

Open Innovation in the Agri-Food Sector

Prof. Dr. W.P.M. Vanhaverbeke
Hasselt University & Eindhoven University of Technology

Drs. M.H. de Rochemont
Eindhoven University of Technology

Ir. E. Meijer
Eindhoven University of Technology

Dr. A.H.W.M. Roijackers
Eindhoven University of Technology

Copyright © Openinnovatie.nl 2007

Research Paper
commissioned by TransForum
(WWW.TRANSFORUM.NL)

Contact:
Maurice De Rochemont
info@openinnovation.eu
www.openinnovation.eu

Content

1. Introduction	3
2. Theoretical framework	7
2.1 Open innovation and networks	7
2.2 Model of open innovation in value networks	8
2.2.1 Value creation	9
2.2.2 Value distribution	9
2.2.3 Network management	10
3. Cases	12
3.1 Case Prominent	12
3.2 Case Decorum Plants	15
3.3 Case TOPIGS	18
3.4 Case Calypto	21
3.5 Case Mussel harvesting	25
4. Conclusions and recommendations	29
4.1 Conclusions	29
4.2 Recommendations	33

References

1. Introduction

Traditionally, the Netherlands has a strong competitive agri-food sector. For most of the 20th century, the focus of the agri-food sector has been on enlarging production capacity and on continuous cost reduction. This focus was very effective in achieving competitive advantage in terms of productivity improvements and desired cost reduction (Duysters et al., 2006) although important agriculture raw materials like sugar, milk etc. also benefited from EU price regulations. However, after many decades of success, this has led to commoditization, an increased environmental burden and encroachment on public spaces. Simultaneously, the Dutch agri-food industry is increasingly facing considerable challenges that undermine its competitive position. The fast development of technologies and the rapidly changing markets, combined with increased global competition (also due to relieve of EU's protection measures) and changing customer demands, imply that a firm's focus on production capacity and cost reduction can only generate a temporary competitive advantage. To remain competitive in the long run, a switch to a more sustainable agri-food sector is required. In order to achieve this, the Dutch agri-food sector has to increase its innovative capacity by creating new products and services, commanding a premium.

Cooperating with others on the development and commercialization of new products and technologies is an important way to innovate. This is one of the several ways to start 'open innovation' (Chesbrough et al., 2006). Open innovation can be defined as the combination of internal and external paths for both the development and commercialization of new technologies and products (Chesbrough et al., 2006). Open innovation will lead to added value for participating firms by the following (De Rochemont et al, 2007):

- Access to new knowledge: by cooperating in networks, firms have better access to new knowledge enhancing the innovative potential of an organization.
- Scale and scope effects: by combining (financial) resources in which cost and risk reduction play a crucial role, new knowledge can be developed which was impossible for each member to obtain alone.
- Total solutions: by cooperating with different partners along the value chain, firms are able to cover a larger part of the value chain. This can lead to increased added value for customers by offering a total solution.

Thus, open innovation enlarges the innovative potential of firms (by capturing a part of the jointly created added value) and leads to integrated innovation across the value chain. Hence, open innovation has many potential benefits to increase the (jointly created) added value of Dutch agri-food firms that could strengthen the competitive position of the Dutch agri-food industry as is shown in figure 1.

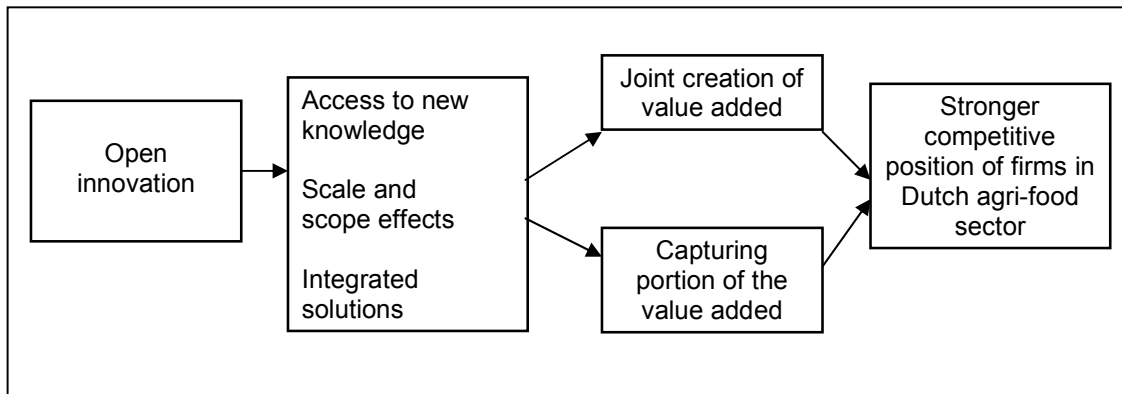


Figure 1: How open innovation can increase the competitive position of firms within the Dutch agri-food industry.

Despite the advantages of open innovation, adopting open innovation successfully is a challenging process (De Jong, 2007 and Chesbrough et al., 2006). Collaborating with a number of partners is more complex because of increased coordination and control efforts (Doz and Hamel, 1998 and Das and Teng, 2002). Previous research has demonstrated that many firms do not feel comfortable in these ‘open’ scenarios in which the return especially depends on the partnering actors. Networks of innovating partners bring with them significant strategic and organizational challenges, about which there is little prior knowledge (Vanhaverbeke and Cloudt, 2006). Moreover, prior research shows that the failure rate of bilateral alliances is quite high, ranging from 50-75% (De Rochemont et al., 2007). Cooperating in groups with an increased number of participants raises the likelihood of conflicting interests, and consequently, could lead to a breakdown of the cooperation (Park and Russo, 1996).

In the present research paper we address the question whether the Dutch agri-food sector is currently practicing open innovation or not and on which aspects these open innovation practices can be improved. The managerial objective is to improve the competitiveness of the Dutch agri-food industry in this way. Open innovation is a broad concept, which encompasses many different elements (Vanhaverbeke et al, 2007). We are especially interested in investigating open innovation from a network perspective. This perspective looks at the cooperation between a set of agro firms and knowledge institutions. Therefore, we assess the Dutch agri-food sector from an open innovation perspective, with a specific focus on its network characteristics and dynamics.

We intend to answer the following sub-questions:

- What is an appropriate framework to analyze innovation-based inter-organizational networks? What are the main dimensions of that framework? How to solve the tension between joint value creation in a network and its distribution among the different partners?

- How should inter-organizational networks be managed? Is a centralized network management necessary? If so, how does one orchestrate an inter-organizational network?
- What are the opportunities for the Dutch agri-food sector when inter-organizational networks are established in an open innovation perspective?
- What are the current weaknesses for the Dutch agri-food sector inhibiting the realization of open innovation practices?

To study open innovation within the agri-food sector five case-studies have been examined. The data for each case was collected during 2004 and 2007 by means of interviews with an expert panel of academics and practitioners of open innovation in the agri-food sector. The selection of these cases was based on availability of data and to what extent these cases represent the agri-food sector. Each case-study represents a different branch in the Dutch agri-food sector. ‘Prominent’, the first case, focuses on tomato cultivation and describes a successful collaboration between tomato producers to improve the quality of their end product. The second case focuses on flowers and plants. It illustrates how growers collaborate and compete simultaneously within the network, which enabled them to dominate the international market. The third case presents TOPIGS. It is the largest and most innovative pig breeding organization in the Netherlands, collaborating with core breeders and multipliers to maintain and improve genetic quality. The fourth case, ‘Calypto’, combines the agri-food sector and the industrial sector. This case illustrates how to organize collaboration in an innovative and international agri-industrial chain to produce durable materials, based on seeds, for painting systems. The last case describes the collaboration of different firms to cultivate mussels in a highly innovative way. This new method is less time-consuming and labor intensive than the traditional harvesting and it improves value of the product for the end consumer. The cases are typical examples of collaboration between actors located upstream in the agri-food value chain as indicated in figure 2.

The remainder of this paper is organized as follows. In the second section we describe a theoretical model based on the theory of open innovation. Using this theoretical model of open innovation as a leading concept, we analyze the five case studies as examples of open innovation within the agri-food sector in the third section. Next, in the fourth section, we conclude discussing the results of the case studies in order to identify the opportunities and weaknesses of the current open innovation practices in the agri-food sector. Finally, recommendations are given how to improve open innovation within the agri-food sector.

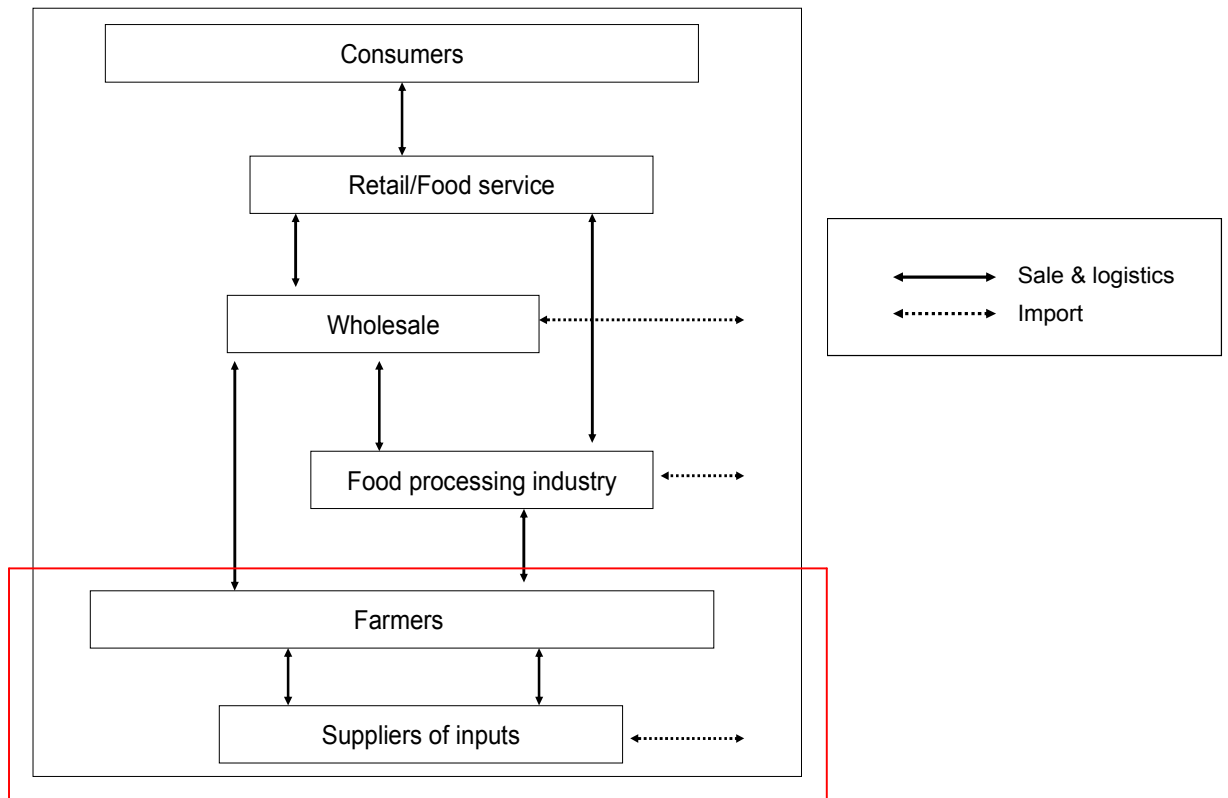


Figure 2: The vertical relationships in the agri-food industry (Duysters et al., 2006).

