, and therefore boosts innovation and gives an opportunity to learn and further improve the development of new product processes (Calantone et al., 2002; Narasimhan et al., 2006; Sisodiya et al., 2013). Another benefit is greater efficiency and less costs. On the one hand, open innovation diminishes the need to maintain large, costly internal R&D projects. On the other hand, open innovation stimulates to make use of underutilized resources, thus improving performance (Chesbrough, 2003). A

³ Revkin, A.C., Galbraith, K. (2009). Energy Chief Seeks Global Flow of Ideas. The New York Times, <http://dotearth.blogs.nytimes.com/2009/03/26/energy-chief-seeks-global-flow-of-ideas/>, reviewed on 23-10-2014.

McKinsey Global Institute report estimated that open data could help unlock an annually \$3 trillion to \$5 trillion in economic value across seven sectors (Manyika et al., 2013).

1.3 Open innovation networks in the food and beverage industry

The paradigm open innovation is especially applied in the high technological sector, a sector that is known for its high level of innovations (Chesbrough, 2003; Chesbrough et al., 2006). Chesbrough et al. (2006) wondered if the open innovation paradigm can also be applied outside the high technological sector, in the lower-tech or more mature industries. Since there is little application of open innovation networks in low technology sectors, this study takes a perspective of a company in the food and beverage industry. Scholars and practitioners often think of it as a sector that is not very active when it comes to innovation. They see it as a conservative, slow growing and mature business (Capitanio et al., 2010; Sarkar & Costa, 2008). One of the reasons that causes this image of the food and beverage industry is the high number of small and medium enterprises (SMEs). SMEs in this industry often rely on locally and family grounded recipes and processes, which is not really the type of business when people think of an innovative company (Dries et al., 2014). Also, SMEs often have a lack of (financial) resources and competences, which makes it very challenging to develop innovations (Parida et al., 2012).

However, innovation is an important aspect in the food and beverage industry, because changing technical and economic environments ask for adjustment of the entire chain (Menrad, 2004). One of the major challenges of the food and beverage industry in the European Union is to provide safe, affordable and healthy food products under changing conditions such as a rapidly growing world population, shifting dietary patterns, increased competition for land use and environmental concerns (Dries et al., 2014). There are several features of the food and beverage industry related to innovation that are highlighted:

- The food industry was traditionally focused on cost minimization, but the focus has moved to safety and high-quality foods, health, wellness and satisfaction of consumers (Bagliardi & Galati, 2013).
- In both national and international food markets, innovation is seen as one of the most important factors to improve competitiveness (Rama & Von Tunzelmann, 2008). It can lower production costs and improve the response to consumers' needs (Capitanio et al., 2010).
- In the food industry, open innovation is more appearing in its inbound form (by networks of collaboration) than its outbound form (e.g. new ventures, spin-offs or, licensing-out) (Parida et al., 2012).
- Most product innovations in the food industry are incremental rather than radical, although companies also undertake radical innovations (Baregheh, 2012; Capitanio et al., 2010).
- Patented food technology is highly concentrated in a few firms, most of which are multinational companies (Garcia Martinez, 2013).

Several studies have highlighted the fact that firms in the food and beverage industry are highly dependent on external sources for innovation, more than the average of all industries (Archibugi et al., 1991; Garcia Martinez, 2013). There are examples of well-known firms in

the food and beverage industry that see the importance of open innovation for the survival and growth of the company: (1) Kraft Foods estimate that 98% of all food-related intellectual property (IP) exists outside their company. (2) Procter & Gamble believe that there are two hundred times as many experts in relevant fields outside the company than there are inside. (3) Leaders at General Mills state that employees must see the world as their lab, not the lab as their world (Garcia Martinez, 2013). (4) Company X indicates the following: “For innovation we need the best experts, both in our core and non-core competencies. That’s why we can’t realize without experts that work outside Company X at suppliers, knowledge providers, and customers in our innovation projects” (Internal document of Company X⁴, 2014). Open innovation networks have a lot of potential opportunities that can significantly improve a company’s innovative performance, for both SMEs and large companies (Chesbrough, 2003; Chesbrough et al., 2006; Parida et al., 2012).

Members of an open innovation network in the food and beverage industry can be very diverse. First of all, a lot of food and beverage companies are focussing on process-innovation to create new products. They use new technologies developed elsewhere by upstream industries (Garcia Martinez & Burns, 1999). To make it more effective and speed up the innovation process it is useful to establish collaborative ties with the relevant upstream company (Enzing et al., 2011). Second, it is also wise to develop downstream ties with parties closer to the end-user. As highlighted before, most product innovations in the food industry are incremental rather than radical. This can be linked to so-called ‘consumer-inertia’, meaning that consumer behaviour shows an aversion to new food products (Capitanio et al., 2010). Relationships with downstream actors can help make introduction onto the market of new products successful (Enzing et al., 2011). Third, market orientation is also an important aspect when it comes to serving the consumer. It is considered as a key success factor for innovation in the food and beverage industry (Batterink et al., 2006; Sarkar & Costa, 2008). Food companies should therefore include in their network actors that provide them with market intelligence, so they can be easily informed about their end-users and future consumer trends (Enzing et al., 2011). Another kind of actor that is an important source for innovation in the food industry is research organisations (Omta et al., 2003). “Food and beverage companies can benefit from new scientific and technological developments that have been developed within these research organisations, but also those developed by other companies and that are embodied in the products and services of these companies” (Enzing et al., 2011, p. 238). Furthermore, multiple companies in the food industry also have developed a broad network with innovators in other industries and apply different technologies and advances from these other industries in the food and beverage industry (Knudsen, 2007).

1.4 Corporation in the food and beverage industry: Company X

This study uses a company perspective, which means that networks and its management are seen through the eyes of an individual company. The company perspective is used, because this study is about a focal company trying to manage and vitalize its open innovation network. The hosting company that came up with the problem about keeping an open innovation network vital is the large corporation Company X. Company X is a multinational agri-food company with more than 20,000 employees worldwide. The company has

⁴Confidential information, source Company X’s Open innovation team

production facilities in 28 countries, exports in more than 100 countries with a total revenue of more than 11 billion euro, and has approximately 40 brands (Company X, 2013). It is one of the world's largest agri-food companies in the specific industry in which it operates. The company provides consumer products, professional products and ingredients, mainly related to animal production and dairy.

That open innovation is important to Company X can be found in several aspects of the company. Innovation is an important part of Company X's strategy aimed at generating growth as well as added value (Company X^a, 2013). In 2013 Company X opened an Innovation Centre within a large university campus in Europe, containing research facilities, laboratories, pilot plant and office rooms (Company X^b, 2013). "Innovation takes place in ever larger, open forms of cooperation. In this place (name of the university), the centre of the agro food knowledge infrastructure, Company X can work together more easily with scientists and other companies operating in this sector" (Company X^b, 2013, p. 19). A well-known open innovation example of Company X is a meat substitute with a fibrous structure that is similar to the structure of meat. This product was developed together with a former sous chef, who had the idea of combining dairy curd with algae (Company X, 2014).

The outcome of this research on conditions for a vital open innovation network can contribute to the knowledge of Company X on how to maintain an open innovation network. It can provide Company X knowledge about which conditions can influence the effectiveness of a network, and to some extent how to deal with these conditions. First, the article elaborates on the concepts of network vitality and network management. Second, it describes the methods used for this study. Third, an inter-disciplinary literature and case study is done aimed at constructing a list of conditions that influence the vitality of a network. Finally, the results of the empirical data are reported, followed by discussion and conclusions.

2 Conceptual framework

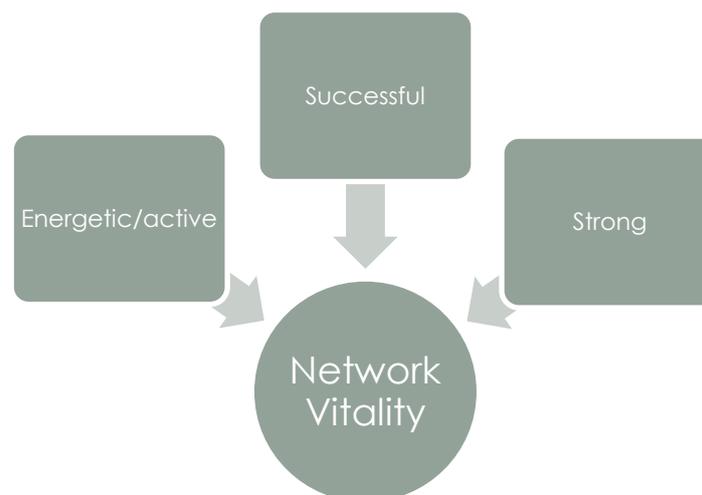
As stated in the introduction there is limited knowledge when it comes to managing a network and the conditions that influence the network. By knowing the conditions under which an open innovation network is vital, managers can improve a firm's ability to manage their network of relationships effectively. In this chapter it is explained what this network vitality means, and it is discussed what network management to achieve this vitality is.

