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Chain Networks as a Leverage for Innovation Capacity: The Case of Food SMEs

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ABSTRACT

Nowadays, innovation is no longer limited to the individual firm but involves increasingly the chain network in which the firm is embedded. The chain network is considered as the place where the internal and external resources of a firm are combined and transformed, leading to innovation capacity. In the increasingly globalizing market, innovation is an important strategic tool for small and medium sized enterprises (SMEs) to achieve competitive advantage. However, SMEs are often confronted with barriers for developing and introducing innovations, such as the lack of economies of scale.

Our paper investigates how the chain network is contributing to the enhancement of the innovation capacity and which chain network characteristics are crucial in this process. In contrast to previous studies at chain network level, in our research specific chain networks are investigated and compared to each other. Hence, data collection took place at different chain network levels, being the supplier, the food manufacturer and the customer, working together and consequently belonging to one specific and unique chain network.

The analysis of innovation capacity at the chain network level is realized by means of cluster analysis. This results in a three-cluster solution dividing the sample into Non-innovator chain networks, Customer-driven innovator chain networks and food manufacturer-supplier-driven innovator chain networks. Next, the influence of the chain network on the innovation capacity is examined. Thereby, the three achieved clusters differ significantly related to certain chain network characteristics. The following characteristics form an important leverage for the innovation capacity: firm size, profitability and business growth of the chain network members, as well as higher dependency, and lower levels of integration, rewarding power, social satisfaction and collaboration. The distinction of Customer-driven and food manufacturer-supplier-driven innovator chain networks reveals that the involvement of the chain network partners for the enhancement of the innovation capacity is a very important aspect. In future research, the degree of complexity of the studied system should gradually be increased, namely from a chain network of three members to more complex chain networks.

Keywords: innovation capacity, chain network, SMEs, food sector.

1 Introduction

The place of innovation is not the single firm anymore but increasingly the chain network the firm is embedded in (Omta, 2002; Pittaway et al., 2004). Although ideas for innovations are still coming from within firms, the development phase is often managed jointly by the chain network members (Pittaway et al., 2004). A chain network consists of at least three members: the food manufacturer, the supplier of the food manufacturer and the customer of the food manufacturer (Mentzer et al., 2001). These members are involved in all upstream and downstream flows of products, services, finances, and information in a vertical chain network (Van der Vorst, 2000).

In the food sector, chain networks comprehend more than 99% of small and medium sized enterprises (SMEs), i.e. enterprises employing less than 250 people (CIAA, 2008). In particular for SMEs, innovation is an important strategic tool to achieve competitive advantage in the increasingly globalised market (Murphy, 2002; Avermaete et al., 2004; Gellynck et al., 2007). Innovation can be defined as an ongoing process of learning, searching and exploring, resulting in new products, new techniques, new forms of organisation and new markets (Lundvall, 1995) which are new to the firm and to the industry ranging from incremental to radical innovations.

At firm level the introduction of innovations is often hampered by a set of specific problems. On the one hand, SMEs can encounter limited internal resources due to a lack of managerial competencies and experiences and a lack of strategic vision (Avermaete et al., 2003; O'Regan et al., 2006; Scozzi et al., 2005). On the other hand, external resources are often difficult to allocate and coordinate in order to collect relevant information and knowledge (Maravelakis et al., 2006; O'Regan et al., 2006; Scozzi et al., 2005). Therefore, over time, the food industry developed strategies that are not exclusively R&D based but rather involve the interaction of different actors (Avermaete & Viaene, 2002; Weaver, 2008). Hence, problems of introducing innovations at firm level are considered to be overcome by networking within the chain network; thus combining the complementary capacities and technologies of the different chain network members (Pittaway et al., 2004).

Previous studies at chain network level do not explore the link between the members of a chain network at quantitative level (e.g. Hardman et al., 2002; Pannekoek et al., 2005; Aramyan et al., 2007; Fischer et al., 2008). In contrast, our research investigates multiple specific chain networks exploring the link between their members on a large scale. In particular, our paper aims at investigating which characteristics of the chain network provide leverage to the innovation capacity of the chain networks of SMEs.

Our paper is structured as follow. In the subsequent section our conceptual framework is presented. In the third section, the methodology of our research is described followed by a discussion of the research results. Finally, conclusions are drawn.