2. Theoretical framework

In order to investigate the concept of open innovation in the Dutch agri-food sector, we use the open innovation model as it was applied to by Vanhaverbeke and Cloudt (2006). This model describes how to create and capture value in inter-organizational networks, and consequently how to manage these networks. First, we briefly explain the concept of open innovation and more specifically open innovation in networks in section 2.1. Next, we focus on the model of open innovation in value networks and describe the different components of this model in section 2.2.

2.1 Open innovation and networks

Companies have changed their approach to R&D and innovation. During the post war period, innovations were managed in what Chesbrough (2003) calls the ‘closed innovation’ paradigm. Within this view successful innovation requires that firms generate, develop and commercialize their own ideas. It is an internally focused logic where the innovating company relies on internal capabilities to successfully innovate. Recently this paradigm has been challenged because of the increasing costs and growing complexity of R&D, the shortening of the technology life cycles, the presence of increasingly knowledgeable suppliers and clients, the growth of venture capital and the growing diffusion of leading-edge knowledge in universities and research labs around the world. Chesbrough (2003) calls this the ‘open innovation’ paradigm, in which a company commercializes both its own ideas as well as innovations from other partners. In the open innovation era firms seek ways to bring their in-house ideas to market by deploying pathways outside their current business models. Within this view, innovators must integrate their ideas, expertise and skills with those of others outside the organization to create value.

Inter-organizational networks play an important role in the realization of open innovation (Vanhaverbeke, 2006). So far, most collaboration between partners has been based on a dyadic relationship, consisting of two partners (e.g. buyer-supplier relationships, international joint-venture etc.). Increasingly, firms are working as part of broader networks to create customer value (Das and Teng, 2002 and Vanhaverbeke, 2006). In this paper we focus on these networks in which a larger number of actors cooperate. First, to realize a product, process or service, a cooperative network with several other actors along the value chain has to be set up to reach downstream players. Second, the costs of the minimum efficient scale of the innovative activities are too high to be absorbed by an individual firm. Large investments are only affordable when a whole set of firms collaborate. Third, an increased number of actors also accelerate the learning process. Finally, in a sector where a group of people who know each other, learning processes take place within existing (in) formal networks.

To jointly create customer value, these networks of partners are based on the collaborative efforts of specialist companies each providing complementary resources. In

this paper we refer to these inter-organizational networks as ‘value networks’ which are inter-organizational networks linking firms with different assets and competencies together to create value for the targeted customers. Vanhaverbeke and Cloudt (2006) developed a model of value networks, in which central players establish a network of partners with complementary skills and assets to create jointly value. This model is used in this paper to analyze the five cases. It will be further explained in the next section.

2.2 Model of open innovation in value networks

How value is created in value networks and how different players can capture part of that value are central topics in open innovation (Vanhaverbeke and Cloudt, 2006). Furthermore, to realize business opportunities central firms manage a value network. This is shown in figure 3. Together, value creation, value appropriation and network management are interrelated and influence each other. The interaction between these different elements will be discussed in the next section. Though some networks can be quite stable and change little over time, networks typically tend to be more dynamic (Gulati et al., 2000). This implies that the dynamics of the network have to be managed continuously.

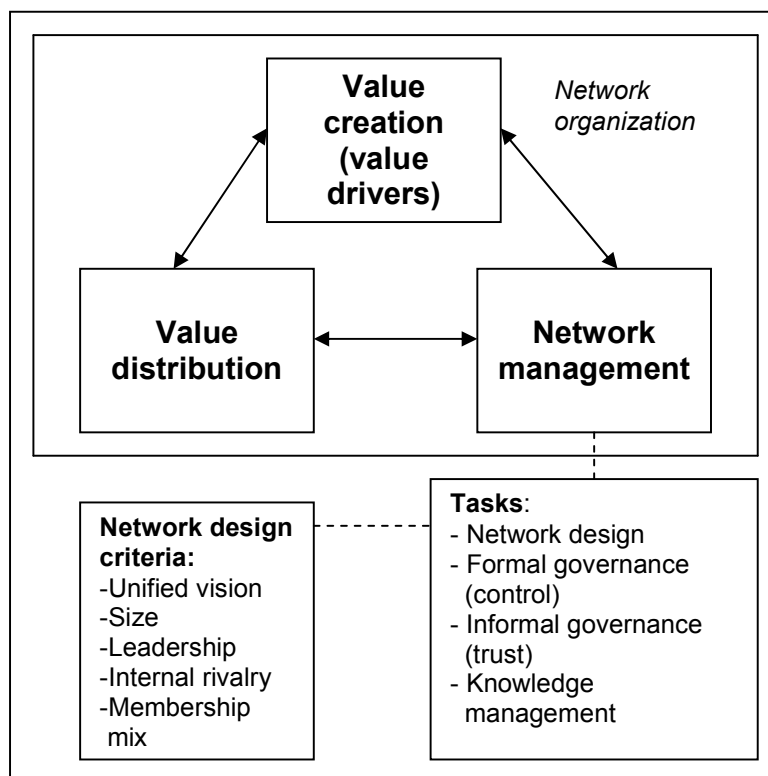


Figure 3: Theoretical model of open innovation in value networks

2.2.1 Value creation

Innovation-based value creation for a targeted customer group is at the center of open innovation in general and in value networks in particular (Vanhaverbeke and Cloudt, 2006). Value creation is always directed to specific customers or customer groups. We call them the ‘targeted customer (group)’. Targeted customers might be direct customers of the innovating firms but they can also be located further downward in the value chain. In that case the innovating company has no direct contact with the targeted customers. According to Vanhaverbeke and Cloudt (2006) value creation within a network or constellation is determined by:

- First, the firm-level resources and competencies that are aggregated at the network level. These group-level resources determine the relative value of the constellation’s products versus other products in the market.
- Second, how these resources are effectively combined and governed at the constellations level which will be further explained in section 2.2.3.
- Third, the value of competing products and the competitive reactions of other competing firms and constellations.

Value can be created in different ways depending on what the targeted customers value. We call the underlying drivers that create value for the targeted customers value drivers. They play a role as sources of value creation in the value constellation. Dependent on the targeted customers value drivers can be very different. End customers might value better tasting tomatoes or environmental friendly products, farmers may benefit from higher returns on crops or from time and cost reductions in cultivating crops, etc. Value drivers are thus critical success factors of how to create value in the network.

2.2.2 Value distribution

The value created in the network also has to be shared among the different participants (including the targeted customers). According to Vanhaverbeke and Cloudt (2006) value appropriation in a value network has to be considered jointly with the value creation strategy because the quality of the collaboration of the participants and the value-sharing among them both determine how much value the constellation as a whole can create. In addition, they mention that each participant should profit from its participation in the collaboration. The strength of the value constellation is determined by (1) the extra value created in comparison with competing value systems and (2) the commitment of the different partners in the value constellation. The latter is in turn the result of the (financial) benefits each one can reap compared to alternative value systems. Hence, it will be necessary to calculate the benefits along the value constellation and to ensure that each partner receives his return so that everybody stays committed. ‘Fair’ value distribution in a value network is important, because some actors are automatically better off in the new network compared to the alternative value creating systems, but others might be worse off and have to be compensated to get/ stay committed to the value network. In sum, a value network can only be successfully established if all players that

are necessary for a smooth working of the value constellation are better off than in competing business systems.

Within a network there is usually a strong tension between value creation on the one side and value capturing on the other side. This tension arises because firms have to cooperate to create a maximum of value for the targeted customers, but at the same time each of them want to appropriate as much value as possible. Cooperation may fail if the tension is too strong. In order to deal with these tensions, network management is very important to the success of the collaboration as will be further explained below.

2.2.3 Network management

Network management takes care of the tension between value creation and value capturing. Both value creation and value capturing can only be realized if a central company acts as an orchestrator or coordinator and manages the 'value constellation' (Iansiti and Levien, 2004). Network management starts with the design of the network based on the strategic goals and the creation of taking superior customer value.

Network design

In order to be competitive compared to other firms or constellations, a network needs to be well designed. Based on Gomes-Casseres (2003) and Bamford et al. (2003), the following network design criteria should be considered:

- **Unified vision:** A shared vision needs to be established to bring different partners together. Strategic agreement on the overall goals of the collaboration is a strong foundation for a supportive overall collaborative environment (Koza and Lewin, 2000).
- **Leadership:** Leadership is important in making collective decisions and in disciplining constellation members that wander away from the collective goals. In the case of a centralized network, the role of the orchestrator can be fulfilled by someone who has benefits by leading the network, or a neutral party. In the case of a decentralized network, no network orchestrator can be identified (Gomes-Casseres, 2003). In that case, the cohesion in the network is determined by mutual social control and strong shared values or norms.
- **Size:** The number of member firms in the constellations is a key design criterion. Having more members may give the constellation access to a broader range of capabilities; but a larger size makes it more difficult to distribute the value created and to manage the value constellation (Vanhaverbeke and Cloudt, 2006).
- **Internal rivalry:** It is rare to find partners that are totally devoid of competitive friction. The key to success lies in minimizing this rivalry by carefully choosing partners and then managing the rivalry by careful design of the structure and governance of the group (Bamford et al., 2003).
- **Membership mix:** A good membership is crucial to combine complementary capabilities in a way that creates value in the market place. This requires a keen

sense for the success factors in a competitive domain, which has strong capabilities in each key part of the value chain (Bamford et al., 2003).