2.1 The concept of network vitality

Vitality of a network is more than just the existence or preventing failure of a network, but network vitality is something that is hard to define. There are very few studies which use the term vitality applied to management-related concepts. According to Gnyawali and Srivastava (2013), network vitality is “the extent to which a network is imbued with new resources, especially knowledge resources, over time” (Gnyawali & Srivastava, 2013, p. 2). However, according to several dictionaries, vitality is more than that. The Merriam-Webster dictionary defines vitality as ‘a lively or energetic quality’, ‘the power or ability of something to continue to live, be successful, etc.’ Oxford dictionaries defines vitality as ‘the state of being strong and active; energy.’ So an open innovation network should be energetic/active, successful, and strong to be labelled as vital (figure 2). Applying these concepts to networks, the following elements of a vital network are developed:

- Energetic/active: many interactions within the network and new resources or outcomes in terms of knowledge, products, processes, etc.
- Successful: achieve goals that are established within the network
- Strong: contains deep relationships between the actors and is likely to exist for a long time

Figure 2: Elements of network vitality



Source: Author's presentation.

2.2 The concept of network management

To keep networks vital, management is needed. According to Järvensivu and Möller (2009), network management involves “restructuring the existing network on one level and improving the conditions of cooperation within the existing structure on another level” (Järvensivu & Möller, 2009, p. 658). Restructuring involves adding or removing actors or resources from the network. Improving conditions of cooperation involves activities to facilitate cooperation between network actors. However, this type of management, network management, includes constant negotiation and re-negotiation among the network-members, it is not a hierarchical way of managing with a top-down approach. Thus network management cannot be carried out through authority (Järvensivu & Möller, 2009).

Despite the clear definition of network management, there are still different views on network management. Some scholars question if network management even exists. Different opinions about whether networks are intentional or emergent result in disagreement about the degree to which network management is possible (Rampersad et al., 2010). Supporters of the “network organization perspective” believe that networks are intentional and hence more manageable, whereas supporters of the “network of organization perspective” believe that networks emerge and are therefore more unmanageable (Rampersad et al., 2010). Seen the complexity and dynamics of networks and its actors, resources and activities, it seems impossible for an organization to manage a network completely on its own (Knight & Harland, 2005). However, “organizations can manage within a network by developing and enacting strategies to improve their network positions” (Knight & Harland, 2005, p. 281). Knight and Harland (2005) indicate that evidence from prior research shows that whilst opportunities to manage networks may be rare, they do exist. There is also something called ‘strategic networks’, which are “intentionally formed and managed strategic relationships with both horizontal and vertical actors with negotiated and agreed upon roles” (Partanen & Möller, 2012, p 481). Therefore it is assumed that, (to some extent) network management is possible.

There are different theories about network management who give the concept different dimensions. Möller and Halinen (1999) divide network management into four levels, involving network visioning, net management, portfolio management, and relationship management. Ford et al. (2002) divides network management into three basic elements: network pictures, networking, and network outcomes. Ojasalo (2004) introduces a systematic approach for managing networks, namely key network management (KNM). This approach includes three different elements: identifying a key network, developing strategies for managing actors of the key network, and developing and applying operational level methods for managing actors within the key network. Finally there is a theory about network management which is called ‘ambidexterity’. It refers to a firm’s ability to engage in both exploratory activities and exploitative activities. Exploration deals with generating new knowledge and finding new partners to learn from. This can also be called broadening a network: extending the network with more actors. Exploitation is about industrializing and commercializing the knowledge, extracting benefits from partners in a stable network (Ferrary, 2011). This can also be labelled as deepening the network: strengthening, deepening and making use of the existing relationships. The challenge for most firms is to practice exploitation activities to ensure the

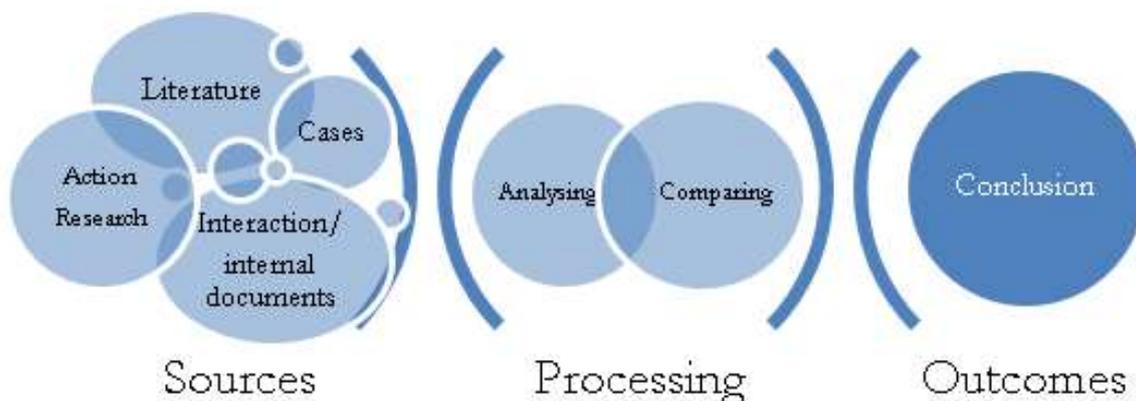
short term profits, and to engage sufficiently in exploration activities to ensure its future growth (Ferrary, 2011).

Based on the lack of knowledge about maintaining networks, the context and on the core concepts of this study described above, the main research question of this study is: *How to keep open innovation networks vital in the food and beverage industry?* More precisely, this study is about conditions that influence network vitality.

3 Methods

A desk research via literature study and case study approach were used and complemented to obtain a set of conditions, and gain more knowledge about their influence on the vitality of an open innovation network. There is also information used directly obtained from managers and stakeholders of Company X. An agreement was made with the Open Innovation Manager and a R&D product developer. Regular meetings were organized to obtain information and feedback about the study. Besides the regular meetings with FC, there was also a day organized by Company X and University Y⁵. Two main questions described the theme of this day: ‘Which type of network is more likely to enhance open innovation possibilities for a company?’ and ‘How does a network get a desired level of vitality’. This theme was comparable to the topic of this study and empirical data was gathered during this day (appendix 1). Figure 3 provides an overview of the different stages of the methodology.

Figure 3: Different stages of the methodology



Source: Author's presentation.

3.1 Desk research

First a literature study and case studies analysis were performed to select a set of conditions that influence the vitality of an open innovation network. Research oriented cases are used as the basis to recognize patterns within and across cases and their underlying arguments. A large advantage of case studies, is that the study is in the real-world, everyday context in which phenomena occur, while other experiments often isolate the phenomena from its

⁵ The name of the university and research centre has been anonymised as well to protect the confidentiality agreement made with Company X. Disclosure of both the company and university names can be granted upon request to the authors of this study.

context (Eisenhardt & Graebner, 2007). The data sources that are used are already existing cases, so cases that are already analysed. The cases that are used are the case of Toyota (Dyer & Nobeoka, 2000), a case about Open Source Software (Von Hippel & Von Krogh, 2003), and an example about IBM (Håkansson & Ford, 2002). These case studies are outside the food and beverage industry, since best practices are not necessarily in the food industry. There is also a lot to be learned from other industries. Besides the case studies there is also information obtained from literature study. It involved a review of scientific articles related to conditions, success factors and failure factors of open innovation networks. The literature was searched in electronic databases such as Scopus, Web of Science, and Google Scholar. The criteria for the articles were English or Dutch language, peer reviewed, and published between 1990 and 2014. The literature was read and analysed with the following points in mind: what is the goal of the paper, what are the main conclusions, and what are the implications for network vitality. From the cases and literature study, a framework is developed containing six conditions for a vital network: (1) network openness, (2) trust, (3) formal governance, (4) sharing knowledge, (5) leadership, and (6) network diversity.

3.2 Action research

After designing the set of conditions that influence the vitality of a network, an empirical study is conducted to validate the set of conditions. The empirical study is designed to learn more about how the conditions found during the case and literature study work in practice. The form of this empirical study is action research. Action research is a qualitative way of gathering empirical data. It is a purpose-drive collaboration between the researcher and participants, involving mutual interaction between the researcher and participants (Nugus et al., 2012). The action research was designed in the form of a workshop together with the Open Innovation Manager and the R&D product developer of Company X, who were organizing a day containing several presentations and workshops related to the theme 'Vitality in Networks'. This day took place at the innovation centre of Company X. All the empirical data that is gathered is related to Company X or at least the food and beverage industry. This is because many participants were employees of Company X, and also other participants were somehow related to the company (e.g. as a supplier or consultant) or active in the food and beverage industry.