2 Conceptual framework

Innovation capacity is the capacity to innovate, also in the future, along the whole innovation process (Gellynck et al., 2007). The innovation process is a continuous process characterised by three steps: efforts, activities and results. Efforts are all resources, such as human and financial resources, a firm is investing in innovation activities, such as R&D, training and study tours, and possible leading to innovations. Results are the effects of these activities on tangible (e.g. growth of market share, profit) as well as less tangible aspects (e.g. firm stability, efficiency, and reputation) (Gellynck et al., 2006).

Since the innovation capacity of a firm depends on the access to information (Avermaete, et al. 2004), internal and external resources to gain access to the information are an important factor for achieving enhanced innovation capacity and hence, sustainable competitive advantage. Internal resources contain a large number of firm characteristics, such as the R&D structure, qualified staff, experience of the manager, the openness toward new ideas, financial structure, and firm's size (Grünert et al., 1997; Diederen et al., 2000; Fey and Birkinshaw, 2005). External resources belong to the firm's strategic environment and include the potential of business-to-business relationships, available infrastructure for collaboration and networking, and access to support from research providers and government (Ussman et al., 1999; Avermaete and Viaene, 2002; Scozzi et al., 2005).

Internal resources are difficult to develop when they are hindered by limited possibilities to realise economies of scale. Hence, SMEs need an environment improving the involvement of both suppliers and customers into the innovation process (Ussman et al., 1999). This is supported by the fact that the place of innovation is no longer the individual firm but increasingly the chain network in which the firm is embedded (Powell et al., 1996; Omta, 2002; Pittaway et al., 2004). An improved integration of all members in the chain network will support the innovation capacity and reduce the risk of implementing innovation, e.g. by joint cost management (Avermaete and Viaene, 2002; Omta, 2002; Pittaway et al., 2004; Weaver, 2008).

Consequently, the chain network plays an important role for SMEs in the process of developing innovation capacities (Figure 1). The chain network is the place where the internal and external resources of a firm are combined and possibly transformed into innovation capacities (Gellynck et al., 2006). Through the optimal use of both internal and external resources in the chain network, a firm can become innovative and able to achieve sustainable competitive advantage (Lengnick-Hall, 1992; Cassiman and Veugelers, 2002). By using complementary capacities and technologies within the chain network, SMEs will be able to

overcome problems related to the implementation of innovations identified by many researchers (Lazzarini et al., 2001; Avermaete et al., 2003; Pittaway et al., 2004; Scozzi et al., 2005; Maravelakis et al., 2006; O'Regan et al., 2006).

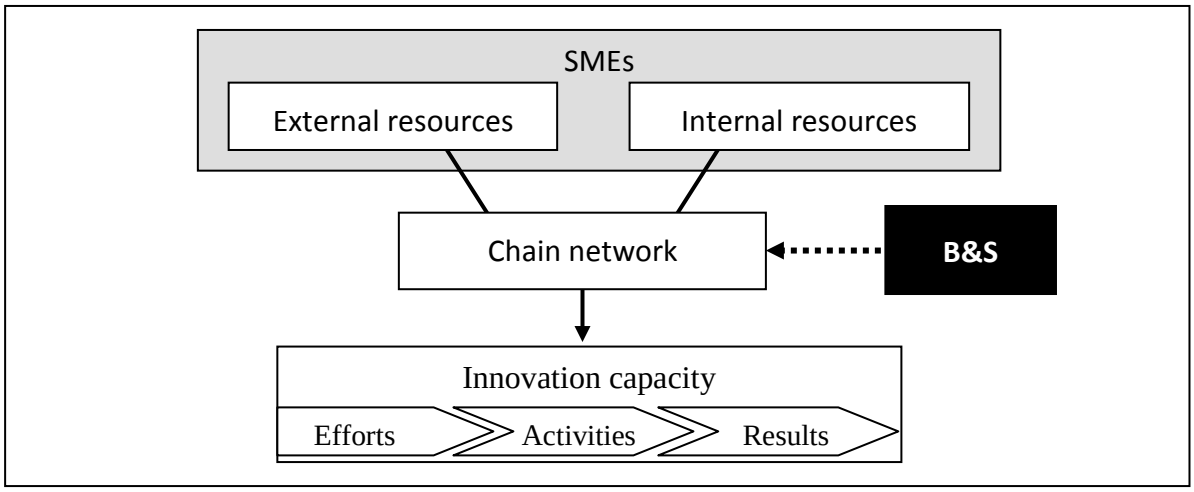

Figure 1. Conceptual framework for investigating bottlenecks and success factors (B&S) for achieving innovation capacity in traditional food chain networks, adapted from X. Gellynck, B. Vermeire, J. Viaene (2006).