After the design of the network, one has to choose between formal governance (control) versus informal governance (trust). Next, knowledge flows between the partners has to be managed too. Trust and control form two fundamental managerial issues for networks. Uncertainties about the environment and the potential opportunism of partners make trust and control particularly important in sustaining cooperative relationships (Lui and Ngo, 2004). Trust may not simply be a substitute for control (Das and Teng, 1998) as will be explained below.

Formal governance (including value appropriation rules)

Collaborating with partner-firms involves more risk than going alone. Increased risks arise from an uncertain environment as well as potentially opportunistic partners (Parkhe, 1998). Contractual safeguards can control opportunism through two mechanisms. First, they can change the pay-off structure by increasing the cost of opportunistic behavior; it is more costly to violate contracts that clearly stipulate penalties for opportunistic behavior (Parkhe, 1993). Second, contracts can reduce monitoring cost by increasing the transparency of relationships and clarifying the objects of monitoring (Reuer and Ariño, 2002).

Informal governance

However, a contract can never specify every potential contingency (Macneil, 1980). When a contract becomes excessively detailed, it will be inflexible and monitoring compliance becomes impossible (Poppo and Zenger, 2002). As a consequence, managers may rely on trust as well as contracts to regulate a partner's behavior. Trust between firms refers to the confidence that a partner will not exploit the vulnerabilities of the other (Lui and Ngo, 2004). Additionally, norms and values stimulating collaboration play an important role in creating a collaborative environment.

Knowledge management

Important in the network is the management of the different knowledge flows between the members. Knowledge can be tacit or explicit. Tacit knowledge is knowledge that people carry in their minds and is, therefore, difficult to access and share within a network. Often, people are not aware of the knowledge they possess or how it can be valuable to others. Effective transfer of tacit knowledge generally requires extensive personal contact and trust. Often face-to-face meetings are necessary to transfer the knowledge within the network. Explicit knowledge, on the contrary, can be articulated, codified, and stored in certain media. This kind of knowledge can be readily transmitted to others by means of newsletters, shared databases etc. In contrast, tacit knowledge is more difficult to spread. Another important issue in knowledge management is intellectual property (IP). Core knowledge is very valuable for the members to stay competitive and therefore they will not want to share the knowledge.

3. Cases

The previous chapter described a theoretical framework to examine value creation in open innovation networks. In this chapter, the framework has been applied on five different cases of open innovation within the Dutch agri-food sector. The first case, Prominent, describes a network of tomato breeders in the Westland. The second case, Decorum Plants, concerns a network of growers creating a quality brand for potted plants also located in the Westland. Next, the TOPIGS network is analyzed. TOPIGS is an organization of core breeders which helps breeders in maintaining and improving genetic quality of pigs. The fourth case is about Calypto, which is a network of firms set up to produce and commercialize a special type of seed. Finally, the last case, Mussel Harvesting, deals with the development of a new machine for harvesting mussels.

3.1 Case Prominent¹

Introduction

Almost 40% of the added value in the Dutch agri-food industry has been realized in two closely aligned regions in the Netherlands, the Westland and Oostland (Rabobank, 2006). Most of the cultivators in the Westland are either focused on growing tomatoes or paprika. For the Dutch tomato industry, the end of the last century was traumatic. Holland's largest customer, Germany, blocked the Dutch tomato. German customers referred to it as 'the Wasserbombe', indicating the watery taste of the tomato. Moreover, the growing conditions to cultivate according to sustainability criteria offered even more challenges. Each Dutch tomato cultivator alone had too little knowledge and resources to improve product quality. Developing new methods of tomato cultivation are costly and require considerable financial resources. Six tomato cultivators decided to cooperate and form a cooperation called 'Prominent' (founded in 1994). The aim of these six tomato cultivators was to increase the quality of the tomatoes in order to gain back the satisfaction of German customers, while maintaining the sustainability of the ecological system. As shown in figure 4 Prominent sells its tomatoes via the Greenery, a sales company dedicated at selling and marketing agri-food products to B2B customers, to different wholesalers, retailers and industrial customers.

¹ Based on a case-study of De Man (2007).

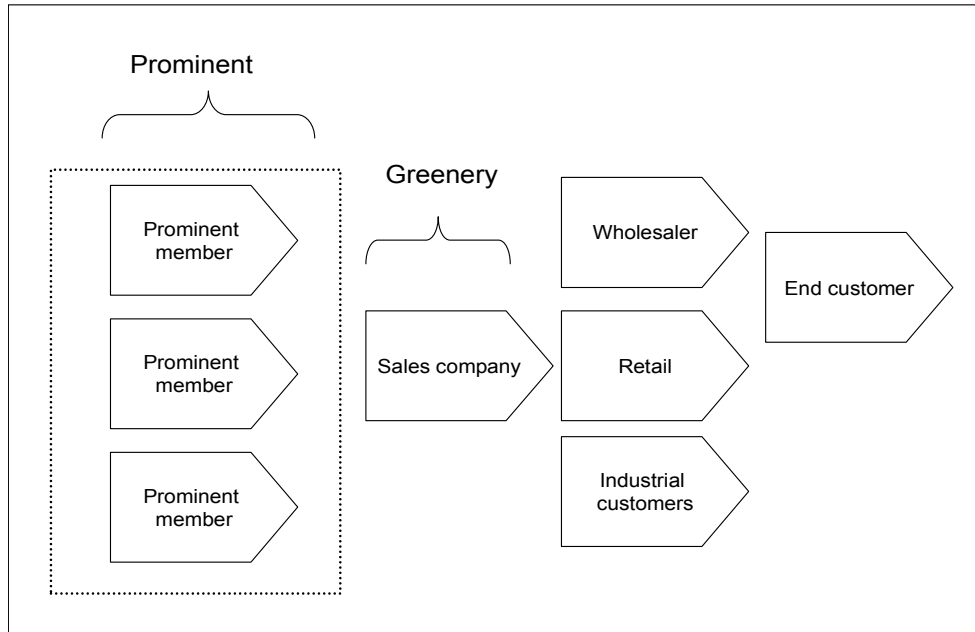


Figure 4: The value chain of Prominent.

An overview of the case is given in the table 1 which is further explained below.

Table 1: Overview of Prominent

Open innovation element	Description
Value creation	Creation of high quality tomatoes
Value distribution	Higher profits for its members by increased sales and purchasing power.
Network management	Managed by a central professional organization using a mix of both formal governance (partner selection rules, financial commitments etc.) and high levels of trust based on a collaborative culture. Knowledge has been diffused via (obligatory) working groups.

Value creation

Prominent has successfully improved the quality of the Dutch tomato and its reputation in Germany. As a result, the Dutch tomato is the most popular tomato in Germany (De Man et al, 2006). For a tomato cultivator creating a radical improvement in the quality of the tomato alone was very difficult. Developing new methods of tomato cultivation requires considerable knowledge and financial resources. However, by exchanging knowledge and resources, members of Prominent were able to learn new techniques to improve the quality of the tomato. For example, Prominent analyzed new lightning techniques for tomato cultivation. Moreover, new methods are developed to create a closed greenhouse leading to 30% less usage of gas and a better climate control. These experiments act as learning vehicles for the members. In addition, Prominent set up a packaging company, one of the most innovative in Europe, in which tomatoes are packaged for American and

German customers. Before, packaging was done by the individual cultivators. By creating a new company taking over these non-core activities, each firm has been able to concentrate more on its primary function, i.e. growing tomatoes. Extra value was created for its members by improving bargaining power against 'The Greenery'. Because of its size, a current number of 22 members (covering 120 m³ tomatoes), members of Prominent participated in several committees of the Greenery.

Value distribution

As explained above, by combining resources and exchanging knowledge, members of Prominent were able to learn new techniques and therefore to improve the quality of the product. Prominent has led to higher profits for all its members. The high-quality tomato led to increased sales for the Prominent members. Moreover, by placing orders for all its members by certain suppliers, Prominent led to reduced order costs and thus higher profits for its members. A greater purchasing power is the result of bundling procurement. However, as the next paragraph will illustrate, firms cannot enjoy these benefits without fulfilling obligations for Prominent.

Network Management

Management of Prominent has been carried out by a management team. New activities were organized in new entities falling under Prominent Holding BV. Each entity has its own management board.

Next to a professional organizational structure, Prominent makes use of a mix of formal and social governance to manage its network. Formal governance is managed by a number of rules or mechanisms. First, to ensure the right membership fit, a partner selection mechanism is used. The following partner selection criteria are applied:

- One has to be located in the Westland.
- Cultivators have to breed tomatoes that are cultivated in the cooperation.
- They have to be members of the Greenery.
- Willing to conform to rules of Prominent.

Second, based on company size, each member has to invest a certain amount of money in Prominent to ensure commitment. A third control mechanism is operational control. Periodically, tomatoes of each member are tested on quality. If the tomatoes do not maintain a certain quality level, members risk the danger of being forced to leave the cooperation. Hence, this rule implies that firms need to keep up the pace and to continuously appropriate and apply knowledge flowing from Prominent. Finally, members are obligated to do their purchasing via Prominent. This leads to lower cost prices for each firm. Next to formal governance, Prominent exemplifies the workings of a strong trust based culture. Hence, partners leave important issues in the hands of their partners, such as purchasing, innovation and quality control. There are three reasons for this trust based culture. First, trust is rooted in the regional culture of the members of Prominent. In the Westland, cooperation is a common way of doing business. In the early fifties, agricultural entrepreneurs looked in each others greenhouses to learn about

cultivation. Second, besides operational fit, partners are also selected on cultural fit. Participation in Prominent requires a lot of commitment. To strengthen social governance in Prominent, partners are screened thoroughly. Finally, Prominent invests in relationship building. Members have to visit each others greenhouses and work groups. This stimulates the strengthening of personal relationships among members.