Participants

Twenty-one professionals representing seven organizations were present during the workshop related to this study. The seven organizations are (1) a business consulting firm, (2) an innovation broker active in the agri-food sector, (3) Company X, (4) a supplier of Company X who produces oils and fats, (5) researchers from two different European universities, (6) and a representative of a business incubator operating outside the agri-food sector. This variety of respondents guaranteed a broad range of expertise. Three of the present people were assisting the participants, including the researcher and two employees of Company X. The other eighteen were active with the assignments during the workshop. The participants were divided in groups of three, so that every group had their own condition to share experiences and discuss about. In table 1 the group division is presented, showing the group members per condition. Names are not stated, because anonymity was

guaranteed before starting the assignment. The groups were divided in such a way that the representatives of the different companies were mixed as good as possible to optimize the learning process. An advantage of the small groups was that there was room and time for every group member to share his or her experiences.

Table 1: Division of companies in groups per condition

	Group member 1	Group member 2	Group member 3
Network openness	Consultancy company – Senior consultant	Company X – Open innovation team member	University researcher
Trust	Company X – Open innovation manager	Supplier – Innovation director	University researcher
Formal Governance	Consultancy company – Senior Manager	Company X – Open innovation team member	Company X – Open innovation team member
Sharing knowledge	Innovation broker – Project manager	Company X – Open innovation team member	Business incubator representative
Leadership	Consultancy – Analyst	Company X – Open innovation team member	University – Open innovation team member
Network diversity	Company X – Open innovation team member	Company X – Open innovation team member	University researcher

Source: Author's presentation.

Workshop

During the workshop a presentation was held by the researcher, explaining the background and aim of the study. Also, the set of conditions that was found during the case and literature study was explained. It was indicated what the meaning was of the conditions, and what was found during the literature and case study about the influence of the conditions on network vitality. Before starting the assignment, the researcher guaranteed that names of the participants would not be used in the study. After the background information and explanations, the assignment of the workshop was presented. The assignment for the participants was to think of two positive and two negative experiences, related to the condition that their group got assigned, individually. For example, members of group 1 had to think of two positive and negative experiences they have had related to the condition network openness (table 1). When all the group members were done with this individual assignment, the group discussion could start: the group members had to share their experiences with the other group members, and as a group they had to pick the best illustrating examples to share

with the other groups (who were discussing other conditions) during a short presentation. The group discussions lasted about one hour. The groups had to assign a chairman who presented the results of the group discussion to the other groups, using a flip chart. During this presentation members of other groups had the opportunity to ask questions or start a discussion related to the presentation. These presentations and interactions with the audience also took about one hour⁶.

Data analysis

Data was gathered by taking notes during the workshop and collecting the posters on the flipcharts that were used during the presentations (appendix 1). The presentations given by the chairman of the groups each had their own topic (condition), so data derived from these presentations was already sorted per condition. However, some comments from the audience during the workshop were more related to conditions that were discussed before or after. To organize the data per condition, notes taken by the researcher were coded with different colours for each condition. Only comments that focused on the conditions found in the literature study and that were discussed during the workshop are used. One condition mentioned during the empirical study by the participants and which is not in the theoretical framework is named in the chapter about further research.

After the empirical data was organized, it was compared to the data found during the case and literature study. It was analysed what is stated in the literature and case studies about the influence of the conditions on network vitality, and what was stated in the data of the action research about the influence of conditions on network vitality. In this way differences and similarities between the data of the different sources are found. The data was also analysed to find possible relationships between different conditions. These relationships could be positive (like a synergy), or negative (like a trade-off).

⁶ There was also a second assignment developed, which contained adding conditions that influence network vitality if participants thought something was missing, and ranking the list of conditions in terms of importance to network vitality. Unfortunately there was not enough time left for this second assignment.

4 Conditions for a vital network

From the case and literature study a theoretical framework of six conditions that have an impact of network vitality is formed. This framework contains the conditions (1) network openness, (2) trust, (3) formal governance, (4) sharing knowledge, (5) leadership, and (6) network diversity. The conditions are discussed one by one in this chapter.

4.1 Network openness

The benefits of strong ties is proven in research on open innovation, where several studies have shown that frequent communication between partners enhances innovation and also the radicalness of innovation (Moran, 2005; Reagans & Zuckerman, 2001; Smith et al., 2005). It is stated that closed networks make partners more willing to share knowledge with each other and thus create stronger ties (Adler and Kwon, 2002). The reason is that multiple norms emerge in a closed network, which promote trustworthiness within a community. It is stated that closure in networks is an important requirement for trustworthiness and the ease of cooperation, because in a more open network, violations of norms are harder to detect and offenders often go unpunished. As a result, partners in a network will be less trusting of one another. This weakens the strength of a network (Adler & Kwon, 2002).

However, in practice, there does not always need to be a closed network for the emergence of norms. Several types of social norms are also effective without strong relationships or closed communities. The norm of reciprocity and politeness of strangers are common examples of this (Rost, 2011). In addition, there are also negative consequences when participating in closed networks with strong norms. The elite group is an example of this, where non-members are excluded and there is strong pressure on group members to behave in a certain way. If this happens in an open innovation network it becomes “rusted” and innovation output declines over time (Gnyawali & Srivastava, 2013). Networks consisting of strong closed ties are counterproductive for innovation, because there is strong pressure to conform to group norms which limits creativity during the innovation process (Rost, 2011). When the company is involved in a too dense network, it can limit the company’s openness to information and flexibility to operate (Nahapiet and Ghosdal, 1998). Rosenkopf and Padula (2008) state that a firm’s network vitality can increase through the increase of partner vitality. Partner vitality can be accomplished by including new network members into the network and exclude some of the old partnerships, so opening up the network to discover new leads (Koka et al., 2006).

Enzing et al. (2011), who did a study in the Dutch food and beverages industry, found that the more open and diversified the innovation network is, the better the short- and long-term market performance of the innovated product will be. Another example where it seems to be better to have an open innovation network is the software market. Apache - a software product resulting from open source software development - has a market share of 60%, despite strong competition from its nearest rival Microsoft, which used a relatively more closed approach. The similar software product from Microsoft has only a market share of 25% (Dwan, 2004; Von Hippel & Von Krogh, 2003). However, a study about SMEs in the medical devices sector showed that relatively closed and focused innovation networks is related to high innovation performance (Pullen et al., 2012). It may be that the “right” level of openness differs per network or context the network is in.

4.2 Trust

Trust can be defined as “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the truster, irrespective of the ability to monitor or control that other party” (De Wever et al., 2005, p. 1528). Previous management studies discovered that many business objectives – for example successful mergers, acquisitions or partnerships – are influenced by the level of trust (De Wever et al., 2005). “The creation and maintenance of trust-based relationships reduces transaction costs, risk and is crucial to long term relationships” (Skardon, 2011). The importance of trust is especially highlighted in ties within a network, because such ties often involve interdependency and consequently vulnerability (Das & Teng, 2001). The need for trust in such networks might be relatively high.

Being vulnerable to another party means taking a risk. Being part of a network often involves exchanging strategic resources, which involves high levels of risk. Strategic resources are heterogeneous, hard to imitate or substitute and not easily traded. These resources are very important for a firm’s competitive advantage (De Wever et al., 2005). In formal networks, resource exchanges consist of work-related sources, while informal networks also exchange social identity and support (e.g. norms and values). From the perspective of the firm that owns the needed resources there is a risk because it gives access to value-generating resources. Other network parties may abuse these resources and do not reward the firm appropriately or do not reward the firm at all. From the perspective of the receiver of the needed resources there is a risk because it makes itself vulnerable by showing its weaknesses and current level of knowledge and skills (Szulanski, 1995). In other words, both parties (owner and receiver) have the possibility to harm each other. Trust is a vital condition in a network because “without trust firms will be reluctant or unwilling to share strategic resources because of the risk involved” (De Wever et al., 2005). Due to the existence of trust, firms may choose to participate in a network, despite the risks.

Trust can be divided into four types (table 1). These four types are based on two dimensions, namely resiliency and specificity. Resiliency reflects the extent to which trust is resilient rather than fragile. Resilient trust is based on strong links and relates to benevolence. Fragile trust is about being confident that the other party will give something in return, which is also called transacting trust (De Wever et al., 2005). Specificity reflects the degree to which trust may exist without much direct information or previous interactions, containing two perspectives: dyadic and generalized trust. Generalized trust relies on less direct knowledge and more on affiliation or reputation. It often occurs between people or organizations with similar identities but who do not know each other personally (Besser & Miller, 2011). Dyadic trust is more based on direct information and experiences or interactions with the other party (De Wever et al., 2005).