However, it is not always possible to optimally use the resources in the chain network, because the chain network relationships are influenced by several success factors and bottlenecks. Most researchers see trust and collaboration as the most important success factors for innovation (Omta, 2002; Ritter and Gemünden, 2003; Pittaway et al., 2004; Roy et al., 2004; Pannekoek et al., 2005; Gellynck et al., 2007; Grunert et al., 2008). Trust can be described as the extent to which one partner cares for the other partner's business interests (Roy et al., 2004). Hence, it is affecting the character and extent of interactions in a relationship. Collaboration is the way how chain network partners work actively together to achieve common objectives by sharing information, knowledge, profits, and risks and benefits (Omta, 2002; Gruat La Forme et al., 2007). Collaboration offers new opportunities for relationships, links or markets and allow access to new or complementary competencies and technologies within the chain network (Lowndes and Skelcher, 1998; Lazzarini et al., 2001; Pittaway et al., 2004). Thus, SMEs are more innovative when they are able to join and manage chain network activities (Avermaete and Viaene, 2002; Gellynck et al., 2006).

Reputation is also acknowledged as an important prerequisite for successful innovation, since it helps to foster initial trust and to solve competition and coordination problems in a business relationship (Omta, 2002; Roy et al., 2004; Arend and Wisner, 2005). Further, satisfaction is another important condition for the improvement of a business relationship (Bruce and Daly, 2003). Since satisfaction derives from all aspects of a business relationship, both economic and social aspects of this relationship should be considered (Batt, 2004). Economic satisfaction refers to the situation where a business partner is satisfied with the economic rewards resulting from the business relationship. Social satisfaction is the satisfaction with non-economic aspects of the relationship, including fulfilling, gratifying and easy accessible information exchange because the business partners believe that they are concerned, respectful and willing to exchange ideas with each other (Batt, 2004).

Power and dependence are closely related to each other and are achieved when one chain network member holds critical resources important for the innovation process of another chain network member (Omta, 2002; Batt, 2004). The more power a chain network partner achieves over another chain network partner the greater the dependency will be (Batt, 2004). Though, power and dependency do not have necessarily a negative connotation, but can also be a driver for improved networking and better performance (Omta et al., 2001; Arend and Wisner, 2005). Hence, a distinction can be made between rewarding and punishing power, whereby rewarding power describes a business relationship which is based on teamwork and common interests (Jonsson and Zineldin, 2003).

However, the chain network relationship can be negatively affected by conflict of interests. These conflicts are mainly not about costs and benefits of the outcome of the chain network relationship, but rather about disagreements, different expectations, or distrust (Batterink et al., 2008). Hence, conflicts

can form a barrier to a successful innovation process.

Finally, integration is a form of governance structure, ranging from spot market to vertical integration. The way chain networks are governed is having an important influence on their contribution to the success of innovation (Coles et al., 2003) and each chain network relationship needs to figure out the appropriate governance structure (Pittaway et al., 2004).

3 Methodology

3.1 Research method and sample description

Quantitative data were collected by means of 270 individual interviews with companies of the food sector. These companies were drawn from triplets (supplier, food manufacturer and customer) belonging to 90 chain networks as presented in Annex 1. In order to assure the identification of the three partners of each specific chain network, first the food manufacturer was identified and interviewed. During the interview, each food manufacturer was asked to identify his/her main supplier and customer. Subsequently, this supplier and customer were interviewed.

Data collection took place between December 2007 and June 2008, across three European countries (Belgium, Hungary and Italy). Based on their socio-economic importance different food subsectors were selected in the three countries (Belgium: cheese and beer, Hungary: white pepper, dry sausage and bakery products, Italy: cheese and ham). Within our study traditional food products are taken as case, being defined according to four criteria: (1) the key production steps of a traditional food product must be performed in a certain area, which can be national, regional or local. (2) The traditional food product must be authentic in its recipe (mix of ingredients), origin of raw material, and/or production process. Further, (3) the traditional food product must have been commercially available for at least 50 years and (4) it must be part of the gastronomic heritage.