Diffusion of knowledge concerning the cultivation of tomatoes is also managed by the Prominent organization. The knowledge required to innovate is mainly tacit and involves new methods or ideas to improve tomato breeding. This knowledge is distributed via work groups (which are obligatory). To understand each other's knowledge is not a problem because all members have the same background. Hence, their 'absorptive capacity' (Cohen and Levinthal, 1990) is accurate. The obligated workgroups ensure constant knowledge flows through the Prominent network, creating a healthy ground for new ideas.

Thus, network management in Prominent is carried out by a professional organizational structure using a mix of both formal and social governance. Diffusing knowledge is managed in working groups that farmers have to attend.

3.2 Case Decorum Plants²

Introduction

Cut flowers and potted plants is another branch that is very important to the Dutch agricultural sector. Cut flowers and potted plants are among the most successful export products of The Netherlands. Potted plants are a growth branch, while cut flowers and fruit and vegetables are shrinking industry branches. Growth in potted plants is achieved by a decreasing number of growers with increasing acreage and ever-increasing yields. Greenhouses are becoming more and more high-tech, investment levels are increasing, and growers are becoming more professional and business-driven. Furthermore, growers are interdependent because of their extreme specialization. This forces them to collaborate in networks of growers. This case describes Decorum Plants, a network of growers situated in the Westland. Decorum Plants strengthens the market orientation of the associated growers by creating a quality brand for potted plants. A simplified version of the horticulture chain is depicted in figure 5 below. The chain consists of four steps: suppliers, growers, auctions and trade and retail. This case study focuses on networks of growers. Marketing plays an important role in Decorum Plants. Historically, the auction was responsible for marketing plants and flowers, and growers did not spend any resources on branding and marketing. With the growth in size and the rise of retail chains as outlets for plants and flowers, growers are becoming increasingly interested in market

² Based on a case-study of De Man (2007).

demand and client feedback. The larger the size of the companies and the higher their investments, the more companies feel the need to ensure stable sales.

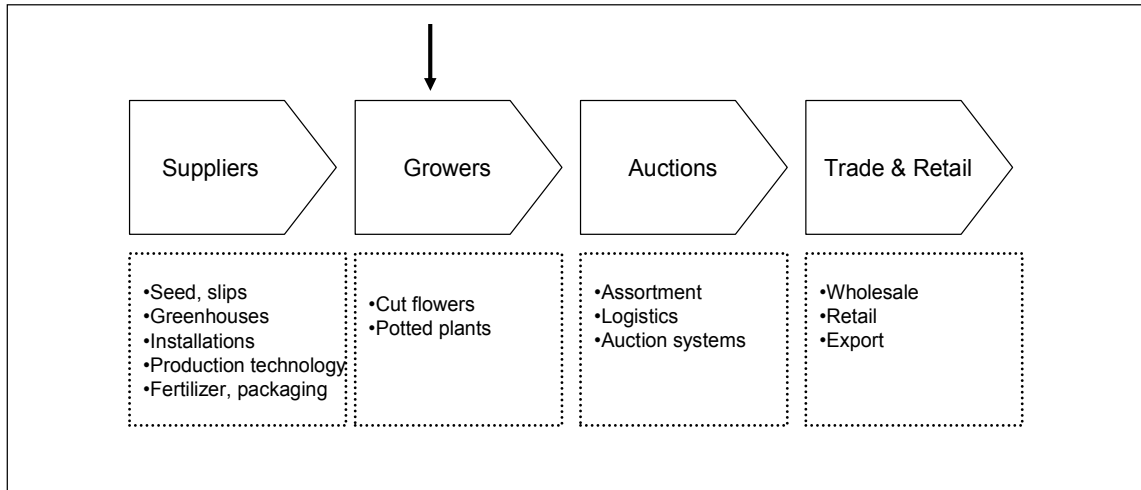


Figure 5: The horticulture chain.

A short overview of the case is given in table 2 below.

Table 2: Overview of Decorum Plants

Open Innovation element	Description
Value creation	Creation of a quality brand for potted plants.
Value distribution	All members (financially) profit from the quality brand name by strengthening the market orientation of the associated growers.
Network management	Managed by a central professional organization using a mix of both formal governance and high levels of trust based on a collaborative culture. Knowledge management by letters, meetings and knowledge interpreters.

Value creation

Next to Prominent that makes an important contribution to knowledge sharing and innovation, other grower networks have moved beyond that and look across plant or flower varieties. These focus on marketing, sales and branding. Because of their extreme specialization, growers are interdependent. Growers tend to specialize in only one type of flower or plant (e.g. only orchids) and sometimes even in one specific variety (e.g. only white orchids). Within Decorum, forty-five growers of different types of potted plants have begun investing in setting up a brand focusing on the better quality plant. Moreover, a grower alone is not able to create a powerful position against the traders and retailers. Therefore, the growers started to collaborate in Decorum Plants, a market-oriented association that creates a quality brand for potted plants and thereby strengthening the

market orientation of the associated growers. The initial aim is to create brand recognition with traders. Next growers leverage that brand with retailers and eventually with the final customer.

Value distribution

The members of the growers association understand that it is more valuable to be part of the network than to go it alone because they share risks and receive special rewards. In Decorum Plants, all members profit from the quality brand name. By selling plants under the Decorum plant, growers develop a stronger competitive position.

Network management

The network is managed by a professional organization using both formal and informal governance. The partners are selected based on their product quality and their willingness to invest in Decorum activities. To address free-riding behavior formal sanctions, agreements on value distributions and aligned goals were established. New members sign a contract stating that they remain a member for at least a year. The contract does define penalties for quality: when a grower does not produce an adequate quality, he is not allowed to sell his plants under the Decorum brand. Additionally, a target was introduced in 2005 stating that at least 50% of the production of each Decorum member should be of Decorum quality and that within two years that 50% should be sold via Decorum. Such a strict criterion may result in number of members leaving. However, Decorum believes the remaining ones are more committed to developing a brand and investing in marketing innovations. Issues like professional pride of the growers, a strong network identity both at the level of association and regional network and inter-personal relationships have a positive influence on the network. The sector has a long history of extensive knowledge sharing, founded on shared cooperative norms and supported, for many years, by a government-backed system of study clubs. Throughout the twentieth century, there has always been a clear need for increasing productivity. As a result growers were continuously on the lookout for new and better ways of growing plants. For this they need to learn from each other and it has led to an open, knowledge sharing culture (like in the Prominent case).

The horticulture network in general is an interesting mix of both competition and collaboration. This combination spurs innovation. To develop new and better ways of growing plants, the growers, being competitors, need to learn from each other and therefore need to collaborate. Additionally, the growers are very specialized which may contribute to the fact that these 'competitors' are willing to cooperate.

To manage knowledge flows Decorum members meet every four to six weeks. Growers visit one of the member companies every six weeks, to learn about members but also to get to know each other in an informal atmosphere. The sector also makes efforts to create absorptive capacity through specialized consultants and incidental training. Specialized consultants are for instance used as knowledge interpreters. Additionally, knowledge

about markets and marketing is gathered by collaborating with a specialized consultancy firm and the Flower Bureau Holland, an organization that tracks market developments worldwide.

Thus, Decorum Plants is managed by a professional organization based on strong formal and informal governance. Knowledge diffusion takes place by company visits, specialized consultants and training.

3.3 Case TOPIGS³

Introduction

The Netherlands is one of the world's leading exporters of breeding pigs and pork and production of pork. Increasing demands on health, animal welfare, economic performance, innovation and internationalization are transforming the production of pork in all stages of the value chain. Breeders have had to cope with this development too. The breeder is responsible for improving the genetic make up of the different lines and crossbreds of pigs. Improvement of genetic material tends to be a lengthy process. Product innovation takes three to five years. At the moment product innovation intends to improve the color of meat, to increase the fertility of pigs, to speed up the growth of pigs or to influence the amount of saleable bacon of a pig. The costs of R&D are increasing, forcing companies to internationalize to recoup their initial R&D investments. Innovation is incremental and driven by the demands of the partners in the chain.

To improve the speed of growth of pigs, to make them resistant to diseases and to adapt them to local market needs, breeders started to collaborate in cooperatives like TOPIGS. TOPIGS, an organization of core breeders, helps the breeder in maintaining and improving genetic quality. They set up breeding programmes that deliver pigs that get the highest price from the slaughterhouses at the lowest cost.

This case describes the cooperative Pigure Group with its breeding program TOPIGS. TOPIGS came into being in 2003 when the three breeding cooperatives existing in The Netherlands at that moment merged into one. TOPIGS operates in thirty countries, often with local partners. With a production of 900,000 gilts per year TOPIGS is one of the top three pig breeders in the world. In The Netherlands its market share is as high as 80%. Core breeders, multipliers and farmers are all members of the cooperative. Figure 5 below depicts the main players in the Dutch pork chain. The value chain can be split up into three distinct phases. The first one focuses on breeding and growing of pigs. The second one is the slaughterhouse and the third one retail/processing. There are several suppliers to the pork chain, the most important suppliers being the feed companies. Other supporting industries are suppliers, equipment producers and veterinary services. We

³ Based on a case-study of De Man (2006b).

focus on the first steps of the Dutch pork chain i.e. the pig breeding part as indicated in figure 6 below.