Type 1 and 4 show expected situations that the feeling of goodwill depends on the amount of interactions. The more interaction, the bigger the feeling of goodwill or kindness. However, a low interaction frequency can also result in a feeling of goodwill and kindness, implying that some form of trust can also exist in loosely connected organizations (open networks). Therefore it can be doubted that trust can only be built in dense networks (De Wever et al., 2005). De Wever et al (2005) state that resilient trust and dyadic trust are more positively

related to network effectiveness than fragile and generalized trust, which means that Type 1 is the ideal situation.

Table 2: Four types of trust

	Resilient – goodwill, kindness	Fragile – based on rewards, calculative
Dyadic – direct information or experiences/interaction	Type 1: Good relationship based on previous interactions.	Type 2: Despite frequent interactions, no feeling of kindness.
Generalized – affiliation, reputation (association)	Type 3: Despite no previous interactions, goodwill is present.	Type 4: Immediate return and no feelings of kindness.

Source: De Wever et al., 2005.

Although trust is vital for a network, Jeffries and Reed (2000) indicate that too high trust is as bad as too little. Molina-Morales and Martínez-Fernández (2009) found that trust has a quadratic (inverted U-shaped) relationship with innovation creation within a network. One of the reasons may be that in highly trusting relationships, members of an organization will be more reluctant to monitor the relationship. This insufficient monitoring can lead to lower performance, in spite of trust (Langfred, 2004). Another reason is that firms in a network with high levels of trust easily ignore opportunities with less trusting partners. Firms become trapped in their own nets, which limits creativity (De Wever et al., 2005; Molina-Morales & Martínez-Fernández, 2009). Above all, too much time and effort devoted to maintaining trust can affect the firm negatively in terms of time and costs (Molina-Morales & Martínez-Fernández, 2009).

4.3 Formal governance

Next to the informal mechanism trust, there are also formal mechanisms to enhance knowledge exchange. Fully relying on informal mechanisms such as trust may be quite challenging in networks in which members do not really know each other and in which other members cannot always even be clearly identified, which is not uncommon in fluctuating innovation networks (Hurmelinna-Laukkanen et al., 2012). In the context of innovation networks, formal governance means the involvement of legal instruments. Formal governance is typically seen to provide safe ground for collaborative innovation: it may enhance knowledge exchange between the network members as the partners consider their knowledge assets to be protected against misappropriation (Klein Woolthuis et al., 2005). Legal instruments can include contracts or intellectual property rights, for example patents, trademarks, and copyright. In this way the roles and responsibilities within a network are clearly formulated and communicated. Another advantage is that innovation appropriability is maintained. Keeping an open innovation network vital asks for fairly distributed outputs and provide network members an equal chance of appropriating the created value (Dhanaraj & Parkhe, 2006).

However, contracts can vary in the degree of completeness. Complete contracts are more legally binding, because the more complete and specific a contract is, the easier it is to

interpret and enforce. “To be enforceable, contracts need to be specific because general contracts are easily misinterpreted by the courts, which do not have access to the specialized knowledge or assumptions shared by the parties” (Klein Woolthuis et al., 2005, p.817). Incomplete contracts are thus less legally binding, because they are more open to different interpretations and are not verifiable. A complete contract should include at least agreements on intellectual property rights (ownerships, patents, licences, right of publications, etc), spillover (pledge of secrecy, sanctions), and management of the relationship (plans, task division, responsibilities, investments, conflict resolution, termination, etc). Establishing complete contracts, however, can be quite difficult in larger networks. Therefore, it is assumed that contracts are efficient only when there is a sufficient level of knowledge about the other network members, and so probably in smaller networks (Hurmelinna-Laukkanen & Puumalainen, 2007; Möller & Rajala, 2007).

As stated before, an informal mechanism to enhance knowledge exchange is trust. How do formal arrangements relate to trust? Klein Woolthuis et al. (2005) proposes three different views. The first view is that IP is a basis for trust. IP arrangements limit the opportunity to behave opportunistic, so partners build trust more easily. It can be discussed if this really can be called trust, since IP in this view works more as an assurance. The second view states that IP is in conflict with trust, because setting up formal arrangements can be seen as a form of distrust by the other party. Both parties become distrustful and conflicts may arise. So here it is argued that IP negatively influences trust. A third view states that trust is already there and thus decreases the need for formal arrangements. Empirical evidence has shown that trust and IP can be both substitutes and complements to one another (Klein Woolthuis et al., 2005).

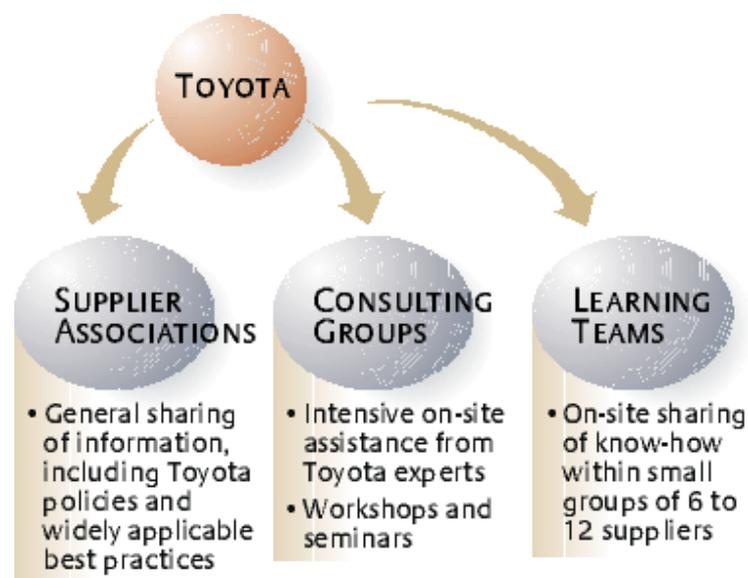
4.4 Sharing knowledge

Firms should not lose their core knowledge to opportunistic partners or direct rivals, but they have to share their internal knowledge with their network partners in order to create value, for example in the form of new innovation (Hurmelinna-Laukkanen et al., 2012). There are several methods to enhance the accuracy, efficiency and speed of knowledge sharing. An example would be workshops, seminars, and training. These activities involve sharing expertise, experience, and skills (Schwartz, 2007). Another example is assigning a person in a firm that visits other companies to learn about other business practices, other ways of performing, and represents to the other company his/her own experiences. This knowledge is then shared with his or her own company to generate new ideas (Schwartz, 2007). However, in a large network this can be an inefficient and even impossible method to share and capture knowledge.

Toyota has several ways to facilitate knowledge sharing, especially within the supplier network (figure 3). In order to improve the ability of the organization and its network to manage valuable knowledge, Toyota has created organizational units that are responsible for knowledge acquisition, storage, and diffusion. Because of these units, Toyota has been able to systematically build and add to the existing stock of knowledge within the network. Network members also know where to find different types of knowledge, which reduces searching time and costs. These units and knowledge databases are mainly designed for production know-how (Dyer & Nobeoka, 2000). However, because of this system, any

knowledge that is production related is accessible to any member of the network (with the exception of direct competitors). To solve the free-rider problem, Toyota creates a norm of reciprocal knowledge sharing within the production network by providing free assistance to suppliers and allowing suppliers full access to Toyota's operations and stock knowledge (Dyer & Nobeoka, 2000). Suppliers must open up their plants to other network members if they want to receive Toyota's assistance and access to the know-how. A supplier executive stated: "They gave us a gift; how can we not open our plant and share what we've learned with other Toyota suppliers." As a result of Toyota's initiative to "freely" share its knowledge with other network members, reciprocal knowledge sharing is the norm.

Figure 4: How Toyota facilitates knowledge sharing within its supplier network



Source: Dyer & Hatch, 2004.

4.5 Leadership

A network is almost never formed or controlled by one firm, although some companies might believe that. As Håkansson and Ford state (2002, p.135), "the network is the outcome of the deliberations, aims and actions of a number of the participants". They also indicate that no firm is the "hub" of the network or has complete control over it, although some will act as if they do. These firms may have a lack of understanding of the nature of networks and the perspectives of other members. "All decisions, all actions and all changes occur within the context of the structure of the network" (Håkansson and Ford, 2002, p. 135). Many companies have the ambition to control the network and manage their relationships in such a way to achieve their own aims. This is not the right ambition because it is not likely that a company can achieve this without tremendous effort, and because the more that a company achieves this ambition of control, the less effective and innovative the network will be (Håkansson and Ford, 2002). If the network will be controlled by one orchestrator, the network will be more internally aligned and have fewer conflicts. However, the network may cease to exist and become a sort of hierarchy (Håkansson and Ford, 2002). Therefore, companies have to let go of control and accept that conflicts are both inevitable and are a

source of change in a network. Freedom from strict rules enhances creative thinking, while rigid monitoring and control mechanisms reduce the potential generation of new ideas (Molina-Morales & Martinez-Fernández, 2009).