The data were analyzed using SPSS 15.0. Innovation capacity was assessed at company level of all three chain network members and aggregated to chain network level by the means of cluster analysis. Therefore, before the cluster analysis and based on sufficient Cronbach's Alpha, for each respondent the items of the four innovation capacity constructs were aggregated to a score for human efforts, financial efforts, innovation activities and innovation results. The items for each construct are described below and in Annex 2. Sufficient Cronbach's Alpha refer to values above 0.60, which indicates that the different items are useful to describe a construct and hence, aggregation is appropriate (Janssens et al., 2008). Subsequently, due to the different scales, the aggregated scores were standardized considering that scales must be in the same unit of measurement as a requirement for the conduction of cluster analysis. Standardization was done by means of Z-standardization so that the variables have a mean of zero and a variance of one (Janssens et al., 2008).

Based on the aggregated and standardized four scores for innovation capacity hierarchical clustering with Ward's method and squared Euclidean distance, followed by k-means cluster analysis were carried out. Cluster analysis was conducted to obtain groups of chain networks with similar innovation capacity. Subsequently One-Way ANOVA comparison of means (for interval-scaled variables) and cross-tabulation with Chi^2-statistics (for categorical-scaled variables) were used to profile the achieved clusters. Finally, multinomial logistic regression was used to identify significant differences between the clusters related to the characteristics of the chain network relationships. Logistic regression was used due to the categorical character of the dependent variable (Janssens et al., 2008, p.5), i.e. the achieved clusters, which cannot be ranked and are hence of nominal character. Furthermore, multinomial logistic regression needed to be preferred above binomial logistic regression because the dependent variable is composed of more than two categories (Garson, 2009). In multinomial logistic regression one category is taken as a reference to which the other categories are compared. In our case first the Non-innovator chain network cluster (reference) are compared to the two innovator chain network clusters, followed by a comparison of the two innovator chain network clusters with the Customer-driven innovator chain network cluster as the reference.

3.2 Measurement and scaling

Innovation capacity

For the measurement of innovation in SMEs it is less suitable to use indicators such as the number of patents, number of employees involved in R&D, or counts of incremental and radical innovations (Avermaete and Viaene, 2002; Maravelakis et al., 2006). In particular for SMEs in the food sector, which is sector of mainly low-tech industry where innovations seldom draw on R&D activities, other indicators for

measuring innovation must be applied such as human and financial efforts, new or improved products, processes, markets and organisational developments, as well as the contribution of these innovation activities to the business success (Gellynck et al., 2007).

Hence, in our approach innovation capacity is measured by exploring human and financial efforts, innovation activities and innovation results of food manufacturers, suppliers and customers. For human efforts, the respondents were asked how often (7-point frequency scale) the responsible person for research and development made an effort to improve his/her knowledge and skills, e.g. by courses and training or experimental trials. Further for financial efforts, the respondents were asked how structured they spent their financial resources for product, process, and organizational development as well as market research. Thus, whether they do not spent financial resources at all, whether they spent according to the necessity, but without being budgeted, whether they have a distinct budget on project base, or whether they have a distinct budget on yearly base (4-point scale). Subsequently, in relation to their innovation activities the respondents were asked whether or not they introduced any changes during the last three years related to product, market, or organizational innovation (binary scale yes/no). The statements have been selected based on a comprehensive literature review and preceding qualitative research (see Annex 2). For product innovation, following items were selected: improvement of packaging, quality and convenience of the traditional food product. Regarding market innovation the items entering new geographical markets and improving marketing activities for the traditional food product were used. Finally, organizational innovation comprises the items introduction of new management tools, improving management practices of research and development, and increasing participation in chain networks. Process innovation was not included as an statement for the innovation activity because traditional food producers consider this innovation activity as not or least suitable for their products (Gellynck and Kühne, 2008).

The same items were used for exploring the results of these innovation activities. The respondents had to indicate on a 7-point Likert-scale (from (1) completely disagree to (7) completely agree) the extent they agree with that the innovation activities applied contributed significantly to the success of their company. A 7-point Likert-scale was used in order to assess the perception of the contribution of the applied innovation activities to the business success. For SMEs it is often difficult to provide objective and clear figures related to their business success (Avermaete and Viaene, 2002).

Chain network characteristics

In order to measure chain network characteristics, suppliers, food manufacturers, and customers were asked to what extent they agree or disagree with statements about ten chain network related measures using a seven-point response scale ranging from completely disagree (1) to completely agree (7). The constructs used are 1) Trust, 2) economic satisfaction, 3) social satisfaction, 4) dependency, 5) non-coercive power, 6) coercive power, 7) reputation, 8) conflict, 9) collaboration, and 10) level of integration. Details about the statements for each construct are provided in Annex 3. Besides, other chain network characteristics, such as size, business growth and profitability are included as indicators.