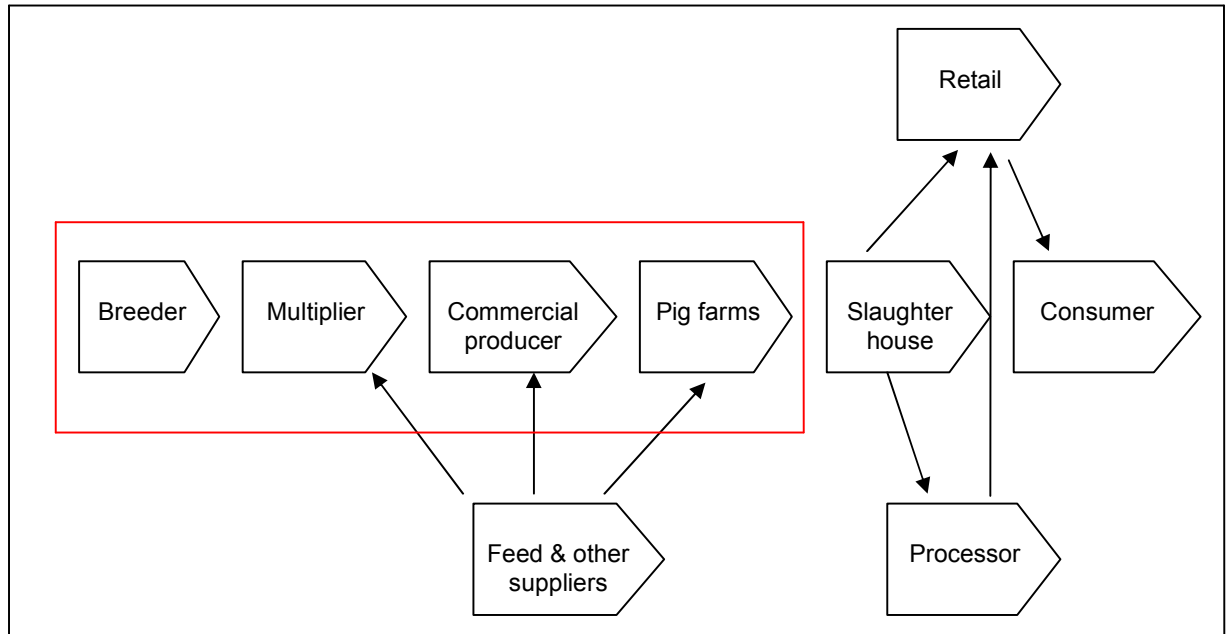


Figure 6: The TOPIGS network.

An overview of the case is given in the table 3 which is explained below.

Table 3: Overview of the TOPIGS case

Open Innovation element	Description
Value creation	Maintaining and improving genetic quality of pigs by developing and exploiting new technologies.
Value distribution	Premium price for farmers against slaughterhouses.
Network management	Network organization is based on a franchise system. Less attention paid to formal governance but clear rules on value distribution. Strong informal governance by professional pride and a network identity. Strong management of tacit and explicit knowledge from TOPIGS.

Value creation

In The Netherlands, TOPIGS collaborates with core breeders and multipliers to improve and maintain the pig lines it has. These breeders are responsible for the production and distribution of the breeding material based on a franchise system. TOPIGS provides the basic elements for breeding, such as breeding value estimations (breeding values are numbers which indicate the expected performance of a sow or boar), product

development, communication and technical support (e.g. advice on animal feed or disease prevention). In this way TOPIGS, enables farmers to come up with improved pigs and pork. This collaboration creates a synergistic process by combining the core competences of the involved parties.

Within the international operations of TOPIGS, TOPIGS combines its knowledge about breeding and genetics with a local partners' market knowledge. Internationalization usually starts with exporting products, but soon local production and sales follow. This is achieved by collaborating with local multipliers and commercial producers.

Underlying value creation, new pig quality by faster working in R&D and in a more professional scientific way leads to increased customer value.

Value distribution

The members of TOPIGS receive value by applying the knowledge (high value breeding material) created at network level in their own business. Via the Pig database, knowledge transfer personnel and other ways of knowledge distribution, members are able to exchange knowledge to improve their breeding and farming techniques. This enables breeders and farmers come up with improved pigs leading to a stronger position for them against the slaughterhouses. There is agreement on value distribution. The franchisees, core breeders of multipliers, sell their products branded as TOPIGS. Royalties and license fees are paid to TOPIGS based on the number of pigs sold and most knowledge is free to be used by all in the Dutch network. Internationally, there is a distribution agreement in place with each local subsidiary, stipulating the rights and obligations. All knowledge of TOPIGS is available to all joint ventures except for knowledge about core breeding. This knowledge is not shared internationally.

Network Management

With TOPIGS as an important player, the network has a certain degree of centralization. In The Netherlands, TOPIGS collaborates with core breeders and multipliers based on a franchise system. The 120-130 franchisees, core breeders and multipliers, sell their products branded as TOPIGS. The international operations of TOPIGS, are often directed via international joint ventures in which the ultimate leadership remains in the hands of TOPIGS.

The cooperative now has 3000 members. Core breeders and multipliers are all members of the cooperative; a minority percentage of farmers are members of the cooperative. Additionally, TOPIGS collaborates with research institutes, feed industry and veterinarians in different countries. The main research partners in The Netherlands are Wageningen University and Research Centre (WUR, among others with Plant Research International, Animal Research Station and the departments of Breeding and Genetics, Animal Feed and Adaptation Physiology) and Utrecht University (Veterinary Faculty).

Some research partners outside The Netherlands are INRA (France) and the University of Bonn (Germany).

The network is open for anyone in the business. Independence and free use of knowledge makes it possible to have a large group size. Consequently, the large number of members enables TOPIGS to invest in research, knowledge development and improvement which is a key success factor for breeding organizations.

The network is mainly managed by informal governance. Professional pride is an important motivator for pig breeders and farmers. They like to share knowledge because it increases their reputation as high quality farmers. A network identity is present as well, even though it is not developed very strongly. Licensing taking place under TOPIGS brand, membership of the cooperative, the presence of study clubs and the general collaborative attitude in the industry underpin the network identity. This increases motivation and, additionally, limits free-riding. A shared vision is clearly present as well: all farmers realize they need to develop new genetics jointly, because they cannot do it by themselves.

Regarding the core knowledge, explicit as well as tacit knowledge have to be managed in the TOPIGS network. There is a clear distinction between mechanisms used for the exchange of tacit knowledge and mechanisms used for the exchange of explicit knowledge. Tacit knowledge is exchanged via face to face contact and site visits by knowledge transfer personnel. Explicit knowledge is shared via magazines, IT mechanisms and meetings. The fact that core knowledge is shared does not mean companies hold back in contributing to the network for fear of losing their competitive advantage. The contrary is true: core knowledge is most valuable to the farmers to meet competitive pressures they all face. By collaborating they can solve problems jointly without everybody reinventing the wheel. It is precisely because core knowledge is valuable, that most partners are interested in sharing it.

So, the network is managed by a centralized organization based on a franchise system. Less attention is paid to formal governance but there are clear rules on value distribution. There exists a strong collaborative culture and precise management of tacit and explicit knowledge from TOPIGS.

3.4 Case Calypto

Introduction

Several years ago, WIB, a research institute of Wageningen University (W.U.R.), discovered that oil, made of seeds of the *Calypto officinalis* (a plant), and could be used as a substitute for toxic chemicals. Although Calypto oil already has different end applications (such as in healthcare), it does not have yet in the paint industry. Hence,

WIB, together with the incubator of the WUR, tried to find a potential new end market for Calypto oil.

Two potential customers were identified. First, WIB contacted CHEMCO, a large Dutch chemical company that has obtained a patent to use methyl esters of Calypto oil as a reactive thinner in alkyd based paint systems. This enables CHEMCO to produce high quality paint with a very low amount of solvents. Next to health advantages, this solution also has the added benefit that the emission of CO₂ is lower compared to turpentine (which is produced on the base of carbon). Van Beuningen, a customer of CHEMCO producing paint, was interested in buying Calypto from CHEMCO. Second, Natures, a paint producer, was interested in using Calypto oil as a substitute for tung oil. Replacement of 'tung' is characterized by a very insecure and instable supply, thus leading to very high sudden rises of prices.

The next step for WIB was to start the development of the product itself. WIB was merely a scientific research institute, and was not only able to extract the fluid or to grow the seeds. Hence, WIB decided that (specialized) partners were needed to develop and commercialize the product.

WIB connected with McBain, a consultancy firm, to set up the right governance structure for the value chain. WIB realized that to make Calypto a success, a business model including the right network management was essential. McBain, very optimistic about the market potential of the product, also invested money as an equity partner. In addition, partners abroad were sought to plant the seeds.

The initial cluster member mix was the following as shown in figure 7:

- WIB: scientific institute for the biological manipulation of seeds, primarily funded by third party projects. Part of Wageningen University.
- R&B: research institute looking at improvement of paints so that they become environmentally friendly. Part of Wageningen University.
- Seed Inc.: company which focuses on the multiplication of seeds.
- Domestic AG Agricoles/Aroles/Biopag: a French company, willing to extract the oil from the seeds.
- Crystallion: French firm located in Morocco (Casablanca), performing extraction of Calypto oil. Only firms in Morocco extract the oil, because it is too expensive to transport Calypto seed to extracting companies outside Morocco.
- Natures: potential customer of the Calundula oil. Is active in the production of natural paint. Looking for an alternative of tung oil.
- CHEMCO Resins: producer of paint ingredients and has customer (Van Beuningen) interested in Calypto paint
- Van Beuningen Verf: client of CHEMCO, interested in Calypto based paints
- McBain: consulting firm and financial sponsor of project.

Goals for the parties in the network varied (commercially). For the equity investors (WIB & McBain), the interest was clear: to develop different applications for the Calypto oil resulting in long term revenues. For other parties, the interest was short term. CHEMCO was only interested because Van Beuningen was interested to buy paint including the Calypto substance. Natures was only interested in Calypto as long as it was a cheaper and more reliable substance than tung oil. For the Moroccan seed growers and extraction company, Calypto was merely an additional revenue stream without any strategic importance.

To summarize, the goals of each partner in this network varied. In addition, the two potential customers required different applications of the product. As a result, it is hard to speak in terms of shared goals. Some actors invested heavily in the development of Calypto and had considerable sunk costs, while for other actors Calypto was not strategically important. In addition, the innovation process of Calypto can be entitled as 'technology' push from the start, while customers were involved after a potential interest was assessed.