An example of a company who failed to let go is IBM, a company active in the IT-sector. IBM set strict roles for its customers, the software companies who had the rights to sell IBM computers. IBM had no plans on changing this, until it became clear that it had become static and the networks of competitors were developing much faster. “IBM lost-out because a controlled network cannot develop faster than the company that controls it” (Håkansson and Ford, 2002, p. 137). The developments of the other networks forced IBM to flatten its network, with fewer strict rules and more freedom for other network members to take initiative, and to become more diversified (Håkansson and Ford, 2002). Managers should not take a self-centred view of the network, but also from the perspective of other network members, each with their own motivations, resources and understandings. It is dangerous to seek to achieve overall control of a network.

However, it has to be noticed that a certain level of influence and direction is possible and also necessary (Hurmelinna-Laukkanen et al., 2012). Finding and establishing common goals is very important for a network to work. It is even doubted if networks would even exist without a common goal to overcome shared problems (Phillipson et al., 2006). “Coordination needs to be carefully planned and approached so that the network can achieve adequate levels of freedom to support innovation” (Hurmelinna-Laukkanen et al., 2012, p.553).

4.6 Network diversity

One of the network conditions that may have an important effect on network performance are the similarities and differences between network members in terms of knowledge, perspectives and competences (Goerzen & Beamish, 2005). According to Nohria and Garcia-Pont (1991), different firms with complementary competences can work together trying to improve their capabilities to compete on a global basis. Reducing uncertainty, exploiting power between organizations, and putting together complex competences and assets are examples of why firms may strive for diversity in their network (Burgers et al., 1993). Although the difficulties of achieving these benefits are well-known, to some managers the possible benefits outweigh the barriers that may need to be taken.

Previous studies indicate that (knowledge) diversity in a network enhances the breadth of perspective, cognitive resources, and the problem solving capacity of the network (Hambrick et al., 1996; Rodan & Galunic, 2004). Firms with diverse ties have a greater access to a variety of ideas and knowledge than firms with homogeneous ties. Firms with homogeneous ties have a high risk of obtaining redundant information about for example technologies and market trends (Goerzen & Beamish, 2005). A study of Beckman and Haunschild (2002) have showed that homogeneous relationships are less successful than heterogeneous relationships. It seems like the more diverse a firm’s relationship portfolio or network is, the richer the benefits a company obtains. For example, Rodan and Galunic (2004) found that access to heterogeneous knowledge is both important for the overall managerial performance and even more important for innovation performance. Also, according to Frenken (2000), successful innovations depend on the complementary competences within the network.

On the other hand, studies have shown that diversity can be a hindrance for individuals, groups, and firms (Hambrick et al., 1996; Miller et al., 1998). Although network diversity may provide greater access to non-redundant knowledge, competences and ideas, it may also cause communication problems, lack of integration, lack of trust, and therefore conflicts. This has negative effects on the vitality of the network (Hambrick et al., 1996; Corsaro et al., 2012). Different competences and perspectives can lead to big misunderstandings, creating tensions and limiting the outcomes of the collaboration (Baraldi & Strömsten, 2009). From a cost perspective, network diversity can diminish returns for an organization. Since partners with different knowledge and competences are likely to be outside the firm's current network of contacts, it costs more time and money to find a suitable partner (Rangan, 2000). Once this new partner is a network member, monitoring costs increase when the firm is distrusting its partner simply because of its difference (Goerzen & Beamish, 2005).

From the previous literature it can be stated that there is not a clear statement that tells firms what to do when it comes to diversity in a network. Goerzen and Beamish (2005) use an inverted U shaped model to explain the relationship between diversity and performance. They indicate that there is an inflection point in the relationship between diversity and economic performance. The positive effect of network diversity will diminish, even reversing itself, when the marginal benefits are lower than the marginal costs of diversity. The network must seek a balance between diversity and homogeneity, so that the level of diversity provides more marginal benefit than marginal cost. This balance can be very different for every network. For example, small firms in the biotechnology are doing much better in highly heterogeneous networks (Powell et al., 1996), while large Japanese multinationals are associated with lower performance in case of high network diversity (Goerzen & Beamish, 2005). Therefore it cannot be stated what the 'right' ratio is between diversity and homogeneity.

5 Results

In this chapter the results of the action research are discussed. The results are discussed per condition.

5.1 Open versus Closed

The group that talked about open versus closed innovation networks stated that an open innovation network stimulates creativity and that it increases new leads because of the high number of possible network members. However, they also experienced some difficulties with open innovation networks. One of the disadvantages is that it is hard to manage an open innovation network. There is a less clear overview of who the network members are, the network has no clear boundaries. Another disadvantage is that it may not be clear to the network members what is in it for them.

A closed network limits creativity. Also, the dependency between members increase, because actors are not coming any further than the members that are already there in the network. However, when the network is closed there is a higher level of confidentiality and deeper or stronger relationships. A remark from Company X was that most of their successful innovations are resulting from a closed innovation network with a limited number of parties, most of the time just one or two.

5.2 Trust

The group that discussed the topic trust came up with some points about trust that they experienced during their career in open innovation networks. The first point made is that trust is very important when participating in open innovation, but that trust 'comes on foot and goes on horse'. This means that trust is hard to gain and easy to lose, since one incident can ruin everything. Another remark is that the more knowledge an actor has about the other actor, the more trust there is in the relationship. Therefore it is important to share values, and understand to which level actors can be open to each other. According to the Innovation Director of the consultancy company, this is also called 'meeting of minds'. A third point was that network members have to give before they get, and that it is about mutual collaboration on the long term. "A network is for the longer term, all parties need to benefit from the collaboration", stated the Senior Manager of consultancy company. It is also stated that culture is important, because having the same culture promotes trust. There was a comment the Project Manager of the innovation broker however, that indicated that cultural differences are often used as an excuse that a network did not work: "Airbus, an aircraft manufacturer, is a good example that failure because of cultural differences is nonsense. It was a very diverse and complicated team that worked on the plains when it comes to culture, but they made it." The final remark about this topic was from the Open Innovation manager of Company X, which is related to the risks of too much trust within a network. He stated that it can be very easy to forget about the formal agreements (such as contracts) in networks with high levels of trust. This lack of formal agreements can hit the company in the longer term, when problems do arise and trust declines within the network.

5.3 Legal Governance

When the topic legal governance came to discussion, experts in contracts and IP stated that too much formalizing the relationship is not going to work. It is stated that too much 'red tape' will limit the open innovation process, and that a company should not try to exclude all risks by setting up contracts. It also takes a tremendous amount of time to set up a complete contract. An IP and contract specialist of the Open Innovation team of Company X stated: "Start small when setting up a contract, things will come along the way. Do not spend months on preparing a contract." Especially if the company are familiar with the other party it is less important to set up a contract. It can also be more efficient to develop the contract along the way when actors are not familiar with the other party, since network members learn more about each other during the relationship and they can make a better estimation of what should be formal agreed upon and what can be kept more informal. However, it is always important to agree on some basic topics. Therefore, it is essential to involve the business model at the beginning of setting up contracts. Involving the business model in an early stage makes clear to both parties what can be expected from the collaboration, without formalizing too much details. It should also be recorded how the captured value will be shared among the parties. The experts called this the 'shared earning model'.

5.4 Sharing knowledge

The first thing that was stated about knowledge sharing is that there should be explicit knowledge sharing, the knowledge should be stored in accessible databases. A database that can be accessed by everyone in the network is efficient in use and supports future project and relationships, because actors know who to approach to obtain certain knowledge for a project. When knowledge is digitalized, it is also easier to keep it up-to-date. It is stated that knowledge needs to be complementary and that it can be difficult when shared knowledge is contradictory. It should also be thought of which knowledge should be shared. Certain core knowledge needs to be protected, so make a balance of what knowledge needs to be protected and what not. This relates to the Tesla example given in the discussion about leadership. Tesla shares knowledge about electrical engines, but keeps the knowledge about car software protected because that is their core knowledge.

A problem with knowledge sharing might be the kind of network member the company is sharing with. The group came up with two examples of partners that are hard to share with. The first example is about consultancy. A lot of companies have the feeling that consultants think that they always knows best and that consultants are therefore not open for ideas or knowledge from the company. A result of this is, according to an Open Innovation team member of Company X, that companies feel that the consultant does not need to know everything, companies keep information to themselves: "It is hard for a consultant to let the company open up to you." The second example is knowledge sharing with academics. There are similar problems when sharing knowledge with academics as with consultants. Adding to this, sharing knowledge with academics can also be hard because of the lack of a common goal.