The statements were presented to the food manufacturers and their specific suppliers and customers. The food manufacturers answered the statements related to their suppliers and customers and vice versa. The level of agreement of the food manufacturer e.g. on the trust statements related to the specific supplier, indicates the level of trust the food manufacturer has in the specific supplier. Consequently, it corresponds with a perceived level of trust the food manufacturer in its supplier. The same applies to the food manufacturer in relation to the customer, and to the supplier in relation to the food manufacturer as well as to the customer in relation to the food manufacturer.

A positive relationship is expected between innovation capacity and collaboration, trust, social and economical satisfaction, and rewarding power. Further, a negative relationship is assumed between innovation capacity and conflict, dependency and punishing power. For the level of integration, size, business growth and profitability no clear relationship can be assumed, since several researches showed different outcomes.

4 Results

4.1 Innovation capacity

The cluster analysis resulted in a three-cluster solution. The clusters are about equally sized and the factors related to innovation capacity are significantly distinguishing between the clusters (Table 1). The different chain networks could be grouped into clusters of “Non-innovator chain networks”, “Customer-driven innovator chain networks”, and “Food manufacturer(FM)-supplier-driven innovator chain

networks". Non-innovator chain networks achieved the lowest means on all factors of innovation capacity. In the Customer-driven innovator chain networks the customers achieved the highest mean values for the innovation capacity factors, while in the FM-supplier-driven innovator chain networks the respective chain network members achieved the highest mean values.

Regarding the different items of the four innovation capacity factors some interesting results are revealed. Among the items for human efforts self-study is most applied in all chain networks and participation in seminars is done least. However, overall the customer-driven innovator chain networks apply more human efforts than the FM-supplier-driven innovator chain networks. Of course the Non-innovator chain networks apply least human efforts as well as for any other innovation capacity factor. In relation to financial efforts all chain networks spend about equally resources, mainly according to a necessity without setting up a budget. Again, the Customer-driven innovator chain networks spend generally more financial resources than the FM-supplier-driven innovator chain networks do. Contrary, related to innovation activities and results, FM-supplier-driven innovator chain networks achieve equal or better innovation results with lower innovation activities than the Customer-driven innovator chain networks. Among the different innovation activities, 'improving the quality of the traditional food product' is the most applied.

Table 1
Innovation capacity of traditional food chain networks, cluster analysis (mean values) and ANOVA, n=90

	Cluster			
	1) Non-innovator chain networks	**2) Customer-driven innovator chain networks**	**3) FM-supplier-driven innovator chain networks**	**Sig.**
Nr of cases	35	21	34	
Human efforts FM	-0.60[a]	0.52[b]	**0.29[b]**	0.000
Financial efforts FM	-0.57[a]	0.67[c]	**0.17[b]**	0.000
Activities FM	-0.68[a]	0.72[c]	**0.25[b]**	0.000
Results FM	-0.55[a]	0.22[b]	**0.43[b]**	0.000
Human efforts S	-0.71[a]	0.60[b]	**0.36[b]**	0.000
Financial efforts S	-0.63[a]	0.08[b]	**0.59[c]**	0.000
Activities S	-0.66[a]	0.57[b]	**0.32[b]**	0.000
Results S	-0.62[a]	0.29[b]	**0.46[b]**	0.000
Human efforts C	-0.18[a]	**1.14[b]**	-0.51[a]	0.000
Financial efforts C	-0.31[a]	**1.27[b]**	-0.47[a]	0.000
Activities C	-0.17[a]	**0.93[b]**	-0.40[a]	0.000
Results C	-0.15[a]	**0.42[b]**	-0.11[a]	0.092

[a,b,c] Various superscripts indicate significant differences of group means in the post hoc Duncan test per factor ($p < 0.05$); FM: food manufacturer, S: supplier, C: customer

For the characterization of the achieved clusters, each cluster is evaluated by the socio-economical descriptors (Table 2). Related to country and product, specific differences were found between the clusters. The Non-innovator chain networks contain mainly Italian chain networks, while the Customer-driven innovator chain networks are mainly found in Belgium. Finally, the FM-supplier-driven innovator chain networks are mainly situated in Hungary. The Italian and Belgian cheese chain networks form the largest part of the Non-innovator chain networks. The Customer-driven innovator chain networks consist mainly of ham and Belgian cheese chain networks and the FM-supplier-driven innovator chain networks contain mainly dried, fermented sausages and beer chain networks. However, there is no reliable assurance of the differences between product categories.