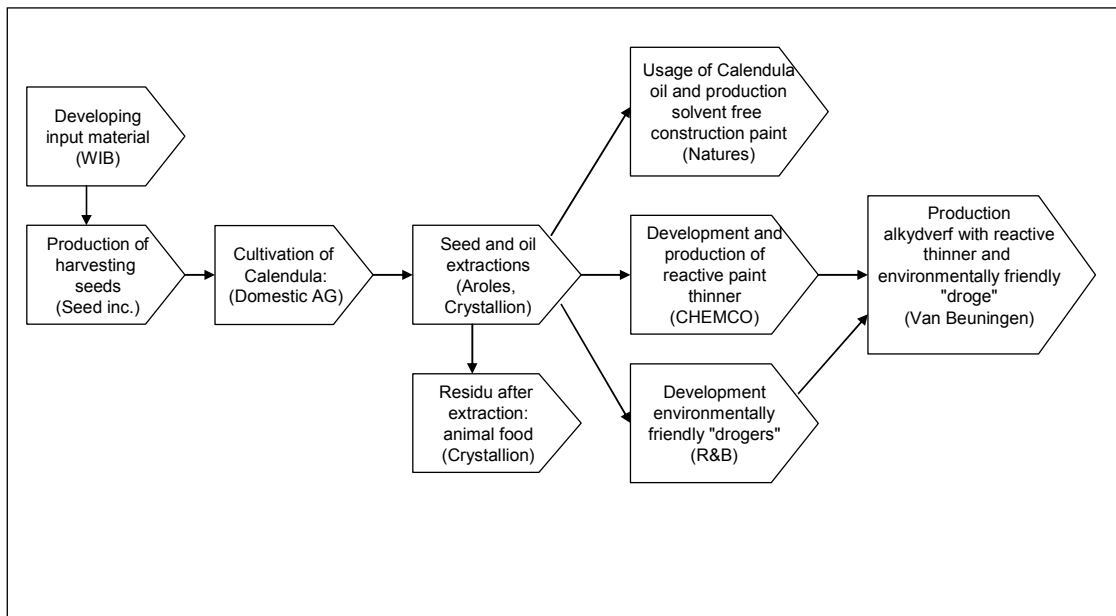


Figure 7: The value chain of the Calypto network.

An overview of the case is given in the table 4 which is explained below.

Table 4: Overview of the Calypto Case

Open Innovation element	Description
Value creation	On the one hand for Van Beuningen, Calypto was an environmentally friendly product resulting into less health risks and costs for employees. On the other hand for Natures, Calypto was used as a

	substitute for tung oil resulting in an improved and secured and less costly supply for paint.
Value distribution	Value distribution remained difficult because parties found it very hard to agree on the right business model.
Network management	The network was not led by a neutral network orchestrator focusing on the common interests. So far, the partners could not agree on a formal governance model and a collective culture was lacking due to weak shared goals.

Value creation

On the one hand the Calypto network aimed to develop an environmentally friendly product for Van Beuningen and an improved and secured supply for Natures. More specifically, for Van Beuningen, Calypto results in less health dangers for employees (and thus less costs), because it is not toxic in contrast to current thinners. For Natures, Calypto was a potential way to lower and stabilize their costs of goods sold, because Calypto prices were more stable than the fluctuating prices of tung oil. At the time of analysis, no final end product had been created yet. However, Calypto was listed in the top 50 of most potential high tech companies by a well-known Dutch magazine. To create value in the Calypto network optimization of the value chain is critical. Growing the seeds, extracting the oil, treating the oil and then ship it to customers is a lengthy and costly process. Only by optimizing each part of the value chain, synergies can be created to reduce costs. In addition new partners joined the network while others left. CHEMCO left because Calypto was commercially not interesting anymore for them. However, there are signals indicating that other partners still believe in the potential of Calypto. The project had received venture capital from two public organizations.

Value distribution

Value distribution remained a difficult issue because parties found it very hard to agree on the right business model. The main reason for this difficulty was that parties had mixed interests. For some parties, there was a clear long term benefit, while for others there was not a very strong motivation to stay committed. WIB wanted to license the Calypto product via the incubator of the WUR. The French seed sowing company (Biopag) wanted to learn about the production of Calypto and was interested in gaining revenues by renting production sites. Crystallion sought a fixed amount per kilo for extraction of Calypto oil. Natures wanted an ingredient of natural paints that is more stable in terms of cost prices than tung oil. CHEMCO wanted to use Calypto in its products to sell it to Van Beuningen. R&B was interested in income by conducting scientific research. McBain wanted to earn its investment back and future dividends from the revenue of Calypto. In addition, if this governance chain model would work, McBain could sell this model to other companies or networks as well. Thus, this mix in interests

made it difficult to create value at a network level which could be distributed in such a way that all members would be satisfied.

Network Management

McBain attempted to act as a network orchestrator. McBain had also invested financial commitments into the Calypto project. This was a clear incentive for this party to make this cluster a success. However, designing the right governance structure remained difficult, also because there was no neutral network orchestrator who tried to focus on common interests. Therefore, an independent organization, TU Eindhoven, was asked to advice on the right governance structure. There was much attention to the network design phase of the cluster. Different types of designs were evaluated with the cluster members at the beginning of the cooperation to determine the fit with the interests of each partner. The role of the TU Eindhoven ended after several months in the set up phase, because no funding could be realized to continue their support.

Formal governance is still in the process of development; a clear business model was yet to be designed and thus formal contracts with rules of costs/profit divisions and value distribution were not arranged yet (which could also be possible because partners have never been working together before). Social governance was not very strong. A strong collective culture was lacking, due to the gap in interests. Some partners invested a lot of money and were determined to realize a return on investment. For other members, there were plenty of alternatives and thus low switching costs. This affected the commitment of some of the partners. For example, Biopag has other crops which they could harvest. Their dependence on Calypto was not that high. In contrast, WIB had high sunk costs (500.000 Euro), thus motivating the firm to make the cluster a success.

Summarized, the main difficulty for the Calypto case is parties could not agree on the right business model and value distribution model. Parties differed in interests; for some, there was a common interest, for others, there only was a transaction based benefit.

3.5 Case Mussel harvesting⁴

Introduction

Clustered hanging mussels have grown into a profitable business during the last two decades. These specific types of mussels grow on ropes, which are vertically placed in the water. To harvest mussels, the ropes are pulled out of the water and the mussels are stripped of the ropes. However, this technique leads to a vast amount of mediocre quality mussels. Moreover, concerns about environmental sustainability have fostered governmental regulation setting limits for mussel breeders. At the same time, the demand

⁴ Based on a case-study of De Rochemont, De Man and Van de Veen (2007)

for mussels is still rising in Europe. Hence, a mussel breeder, a machine producer, an aquaculture consultant, a plastics company and a design company, all active in different parts of the value chain as shown in figure 8, started to cooperate on a harvesting machine with a new floating technique. This machine could be sold to the mussel breeder in the network and possibly to other mussel breeders outside the network. Instead of vertically ropes, a cage was build consisting of several interconnected ropes. This would decrease the amount of labor required to collect the mussel shelves and would lead to a higher quality mussel.

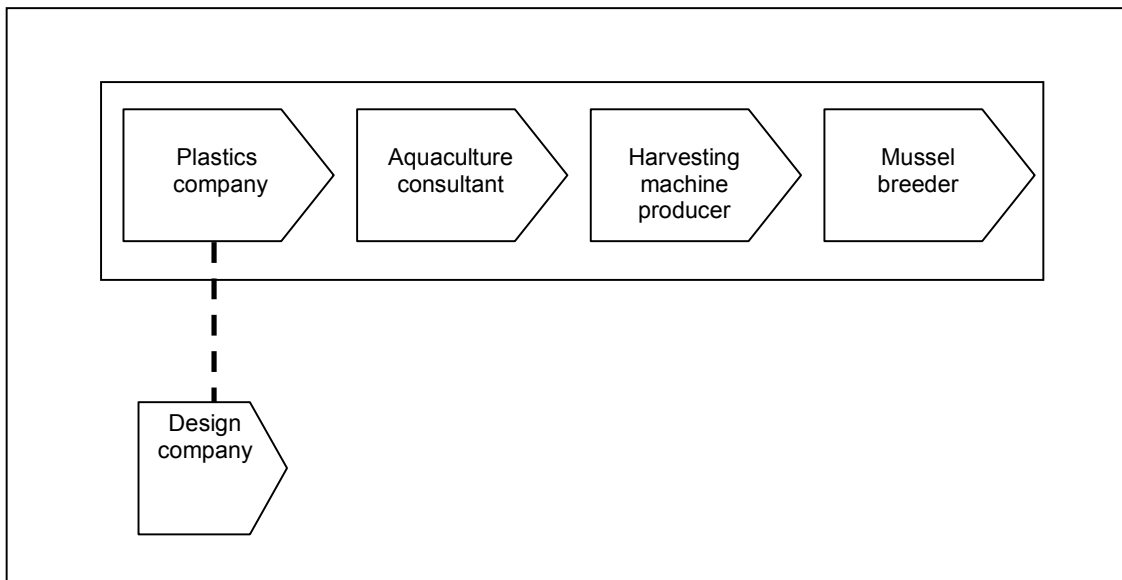


Figure 8: The value chain of the mussel harvesting network.

An overview of the case is given in the table 5 which is explained below.

Table 5: Overview of the Mussel Case

Open Innovation element	Description
Value creation	Development of a new mussel harvesting machine leading to increased harvest productivity and high-quality mussels.
Value distribution	The plan was that for each mussel harvesting machine sold, each party would deliver components thus increasing the members' revenue.
Network management	There was a lack of formal governance leading to conflict but a strong reliance on social governance due to geographical embeddedness.

Value creation

The aim of the network was to develop a new harvesting machine in order to make the harvesting process less labor intensive and to increase the quality of the mussel.

Developing a new harvesting machine requires different kind of competences and financial investments. Each member had a specific competence contributing to the cooperation. By combining different kind of competences, the five partners were able to create a successful prototype of a new mussel harvesting machine.

Value distribution

The new harvesting machine led for the mussel breeder to increased profits by a less labor intensive process and high-quality mussels. The other members would receive an increase in revenue for each harvesting machine sold to other mussel breeders outside the network. However, some difficulties existed about the value distribution. The mussel breeder was interested in the new harvesting machine at lowest cost, while the other members wanted to maximize their revenues.