5.5 Leadership

This topic was interpreted in two different ways. Letting knowledge go and letting go of control. Although the literature study was more focussed on letting go of control, it still may be interesting to discuss the letting go of knowledge. This group took as an example the company Tesla, an electrical car manufacturer. They released patents to boost the electrical car industry. Comments from other participants of the Open Innovation Day stated that Tesla can do this because they are not going to be a leader in electrical engines anyway. It can share these patents because electrical engines is not the core competence of Tesla, software is. This example can also be linked to the condition sharing knowledge, where it is also discussed which knowledge to share and which knowledge a company can better keep for itself (core knowledge). Another interesting example that the chairman of this group spoke of is the company GoPro, a company that makes personal cameras often used in action video photography. This company uses the images that their customers made with GoPro cameras and uploaded them as a marketing strategy. This marketing creation by users is a good way to reduce costs and to increase brand awareness amongst the users. In this way letting go enhances the creativity of the network.

An example that is more about letting go of control is about Community of Practice (CoP), a project that one of the university researchers worked on. This community wants to enhance knowledge exchange between different kinds of actors in the network of Italian agribusiness. To achieve this, CoP needed to shift from a closed to an open and flexible community. However, stated the researcher, organizers of CoP still had a closed network mentality. Enhancing knowledge exchange did not work because of the top down approach and a limited number of actors, because access to the network was highly controlled. A comment from the Open Innovation manager of Company X was that steering is necessary, but network members should not control: "If you do not steer, it remains a good idea and does not become an innovation." He also stated that common goals and leadership gives people energy, since they know where to go.

5.6 Network diversity

According to the experiences of the group that discussed network diversity, two things are really important in diverse networks. One of them is the willingness to understand each other. If a company is in a network with very diverse partners, it has to have an open mind and at least try to understand the other party and use their perspective as well in the innovation process. Another important thing is that attitudes and the drive should be shared within an open innovation network. What are the different motivations to participate in the open innovation network? This group also wondered if a leader is necessary to communicate and connect these different motivations to all the parties.

Things that negatively influence open innovation networks are too many experts and too diverse horizons. Too many experts can be bad, because experts are not always open to learn, they think they know best. This may limit the collaboration within a network. In a diverse open innovation network, actors should take other perspectives than their own as well. Another problem is too different "horizons" in terms of timing and expectations. This makes agreeing on what the network members want to achieve very difficult. Once again, according to an Open Innovation team member of Company X, it is important to share drivers

and to find a common goal: “It does not matter how you get there, but go for the same goal as a network.”

6 Discussion

Given the importance of open innovation networks for organizations, it is essential to know how to keep open innovation networks vital. This study explored the conditions that have an influence on the network’s vitality through a literature review and empirical validation (table 3). The different types of data are compared and discussed per condition. Also, relationships between different conditions are discussed.

6.1 Network openness

When it comes to the condition network openness, the literature and the empirical data are conformable about the advantage and disadvantages of open and closed networks. Both methods showed that a closed innovation network promotes strong relationships and trustworthiness, but that it limits creativity. It is also indicated that open innovation network enhances creativity and makes it easier to find new leads. During the workshop some aspects were added, such as the disadvantage of higher dependency on existing partners in closed networks, and the limitations of being able to manage an open innovation network. The literature does not point in one direction when it is about being open or closed as a network, and there was not a clear preference for open or closed innovation networks during the discussion in the workshop. When asking the Open Innovation manager of Company X about this, he stated that most of the innovation successes of Company X resulted from a closed innovation network with one or two partners. The differences about the right level of openness between open innovation networks may be caused by the fact that according to both the literature study and the workshop closed innovation networks have their advantages and disadvantages, just as open innovation networks. It might be the same situation as with diversity, that the right level of openness differs per network and it cannot be stated what the right ratio is between openness and closeness.

6.2 Trust

It can be concluded that trust is a very important condition, since both workshop participants and literature state that the need for trust in networks is relatively high. The empirical data, however, shows that it takes effort to build trust, actors have to give before they get. Besides the fact that trust can be hard to gain, it is also very easy to lose. As stated in the literature, when trusting the other party network members are vulnerable to the actions of another party. When this vulnerability is abused or treated in the wrong way, trust declines or even disappears. This can also be related to insufficient monitoring that can occur when there is too much trust. Due to the insufficient monitoring of network members, it is less clear for the network members what and why other actors are doing. It can be that certain actions of actor X are interpreted as wrong by actor Y, even though the action was not meant as wrong. Actor X feels that its vulnerability to actor Y is misused, and trust will decline. That trust is hard to gain and easy to lose does not necessarily has to be a negative fact. It can also be used as a certain kind of threshold that allows a company to enter the network or not. If the level of trust surpasses the perceived risk of the possible membership, the actor is allowed to

become a member of the network. The effectiveness of trust also depends on the type of trust. From both the literature study and the data from the workshop it can be concluded that knowing the other partner due to earlier experiences, shared values and understanding each other, improves the effectiveness of trust.

6.3 Formal governance

There are many similarities between what is stated in the literature and what was discussed during the workshop about formal governance. Legal agreements on protection and responsibilities are important, but it is very hard to establish complete contracts on these topics. Therefore it is important to make agreements about the basis (e.g. business model, sharing value), and try not to exclude all possible risks when setting up a contract. It would take too much time and it can limit the freedom and creativity during the open innovation process. The amount of time that is spend on setting up contract can also be a signal. When it takes too much time to set up the contract and to agree on certain arrangements, it may be wise to think twice about letting the actor enter the network.

6.4 Sharing knowledge

The creation of databases that are accessible by every network member is mentioned as a good way to share knowledge within a network, both in a case study and during the workshop. Besides the issue of solving the free rider problem mentioned in the case study, the workshop participants also added problems about deciding which knowledge to share and how to share knowledge with network members like consultants and academics. Which knowledge to share relates to the Tesla example, where non-core knowledge is shared with network members to boost the industry, but core knowledge, the knowledge that delivers most value to the company, is kept inside the company. Difficulties of sharing knowledge with certain network members like consultants and academics are linked to the perceived stubbornness of consultants and the lack of a common goal with academics. The risk of free-riding found in the literature can probably also be linked to the hesitation about sharing knowledge with consultants. Companies pay consultants in exchange for solving a problem or gathering important knowledge. So the consultant gets paid, the company gets knowledge. However, money is not the only thing that the consultant receives. They also learn about the company and its problems. Companies may be afraid that consultants take their knowledge about the company to other companies they consult for.

6.5 Leadership

Literature and empirical data are conformable about the topic leadership. Both showed that a too controlled network develops into a hierarchy with limited creativity. The participants of the workshop also added that the number and diversity of actors can be limited, because the company that controls the network probably also determines who access the open innovation network. From this it can be concluded that control, openness and diversity of a network may be related to each other. An open innovation network that is controlled by one actor who determines who can access the network and who cannot, can become a closed and homogeneous innovation network. However, despite the risk of too much control the

workshop participants supported the literature in that some steering or guidance within an open innovation network is necessary.

6.6 Network diversity

During the workshop it was confirmed that a balance of network diversity is important. Too many experts or different goals in an open innovation network makes collaboration between the different members difficult. Participants of the workshop agreed on the benefits of different types of network partners, but once the balance between diversity and homogeneity is found, some conditions need to be there that make diverse open innovation networks possible: (1) there has to be a willingness to understand each other, and (2) drivers of the network participation need to be shared. To communicate and connect the different drivers of the network members, some leadership may be necessary.