Table 2
Socio-economical description of the different clusters, Frequencies based on Crosstab

Cluster		1) Non-innovator chain networks	2) Customer-driven innovator chain networks	3) FM-supplier-driven innovator chain networks	Total		Sig.
Size of cluster	**N**	35	21	34	90		
	%	38.9	23.3	37.8	100		
Socio-economic variables		%	%	%	%	N	**Chi²**
Country							0.082
Italy		**48.6**	28.6	20.6	33.3	30	
Hungary		22.9	28.6	**47.1**	33.3	30	
Belgium		28.6	**42.9**	32.4	33.3	30	
Total		100	100	100	100	90	
Type of product							0.001[#]
Dried fermented sausage		5.7	9.5	**20.6**	12.5	11	
Processed white pepper		0	4.8	11.8	5.6	5	
Cheese - Italy		**37.1**	4.8	5.9	17.8	16	
Cheese - Belgium		**20.0**	**33.3**	2.9	16.7	15	
Beer		8.6	9.5	**29.4**	16.7	15	
Ham		11.4	**23.8**	14.7	15.6	14	
Bakery products		17.1	14.3	14.7	15.6	14	
Total		100	100	100	100	90	
Nr of employees – FM							0.001
< 10 employees		**71.4**	19.0	35.3	**45.6**	41	
11 - 50 employees		20.0	**47.6**	32.4	31.1	28	
50 - 250 employees		8.6	33.3	32.4	23.3	21	
Total		100	100	100	100	90	
Nr of employees - Supplier							0.002
< 10 employees		**60.0**	23.8	14.7	**34.4**	31	
11 - 50 employees		31.4	**38.1**	**38.2**	35.6	32	
50 - 250 employees		5.7	**33.3**	**38.2**	24.4	22	
> 250 employees		2.9	4.8	8.8	5.6	5	
Total		100	100	100	100	90	
Nr of employees - Customer							0.004
< 10 employees		**55.9**	15.0	**50.0**	**44.3**	39	
11 - 50 employees		29.4	**30.0**	35.3	31.8	28	
50 - 250 employees		11.8	**35.0**	14.7	18.2	16	
> 250 employees		2.9	**20.0**	0	5.7	5	
Total		100	100	100	100	90	

[#] No reliable significance, since more than 20% cells with expected count less than five occurred. Hence, interpretation of the statistical significance is not possible; FM: food manufacturer, S: supplier, C: customer

As to be due from the result of the cluster analysis the three clusters differ significantly according to the size of the suppliers and customers. In the cluster of Non-innovator chain networks the supplier and customers are mainly firms with less than ten employees. In contrast the Customer-driven innovator chain networks assemble primarily both small-sized and medium-sized suppliers and small- to large-sized customers. Finally, the FM-supplier-driven innovator chain networks contain for the most part small- and medium-sized suppliers and micro-sized customers.

4.2 Chain network characteristics

The three innovation clusters are characterised by different aspects of chain network characteristics (Table 3). In general, in all chain networks reputation, satisfaction and trust are of main importance (overall means between 4.90 and 5.90 on a 7-point scale). However, there are specific differences among the different clusters. The Non-innovator chain networks are mainly composed of chain network members with lowest profitability and business growth in the last three years compared to the innovator chain network clusters. Furthermore, in such chain networks conflict and the degree of integration of chain network partners are higher in comparison to the other two clusters. In contrast, the Customer-driven innovator chain networks are rather assembled of customers with higher business growth and higher profitability than the food manufacturer and the supplier. Customer-driven innovator chain networks can be characterised by higher dependency, rewarding power, punishing power, reputation, economical and social satisfaction and collaboration. Finally, FM-supplier-driven innovator chain networks are characterised by suppliers with the highest profitability and business growth in the last three years among all clusters. However, also the food manufacturer and the customers achieved fairly high profitability and business growth. Furthermore, the FM-supplier-driven innovator chain networks are characterised by highest trust levels among the chain network members.

In order to verify the differences between the three clusters presented in Table 3, multinomial logistic regression was used. Table 4 details the result of the multinomial logistic regression comparing the three clusters respectively. In this model the Non-innovator chain networks are indicated as reference category for the first two comparisons. In the third comparison Customer-driven innovator chain networks is the reference category.