Network management

Leadership in this network was decentralized. There was no formal board. Leadership and decision making evolved organically. The most dominant actors were the machine producer (main supplier) and the mussel harvester (client). Within the network, Syntens⁵ participated in the role of counselor. Syntens advised the group to attract a consultant with specific expertise of aquaculture. By adding such expertise, it would improve the reputation of the cluster towards other stakeholders, such as the Ministry of Agriculture and the Province of Zeeland.

During the collaboration a difficulty raised. The plastics company contacted a company, specialized in drawing designs, to make a graphic design of the machine. No formal contract was made between the plastics company and the design company. After a few months, a competitor of the plastic company used the same design for plastic floaters. So, the plastic company concluded that someone had stolen the idea and passed it to a competitor. Although, the plastics company did not attend meetings anymore, the other partners were not aware of the distrust of their partner. Syntens, a neutral third party, decided to evaluate the cooperation. Using a network management tool developed by Eindhoven University of Technology (TU/e), Syntens discovered that the plastics company felt betrayed and therefore suspicious towards his cluster partners. The plastics company did not trust the partners anymore. Syntens discussed the outcomes of the scan with the other partners. Hereafter, the machine producer and the mussel harvester decided to alter the structure of the cooperation. The plastics company left the network and the cooperation between the initial members continued, but more in a bilateral way.

As the example above shows, the network was characterized by a lack of formal governance resulting in a conflict with the plastics company. The partners did not make use of formal contracts to safeguard a proper follow up of agreements. Social governance

⁵ Syntens, an innovation network for entrepreneurs, stimulates and advises entrepreneurs of small and medium companies participating in innovation projects.

was the main governance mechanism in this network. Agreements were based on trust, goodwill and commitment. This form of governance is deeply rooted in this specific industry. All cluster partners came from the same geographical area (Zeeland) and were active within the mussel industry with the exception of the plastics company.

Finally, knowledge management was not an issue. During the experiments to test the floating capacity of the prototypes, the results were recorded by the consultant part of the cluster. These results were discussed in the meeting and mailed to each member.

Hence, network management was fairly passive in this case. Formal governance was lacking and governance was mainly based on social governance, driven by geographical and cultural embeddedness of most of the members.

4. Conclusions and Recommendations

As argued at the beginning of this report, the Dutch agri-food sector has to innovate to strengthen its competitive position. An important type of innovation is by cooperating with others in the development and commercialization of new products and technologies, called 'open innovation'. Here the aim of this research paper has been to investigate whether the Dutch agri-food sector is currently practicing open innovation or not and on which aspects these open innovation practices can be improved taking a network perspective. To answer this research question, a theoretical framework was used to analyze open innovation in the agri-food sector. Key elements in this framework are value creation, value distribution and network management. Based on these elements five cases were analyzed as summarized in table 6 below. In this section we will first discuss key findings of the cases and consequently answer the research question. Finally, recommendations for policy and suggestions for further research are described.

4.1 Conclusions

In most of the cases, the network members aim to increase their competitive position by differentiating themselves from pure 'low cost' (foreign) competitors and offering high quality products for the targeted customers. Innovation-based value creation for a targeted customer group is at the center of open innovation. For example, in the Prominent case, after German customers blocked the Dutch tomato, growers started to collaborate and successfully improved the quality of the Dutch tomato and created a premium. This, in contradiction to the technology driven network Calypto, in which scientists at the WUR University discovered the potential of the Calypto seeds for paint purposes. While it still remains unclear if Calypto becomes successful, it illustrates that pure technology driven networks can prove to be difficult to organize.

To develop high quality products, these firms collaborate in innovation-based inter-organizational networks. Product innovation requires new insights and knowledge which is often not available within one company. Moreover, creating high quality products through a stand-alone strategy of individual firms is a costly and highly risky process. Innovation-based networks enable firms to achieve the required economies of scale and scope in R&D. By collaborating, the individual members achieved higher benefits than by going alone. As shown in the cases, members make use of the knowledge (or product) developed at the network level and apply it in their own firms. In most of the cases, the history of geographical and social embeddedness in the Dutch agri-food sector has been a trigger for these networks. For generations, farmers in the Westland have shown pride in sharing knowledge and collectively facing problems.

Within a network there is usually a strong tension between value creation on the one side and value capturing on the other side. Firms have to cooperate to create a maximum of value for the targeted customers, but at the same time each of them want to appropriate as much value as possible. Cooperation may fail if the tension is too strong. To deal with these tensions, network management is critical to the success of the collaboration.

Table 6: Overview of the Five Case-Studies

Open Innovation Elements	Prominent	Decorum	TOPIGS	Calypto	Mussel harvesting
Value creation	Creation of high quality tomatoes	Creation of a quality brand for potted plants.	Maintaining and improving genetic quality of pigs by developing and exploiting new technologies.	On the one hand for Van Beuningen, Calypto was an environmentally friendly product resulting into less health risks and costs for employees. On the other hand for Natures, Calypto was used as a substitute for tung oil resulting in an improved and secured and less costly supply for paint.	Development of a new mussel harvesting machine leading to increased harvest productivity and high-quality mussels.
Value distribution	Higher profits for its members by increased sales and purchasing power.	All members (financially) profit from the quality brand name by strengthening the market orientation of the associated growers.	Premium price for farmers against slaughterhouses.	Value distribution remained difficult because parties found it very hard to agree on the right business model.	The plan was that for each mussel harvesting machine sold, each party would deliver components thus increasing members' revenue.
Network management	Managed by a central professional organization using a mix of both formal governance (partner selection rules, financial commitments etc.) and high levels of trust based on a collaborative culture. Knowledge has been diffused via (obligatory) working groups.	Managed by a central professional organization using a mix of both formal governance and high levels of trust based on a collaborative culture. Knowledge management by letters, meetings and knowledge interpreters.	Network organization is based on a franchise system. Less attention paid to formal governance but clear rules on value distribution. Strong informal governance by professional pride and a network identity. Strong management of tacit and explicit knowledge from TOPIGS.	The network was not led by a neutral network orchestrator focusing on the common interests. So far, the partners could not agree on a formal governance model and a collective culture was lacking due to weak shared goals	There was a lack of formal governance leading to conflict but a strong reliance on social governance due to geographical embeddedness.

As shown in most of cases, a professional network organization led by a network orchestrator or coordinating unit is important. Leadership is important in making collective decisions and in disciplining constellation members that wander away from the collective goals. For example, differences in goals and interests among the members of Calypto led to difficulties. To manage a network effectively a mix of both formal and informal governance mechanisms is required. As shown in the cases formal governance (safeguard mechanisms) consists of partner selection rules to ensure the right membership; financial investments to ensure commitment of a member and operational control to periodically test the quality of the product. Of almost all of the cases analyzed, rules concerning value distribution were made. In the Mussel case, the lack of contracts regarding the usage and or property of ideas and tacit knowledge led to major conflict, thus endangering the network success. However, formal governance alone is not sufficient. Next to formal governance, social governance is critical to effective open innovation in networks. When social governance is lacking, the network can become unstable. For instance, in the Mussel case, a lack of trust and commitment led to the withdrawal of one of the members. In Prominent and Decorum, collaboration and knowledge sharing among the members has been facilitated by strong social governance. This strong social governance was the result of a collaborative culture determined by local habits and proximity of the different partners. Due to its long tradition of collaboration and knowledge sharing, few problems of free-riding or lack of motivation to share knowledge have been reported. The regional concentration of this sector has greatly enhanced the effectiveness of collaboration and knowledge sharing. To stimulate knowledge sharing and improve the absorptive capacity, working groups and company visits are used. By doing so, members learn faster and therefore the innovative performance of the network may increase.

Based on the case studies, the Dutch agri-food sector demonstrates that it contains several valuable best practices of firms which successfully participate in open innovation networks. According to the literature, managing multi-partner alliances is a difficult task (Gomes-Casseres, 1996; Das and Teng, 2002; Lavie et al., 2007) with failure rates of 50% to 75% (De Rochemont et al., 2007). It is therefore encouraging that the Dutch agri-food industry is able to successfully implement open innovation in networks. However, these networks have been spurred by major threats to the competitiveness of the firms or farmers. These networks are mainly ad hoc reactions of the firms to changes in the environment. For example in Prominent, German customers blocked the Dutch tomato, while EU regulations and ecological factors were the cause for network formation in the Mussel case. So far, the agri-food sector has not developed a set of clear targets to improve the competitiveness of several branches within the agri-food. Next to this, most of the cases show that cooperation among the different partners along the value chain has not been optimized. For example within the Dutch pork chain there are broadly three distinct phases. The first is from breeder to pig farms, the second is the slaughterhouse and the third retail/processing. Each of these three steps is relatively isolated from the other and tends to optimize its own operations, not the chain. In general the individual

breeder is so far removed from the final market that translating market trends into the product is difficult. There is no direct contact with retailers. For this reason it remains unclear whether there are other opportunities for innovation and optimization across the chain. As a consequence each link in the chain now aims to optimize its own production process, rather than thinking about a way to improve the effectiveness of the entire chain. In addition, strong social ties, on the one side, form important drivers for open innovation, but on the other side, these can lead to lock-in effects and group-thinking. For example in Prominent, discriminating rules for membership may lead to inflexibility of the member firms. Network members may be locked out from other networks or resources. Other firms outside the network may have or access new ideas or technologies important to their future. Hundley et al. (1998) found that cartel-like properties of Japanese business alliances (Keiretsus) actually reduce competitiveness by creating a lock-in effect. In addition, Rowley et al. (2000) illustrate that firms that are locked in innovation networks have lower firm performance compared to firms that have a greater diversity of partners. Moreover, focusing on the Westland area may lead to group-thinking. For a vital network it is important to set up links with knowledge sources outside the sector. Burt (1982) showed that industries that occupy "structural holes" enjoy greater returns by being able to appropriate a larger share of the resources that flow through them. As a result, agri-food firms should learn more from cross-industry networking. Hence, the sector should not restrict its cooperative networks to horizontal networks among co-opetitors (e.g. Prominent) or vertical networks that bring together partners over the value chain (e.g. Mussel harvesting case). Creating major improvements in competitiveness will require ready cross-industry networks linking the agri-food industry with industrial partners that have never had any relation with the agri-food sector. Examples are the pharmaceutical industry, biotech, chemical industry etc. In case these networks develop to realize the economic potential of new technologies, agri-food firms will also have to learn how to cooperate (in a structured way) with resource labs, universities etc. In the cases we studied, cooperation with knowledge institutes (such as TNO, universities) was minimal. According to Peutz (2007), a major bottleneck is that Dutch SMEs are not able to identify a knowledge institute to collaborate with. Exceptions are Calypto, which originated from research departments from the WUR University and TOPIGS that collaborates with a number of universities and research institutes. Universities offer a valuable source of new R&D (Chesbrough et al., 2006). Hence, cooperation with universities might facilitate the innovative output of innovation networks even more. As a result, we expect that when these open innovation networks develop, the organization of the networks also needs to be professionalized. To successfully implement open innovation networks, learning has to take place over the different networks. Lessons learned about collaboration in inter-organizational networks should be collected and diffused within the agri-food sector to professionalize and improve learning about how to innovate in networks.