Table 3: Comparing data from literature with empirical data per condition

	Literature	Empirical
Network openness		
<i>Open</i>	<ul style="list-style-type: none"> + Creativity + Successful innovations 	<ul style="list-style-type: none"> + Creativity + New leads - Hard to manage - Lack of clear incentives
<i>Closed</i>	<ul style="list-style-type: none"> + Enhances innovation + Increases willingness to share + Increases level of trust + Successful innovations - Rusted innovation network - Limited creativity - Less flexible 	<ul style="list-style-type: none"> + Increases confidentiality + Deeper/stronger relationships + Most successful innovations Company X - Limits creativity - Higher dependency
Trust	<ul style="list-style-type: none"> + Crucial for long term + Reduces perceived risk + Enhanced resource/knowledge sharing + Resilient and dyadic trust most effective - Insufficient monitoring - Less open - Costs 	<ul style="list-style-type: none"> + Share values, know the other party + Give to get + Mutual benefits +/- Hard to gain +/- Easy to loose - Forgetting formal agreements
Formal governance	<ul style="list-style-type: none"> + Protection + Enhanced knowledge exchange 	<ul style="list-style-type: none"> + Involve business model early + Start small

	<ul style="list-style-type: none"> + Clear roles/responsibilities - Complete contracts hard to establish 	<ul style="list-style-type: none"> - Too much time setting up a contract - Too much red tape
Sharing knowledge	<ul style="list-style-type: none"> + Create value + Knowledge database - Free rider problem 	<ul style="list-style-type: none"> + Complementary + Explicit knowledge sharing - Which knowledge to share - Difficulties with type of partner (consultants and academics)
Leadership	<ul style="list-style-type: none"> + Guidance is necessary + Common goals + Fewer conflicts - Less innovative - Hierarchy - Self-centred view - Limits creative thinking 	<ul style="list-style-type: none"> + Common goals + Energize members - Closed mentality - Top down approach - Limited number of actors
Network diversity	<ul style="list-style-type: none"> + Breadth of perspective + Cognitive resources + Problem solving capacity + Greater access + Non-redundant innovation + Successful innovations - Communication problems - Lack of integration - Lack of trust - Higher costs 	<ul style="list-style-type: none"> + Willingness to understand each other + Share attitudes and drives - Too many experts - Too diverse horizons

Source: Author's elaboration

6.7 Trade-offs and synergies

Between the different conditions for a vital network several positive and negative relationships can be found. Some conditions work as a trade-off, while others are more related as synergies. In figure 4 it can be seen which conditions are related to each other. Connections with a red minus are negatively related (which can be seen as a trade-off), while connections with a green plus are positively related (which can be seen as a synergy).

The first trade-off is between formal governance and openness (C to A). It can be argued that when companies focus too much on formal governance, the network becomes closed. The network members focussing on legal governance are constantly dealing with setting up contracts for every new member that wants to join. This will take a tremendous amount of time and cost in an open innovation network, so it is likely that these companies will collaborate with a limited number of partners in a closed network.

A second trade-off is between network diversity and knowledge sharing (F to D). An open innovation network with a high level of diversity can negatively influence the amount of knowledge sharing between the different partners. Issues with sharing knowledge with certain network members (like consultants or academics) limits the flow of knowledge within the network. It may also limit the diversity of the open innovation network. When a company does not want to share knowledge with a certain type of network member, it is very likely that this type of network member is excluded from the open innovation network. When these willingness to share problems apply to multiple types of network members, the network runs the risk of not finding an optimal diversity balance and become too homogeneous.

A third trade-off is between trust and formal governance (B to C). If the level of trust is high the need for formal governance decreases. It was even mentioned in the empirical data that a disadvantage of a high level of trust is that making formal arrangements can be easily forgotten. So, trust can become a substitute of formal governance. On the other hand, when putting too much focus on formal arrangements it can be seen as a form of distrust by the other party. In this way formal arrangements can become a substitute of trust.

As stated above, it can be discussed that leadership, openness and diversity of an open innovation network may be related to each other. A fourth trade-off can be found between network openness and leadership (A to E). The lack of clear boundaries of the network and the limited knowledge about all the network members limits the possibility of leading a network. As it is stated in the empirical data, the more open a network is, the harder it is to manage the network. A fifth trade-off between leadership and openness can be found (E to A), since too much leadership or control by one or a limited number of actors can limit the openness of a network (the CoP example). Leaders of the network may strictly control the access to the network and develop clear boundaries around the network which make it more and more closed. When this access is strictly controlled, there can also be a sixth trade-off between leadership and diversity (E to F). The actor who controls the network may have a preference for certain types of partners, and can determine to only provide access to actors into the network when they fit the preference of the leader. Actors who do not fit the type that is preferred by the leader are likely to be excluded from the open innovation network. So, an open innovation network that is controlled by one actor who determines who can access the network and who cannot, can become a closed and homogeneous innovation network.

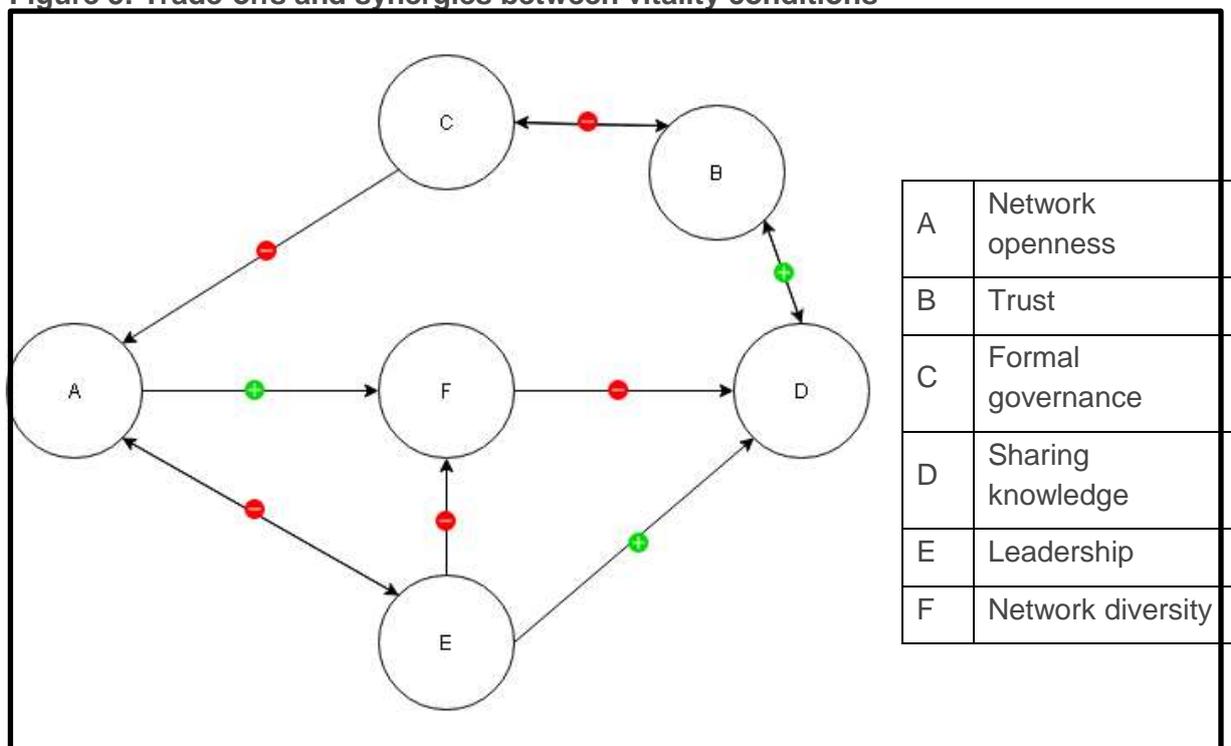
Then there is also the relationship between network openness and network diversity (A to F). It can be expected that there is a synergy between these two conditions. The more open a network is, the more diverse network members can be. When being open input in terms of information, knowledge or resources from diverse actors can be expected.

The second synergy is between trust and knowledge sharing (B to D and D to B). It can be expected that when the level of trust is high, there will be more knowledge sharing within the network than when the level of trust is low. As it was indicated in the literature about closed networks, a high level of trust makes partners more willing to share knowledge with each other. This relation between trust and knowledge sharing also works the other way around: when there is a high level of knowledge sharing it is likely that the amount of trust within a network increases. Sharing knowledge and interacting with other network members increases the knowledge about the other actors. In this study it is concluded that knowing the

other party improves the effectiveness of trust. The more interaction, the bigger the feeling of goodwill or kindness and the larger the amount of dyadic trust. So, sharing knowledge and trust can be perceived as complements.

A third and final synergy can be found between leadership and knowledge sharing (E to D). It was stated before that to communicate and connect different motivations of the network members, some leadership may be necessary. Here it seems like some guidance is necessary to connect the different network members and to let them share their knowledge with each other. Actors offering this guidance can play as an intermediary or organize activities that facilitate sharing knowledge within the network. In this way leadership can have a positive influence on knowledge sharing.

Figure 5: Trade-offs and synergies between vitality conditions



Source: Author's presentation.

7. Conclusions and Further Research

The goal of this study is to contribute to the knowledge of network management, and to provide a guideline of how to keep a network vital. This is done by discussing six different conditions that have an influence on the vitality of an open innovation network. Different conclusions and implications for further research can be drawn from this study.