Comparing chain network characteristics between Non-innovator chain networks and Innovator chain networks, different chain network characteristics are significantly distinguishing between the clusters. The Non-innovator chain networks are compiled of suppliers with higher profitability but lower business growth, and customers with lower profitability than in the Customer-driven innovator chain networks. Furthermore, the partners of the Non-innovator chain networks trust each other significantly more, but collaborate less than the Customer-driven innovator chain networks.

Table 3
Descriptive statistics related to chain network characteristics, based on Crosstab (means), n=90

Cluster	1) Non-innovator chain networks	2) C-driven innovator chain networks	3) FM-S-driven innovator chain networks	Overall mean
Profitability FM	4.44	**5.29**	**5.24**	4.94
Business growth FM	4.54	**5.14**	**5.53**	5.06
Profitability S	5.00	4.86	**5.88**	5.30
Business growth S	4.57	5.24	**5.56**	5.10
Profitability C	4.69	**6.33**	5.44	5.36
Business growth C	5.06	**6.43**	5.24	5.45
Conflict	**2.96**	2.31	2.60	2.67
Dependency	3.52	**4.09**	3.77	3.75
SC-integration	**3.12**	3.06	2.73	2.96
Rewarding power	3.53	**3.76**	3.24	3.47
Punishing power	3.01	**3.15**	2.95	3.02
Reputation	5.59	**5.93**	5.84	**5.77**
Economical satisfaction	5.18	**5.38**	5.16	**5.22**
Social satisfaction	4.93	**5.20**	4.74	**4.92**
Trust	5.81	5.83	**5.94**	**5.86**
Collaboration*	1.33	**2.13**	1.56	1.60

* Maximum achievable score is 4, other chain network related characteristics maximum achievable score is 7. FM: food manufacturer, S: supplier, C: customer

Comparing Non-innovator chain networks with FM-supplier-driven innovator chain networks, the former is assembled of food manufacturers and suppliers with significantly lower business growth and customers with lower profitability but higher business growth than in the FM-supplier-driven innovator chain networks. Moreover, dependency among chain network members is significantly lower for Non-innovator chain networks than for FM-supplier-driven innovator chain networks while integration, rewarding power and social satisfaction are higher for the former.

Finally, the two innovator chain network clusters are compared with each other. As expected there are significant differences in relation to the supplier and customer. In the Customer-driven innovator chain networks there are suppliers with lower profitability and customers with higher business growth than in the FM-supplier-driven innovator chain networks. At last, these two clusters only differ significantly in their trust levels, which are lower for the Customer-driven innovator chain networks.

Table 4
Multinomial logistic regression model comparing Non-innovator chain networks, C-driven innovator chain networks, and FM_S-driven innovator chain networks

	Non-innovator chain networks vs. C-driven innovator chain networks	**Non-innovator chain networks vs. FM-S-driven innovator chain networks**	**C-driven innovator chain networks vs. FM-S-driven innovator chain networks**
Intercept	-5.548 (0.342)	0.249 (0.001)	5.797 (0.382)
Profitability FM	0.576 (2.649)	0.373 (1.941)	-0.204 (0.395)
Business growth FM	0.343 (1.211)	**0.673 (3.532)***	0.330 (0.816)
Profitability S	**-0.787 (4.134)****	0.285 (0.748)	**1.072 (7.360)*****
Business growth S	**0.587 (3.006)***	**0.753 (5.531)****	0.165 (0.204)
Profitability C	**1.074 (5.025)****	**1.157 (6.852)*****	0.082 (0.029)
Business growth C	0.013 (0.001)	**-1.090 (7.818)*****	**-1.103 (4.492)****
Conflict	-0.346 (0.258)	-0.160 (0.133)	0.186 (0.077)
Dependency	1.104 (1.729)	**1.639 (4.924)****	0.535 (0.458)
Integration	-0.686 (0.449)	**-1.538 (4.333)****	-0.853 (0.839)
Rewarding power	-0.262 (0.170)	**-0.917 (3.347)***	-0.655 (1.286)
Punishing power	-0.011 (0.000)	-0.202 (0.341)	-0.192 (0.134)
Reputation	0.793 (0.473)	-0.164 (0.051)	-0.957 (0.721)
Economical satisfaction	0.678 (0.373)	-0.644 (0.589)	-1.322 (1.619)
Social satisfaction	-0.563 (0.946)	**-1.287 (5.444)****	-0.724 (1.907)
Trust	**-2.237 (2.837)***	0.133 (0.018)	**2.370 (3.194)***
Collaboration	**1.713 (3.982)****	0.848 (1.416)	-0.865 (1.166)
R^2	0.73		
-2 Log-likelihood	97.680		
Chi^2 (32 df)	91.900***		
N	88		