4.2 Recommendations

Finally, we provide a number of recommendations that may help professionalisation of open innovation within the Dutch agri-food sector:

- Create a benchmark study to investigate the state-of-the-art of open innovation for different branches within the agri-food sector. Moreover to create a better understanding of the level of open innovation in the agri-food sector, one should also benchmark the agri-food sector with different types of industry excelling in open innovation e.g. pharmaceutical industry, biopharma etc. Hence, branch specific and agri-food sector specific weaknesses and opportunities can be identified and consequently targeted by a more focused use of policy instruments. While other analyses (e.g. Vrolijk et al., 2007) of the agri-food industry have focused on the Porter's Diamond approach, we believe that this method does not give enough attention to the role of other actors in the innovation system: universities, brokers, government and other cross-industry partners. Porter's approach should be adjusted for the role of the so-called complementors (Brandenburger and Nalebuff, 1997) and that of ecosystems that feed the dynamics of networks (Iansiti and Lewin, 2004). It remains for example unclear how third parties (such as knowledge institutions, incubators, or other public parties) contribute to innovation in Dutch agri-food networks. Further research is required to get a better understanding and to assess bottlenecks in technology transfer between these public parties and agri-food firms.
- Professionalize the organization of open innovation networks by collecting and diffusing lessons learnt within the agri-food sector. A network needs to be managed. It is important that this activity is carried out professional, structural and pro active. Professionalization of networks is related to the establishment of very specialized organizations or intermediaries that have a unique role to play in the organization of open innovation within networks. For example Syntens⁶ or other institutes can play an important role as a neutral orchestrator or coordinating unit of networks and in advising networks. The W.U.R. has already experimented in financially supporting innovation networks of agro-food firms in which firms are also given neutral network management ("Netwerken in de Veehouderij"). A key success factor in this project is the presence of a neutral third party network orchestrator (Wielinga et al., 2007). A key role of the network orchestrator or coordinator is to monitor the level of trust and commitment between partners and to 'intervene' if these factors are decreasing.
- More practically speaking, to manage these open innovation networks management tools should be used. Checklist or scorecards help innovation networks to be aware of most common pitfalls. Syntens and the Eindhoven University of Technology have developed "the Cluster Radar" (De Rochemont et al., 2007), an open innovation tool that gives insight into the strengths and

⁶ Syntens, an innovation network for entrepreneurs, stimulates and advises entrepreneurs of small and medium companies participating in innovation projects.

weaknesses of networks. As shown in the Mussel Harvesting case, periodically monitoring performance networks can improve the longevity of networks. Moreover, workshops and trainings can be organized in which open innovation practitioners can share experiences. To optimally learn, invite experts of other types of industry who have more experience with open innovation e.g. IT, telecom etc.

- A question remains: How sustainable are the Dutch domestic open innovation networks? If other countries are also growing economically, they could also form (local) innovation networks which could undermine the competitiveness of the Dutch networks. The question is how to realize a quantum-leap in inter-organizational networks, professionalizing them and becoming faster through them. More research is needed to analyze best practices abroad. A limitation of this study is that most of the networks examined were limited to domestic networks (with exception of TOPIGS). Recently, farmers have experienced an increase in foreign demand (Vrolijk et al., 2007). Hence, as the origin of the customers moves abroad, new value chains are emerging. For instance, in the Mussel case, more recently, the mussel harvester has exported the mussel harvesting technology to China. As such, innovation in networks becomes a more international issue. Further research using our framework could assess the effectiveness of international innovation networks.

References

- Bamford, J., Gomes-Casseres, B. and Robinson, M. (2003) *Mastering alliance strategy: A comprehensive guide to design management and organization*, Jossey-Bass, San Francisco: CA.
- Brandenburger, A.M. and Nalebuff, B.J. (1997) *Co-optition*, Double Day: New York.
- Burt, R.S. (1982) *Toward a Structural Theory of Action: Network Models of Social Structure, Perception, and Action*, Academic Press.
- Chesbrough, H. (2003) *Open innovation: The new imperative for creating and profiting from technology*, Harvard Business School Press: Harvard, MA.
- Chesbrough, H., Vanhaverbeke, W. and West, J. eds., (2006) *Open innovation: Researching a new paradigm*, Oxford University Press: Oxford.
- Cohen, W.M. and Levinthal, D.A. (1990) Absorptive capacity: A new perspective on learning and innovation, *Administrative Science Quarterly*, 35.
- Das, T.K. and Teng, B.S. (1998) Between trust and control: Developing confidence in partner cooperation in alliances, *Academy of Management Review*, 23, pp. 491-512.
- Das, T.k. and Teng, B-S. (2002) Alliance Constellations: A social exchange perspective, *Academy of Management Review*, 27, 3.
- Doz, Y.L. and Hamel, G. (1998) *Alliance Advantage: The art of creating value through partnering*, Boston: Harvard Business School Press.
- Duysters, G.M., Gilsing, V.A. and Bijman, J. (2006) *Innovation in agriculture and food: The paradox of many co-operatives, yet few collaborations*, an essay commissioned by TransForum.
- Gomes-Casseres, B. (1996) *The alliance revolution: The new shape of business rivalry*, Cambridge, MA: Harvard University Press.
- Gomes-Casseres, B. (2003) *Constellation strategy: Managing alliance groups*, Ivey Business Journal Online. London: May/June.
- Gulati, R., Nohria, N. and Zaheer, A. (2000) Strategic Networks, *Strategic Management Journal*, 21, pp. 203-215.
- Hundley, G. and Jacobson, C.K. (1998) The effects of the keiretsu on the export performance of Japanese companies: help or hindrance? *Strategic Management Journal*, 19(10), pp. 927.
- Iansiti, M. and Levien, R. (2004) *The keystone advantage: What the new dynamics of business ecosystems mean for strategy, innovation and sustainability*, Harvard Business School Press, Boston, MA.
- Jong, de, J.P.J., Vanhaverbeke, W., Van de Vrande, V. and De Rochemont, M. (2007) *Open Innovation in SMEs: Trends, motives and management challenges*. Conference paper.
- Koza, M. and Lewin, A. (2000) Managing partnerships and strategic alliances: raising the odds of success, *European Management Journal*, 200, 18(2), pp. 146-151.

- Lavie, D., Lechner, C. and Singh, H. (2007) The performance implications of timing of entry and involvement in multipartner alliances, *The Academy of Management Journal*, 50(3), pp.578.
- Lui, S.S. and Ngo, H. (2004) The role of trust and contractual safeguards on cooperation in non-equity alliances, *Journal of Management*, 30(4), 471-485
- Macneil, (1980) *The new social contract*, New Haven and London: Yale University.
- Man, de, A. P. (2006) *Alliantiebesturing: samenwerking als precisieinstrument*, Van Gorcum.
- Man, de, A.P. (eds.) (2007) (forthcoming), *Knowledge management and innovation in networks*, Edward Elgar: Aldershot UK.
- Parkhe, A. (1998) Understanding trust in international alliances, *Journal of World Business*, 33(3), pp. 219-240.
- Parkhe, A. (1993) Strategic alliances structuring: A game theoretical and transaction cost examination of interfirm cooperation, *Academy of Management Journal*, 36(4), pp. 794-829.
- Park, S.H. and Russo, M. (1996) When competition eclipses cooperation: an event history analysis of joint venture failure, *Management Science*, 12(6), pp. 875-890.
- Poppo, L. and Zenger, T. (2002) Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23, pp. 707-725.
- Peutz, M. (2007) *Ondernemers op Onderzoek*, Syntens.
- Rabobank, (2006):
<http://www.rabobankgroep.nl/download/KrachtWestland06.pdf>
- Reuer, J. and Ariño, A. (2002) Contractual renegotiations in strategic alliances, *Journal of Management*, 28(1), pp. 47-68.
- Rochemont, de, M.H., Man, de, A.P. and Van de Veen, M. (2007) De Cluster Radar: diagnose van samenwerking in het MKB, *Holland Management Review*, (July/Aug).
- Rowley, T., Behrens, D., Krackhardt, D. (2000) Redundant Governance Structures: An Analysis of Structural and Relational Embeddedness in the Steel, *Strategic Management Journal*, 21, pp. 369–386.
- Vanhaverbeke, W. (2006) The inter-organizational context of open innovation, In: Chesbrough, H., Vanhaverbeke, W. and West, J. eds., (2006) *Open innovation: Researching a new paradigm*, Oxford University Press: Oxford.
- Vanhaverbeke, W. and Cloudt, (2006) Open innovation in value network, In: Chesbrough, H., Vanhaverbeke, W. and West, J. eds., (2006) *Open innovation: Researching a new paradigm*, Oxford University Press: Oxford.
- Vrolijk, H. and Jacobs, D. (2007) *De economische kracht van agrofood in Nederland*, Rijksuniversiteit Groningen.
- Wielinga, E., Zaalmink, W., Bergevoet, R., Geerling-Eif, F., Holster, H., Hoogerwerf, and Vrolijk, L.M. (2007) *Netwerken in de Veehouderij*, Wageningen Universiteit.