Openness: Seen the fact that there are different findings about the right level of openness of an open innovation network in previous studies and in this study, the right level probably differs per network or per context the network is in. *Trust:* From the second condition it can be concluded that trust is a very important aspect within open innovation networks, and that trust based on previous interactions or experiences is the strongest kind of trust. It is important to maintain this trust by interacting with the other network members and prevent misunderstandings and a decline of trust resulting from insufficient monitoring. *Formal governance:* Another conclusion that can be drawn is about formal governance. It is important to make formal agreements about certain basics like the business model, but it is also important to not devote too much time to setting up the contract. *Sharing knowledge:* This is the key to generate new value, probably the reason why the network is set up in the first place. Make knowledge digital, accessible, and keep it up to date. *Leadership:* An important lesson about leadership is that members should not try to control the network, but guide or lead the network. *Network diversity:* As it is the case with the openness of a network, there is not a right level that applies to every open innovation network. Actors should find a balance between diversity and homogeneity. The different types of actors should be willing to share their motivations with each other, be willing to understand each other, and go for the same goal. A recommendation would be to use this list of conditions as a guideline for managing an open innovation network. Think of the current state of the open innovation network and think about what should be changed per condition. For example, when the network is not producing outcomes because it lacks creativity, is it because of the limited openness of the network, or is the diversity too low? Find out what the source of the lack of vitality is and which conditions should be addressed to make a network more vital. However, when using this knowledge about the conditions for a vital network, keep in mind that certain conditions are related to each other. The conditions can be positively related (like synergies), or negatively related (like trade-offs). So when a company wants to change a certain condition of the network, think about the consequences for the other conditions and try to prevent negative ones by taking measures.

Interpretation of the results of the study should be undertaken in light of a number of limitations. First, the perspective of this study is mainly from one company in the food and beverage industry, Company X. Perspectives from multiple organizations (others than active in the dairy sector) in the food and beverage industry may be useful to strengthen the results. Further research might also focus more on the perspective of SME's, since there is a high number of these enterprises in the food and beverage industry.

More suggestions for further research can be derived from this study. In this study it is expected that the right level of openness differs per network. For further research it might be interesting to find out in which cases or types of network it is better to be open or closed. What kind of factors of an open innovation network determine the right level of openness?

These factors might be for example the type of industry, innovation (e.g. product, service, process) or actor (e.g. SME). Another implication for further research might be the problem related to sharing knowledge with certain types of network members. In the empirical data it was found that companies may have some problems with sharing knowledge with consultants or academics. It may be helpful to find out more about this knowledge sharing problem: how common is this problem, why is it a problem, and how to solve it? Also, one could wonder whether the conditions are unique to an open innovation network in the food and beverage industry. It is expected that all the conditions can be applied to open innovation networks outside the food and beverage industry. Probably most of these conditions can even be applied to other types of networks than an open innovation network. Further research comparing different industries and network types is needed to discover the differences and similarities of the application of the conditions for vitality. It can also be questioned if the conditions mentioned in this list are the only conditions influencing network vitality. One remark during the workshop was that the innovation champions were missing in the list. For further research it might be interesting to do a (quantitative) study to find out more about the completeness of this list of conditions that influence network vitality. Finally, this study provides knowledge about how to deal with each condition separately. However, it is discussed that there are relationships between the different conditions. Future research might go deeper into the relationships between the different conditions, and study how the relationships should be handled, instead of the conditions separately.

To conclude, this study has defined a list of conditions for keeping an open innovation network vital, which contributes to the knowledge about network management. However, further research is needed to find out which factors determine the right level of network openness, to find out more about knowledge sharing with certain types of network members, about how unique the conditions are for open innovation networks in the food and beverage industry, about the list of conditions that influence network vitality, and about the relationships between the conditions.

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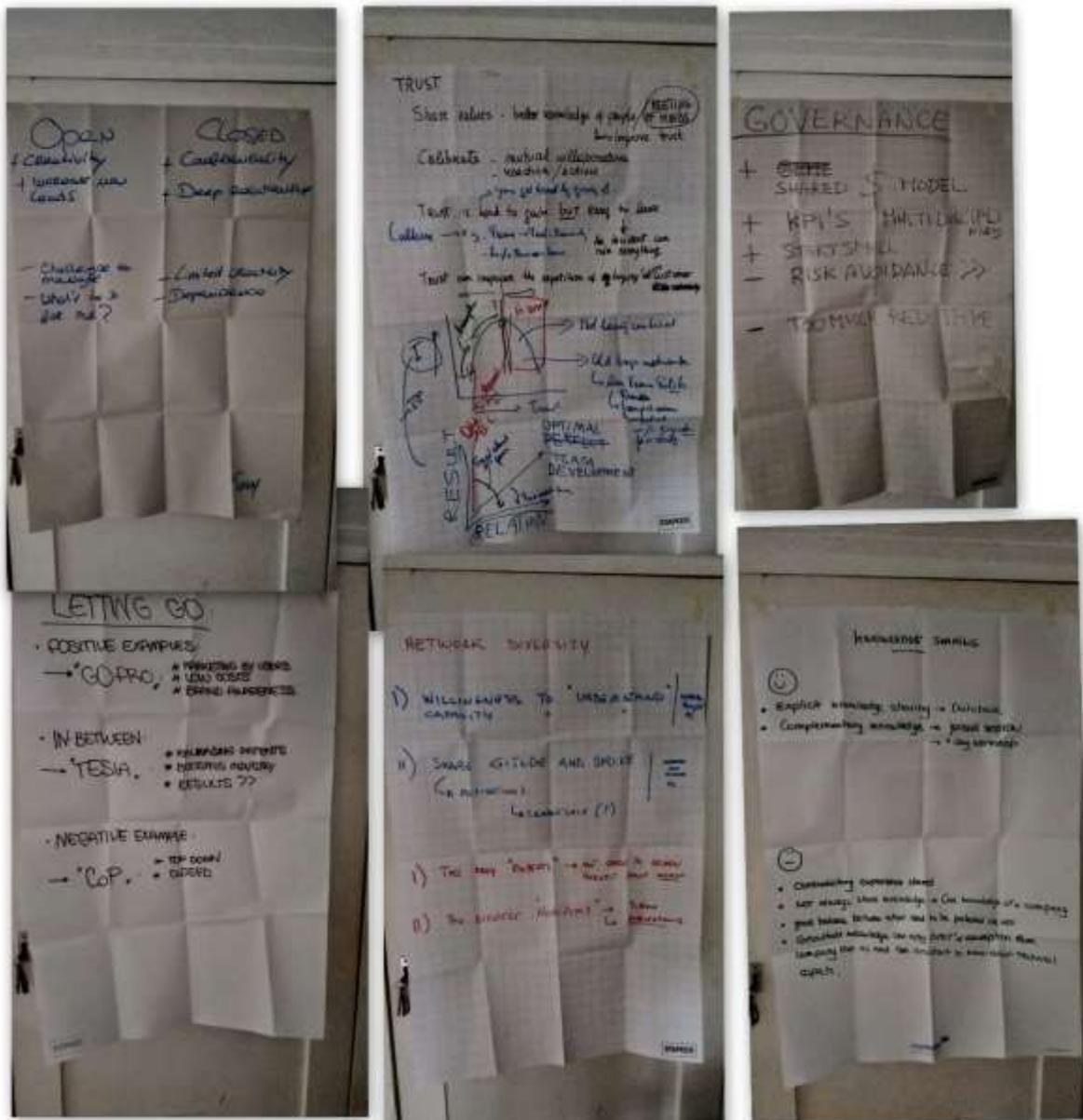
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Appendix 1: Presentations on flipchart



Project information

- Title:** International comparisons of product supply chains in the agri-food sectors: determinants of their competitiveness and performance on EU and international markets (COMPETE)
- Funding:** Collaborative research project (small or medium-scale focused research project), FP-7-KBBE.2012.1.4-09, total EU contribution is 2,422,725 €
- Duration:** 01/10/2013-30/09/2015 (36 months)
- Objective:** The objective of the COMPETE project is to gain a more comprehensive view on the different elements which contribute to the competitiveness of the European agri-food supply chain in order to provide better targeted and evidence based policies on the EU as well as on the domestic level. The project investigates selected determinants of competitiveness like policy interventions and the business environment, productivity in agriculture and food processing, the functioning of domestic and international markets, the choice of governance structures, and innovative activities in food processing. The research results will enable a congruent, coherent and consistent set of policy recommendations aiming at improving competitiveness of European product supply chain.
- Coordinator:** IAMO, Germany, Prof. Heinrich Hockmann
- Consortium:** 16 Partners from 10 European countries. COMPETE brings together academics, trade bodies, NGOs, agricultural co-operative, industry representative advisory services. In addition, the project is supported by the group of societal actors, incorporating farmer, food processing and consumer associations, providing in-depth knowledge on the agri-food sector and speeding up the achievement of the project goals.
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