Figures in parentheses are Wald statistics. ***significant at 0.01, **significant at 0.05, * significant at 0.10. FM: food manufacturer, S: supplier, C: customer

5 Conclusions

The investigation of the innovation capacity of food chain networks revealed three different types of innovators: Non-innovator chain networks, Customer-driven innovator chain networks and Food manufacturer(FM)-supplier-driven innovator chain networks. These types of innovator chain networks differ significantly in relation to their characteristics. Between Non-innovator and Innovator chain networks the profitability and business growths of the supplier and the customer, as well as the level of dependency, integration, rewarding power, social satisfaction, trust and collaboration are distinguishing factors. Between Customer-driven innovator chain networks and FM-supplier-driven innovator chain

networks also the profitability and business growths of the supplier and the customer are influencing the innovation capacity of the chain networks. Furthermore, only trust is significantly differing between these two Innovator chain networks.

In conclusion, the following characteristics form an important leverage for the innovation capacity. Thus, chain network characteristics that have a positive relationship with innovation capacity are the firm size of the chain network members (SMEs with more than ten employees), higher dependency, a lower level of integration (non-contractual relationships) and lower levels of rewarding power, social satisfaction and collaboration.

Interestingly, the results of our paper show that there is a distinction between Customer-driven and FM-supplier-driven innovator chain networks. In the first chain network the customers are significantly larger than in the latter chain network. Hence, there is a clear sign that larger customers can push their chain networks to more innovation capacity. Contrary, a larger supplier alone seems not to provide leverage for improving the innovation capacity. Our results give the impression that it is necessary to have a close mutual influence between the supplier and food manufacturer for the enhancement of the innovation capacity in the FM-supplier driven innovator chain networks.

Furthermore, our results also imply that the individual food SME is not able to provide the necessary leverage for improving its innovation capacity on its own, but that a food SME is benefitting from the involvement of its supplier or customer in the innovation process. Thereby, the involvement of the two different chain network partners is occurring in two different ways, as shown in our results. The involvement of the customer for becoming an Innovator chain network relies on less trust levels and more collaboration, while the involvement of the supplier for becoming an Innovator chain network is rather based on high dependency and low integration, rewarding power and social satisfaction.

There are few limitations related to our study, namely that rather subjective measures, e.g. for profitability and business growth, were used and hence a too positive assessment of these items could have occurred. Furthermore, we investigated only a limited number of chain network partners which is not providing a complete picture of the total chain network. Nevertheless, our study went further than other researches did in the past (e.g. Hardman et al., 2002; Pannekoek et al., 2005; Aramyan et al., 2007; Fischer et al., 2008). Thus, in future research, the degree of complexity of the studied system should gradually be increased, namely from a chain network of three members to more complex chain networks.

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Annex

Annex 1. Sample description

BELGIUM: Cheese	15 S	7 micro, 4 small, 2 medium, 2 large
15 Chain networks	15 FM	11 micro, 2 small, 2 medium
45 Respondents	15 C	4 micro, 5 small, 2 medium, 4 large
BELGIUM: Beer	15 S	4 micro, 7 small, 1 medium, 3 large
15 Chain networks	15 FM	8 micro, 5 small, 2 medium
45 Respondents	15 C	9 micro, 5 small, 1 large
HUNGARY: White pepper	5 S	3 micro, 1 small, 1 medium
5 Chain networks	5 FM	1 micro, 2 small, 2 medium
15 Respondents	5 C	4 micro, 1 small
HUNGARY: Dry sausage	11 S	2 micro, 2 small, 7 medium
11 Chain networks	11 FM	2 micro, 3 small, 6 medium
33 Respondents	11 C	1 micro, 3 small, 7 medium
HUNGARY: Bakery products	14 S	2 micro, 7 small, 5 medium
14 Chain networks	14 FM	7 small, 7 medium
42 Respondents	14 C	8 micro, 3 small, 3 medium
ITALY: Cheese	16 S	10 micro, 6 small
16 Chain networks	16 FM	13 micro, 2 small, 1 medium
48 Respondents	16 C	11 micro, 5 small
ITALY: Ham	14 S	3 micro, 5 small, 6 medium
14 Chain networks	14 FM	6 micro, 7 small, 1 medium
42 Respondents	14 C	2 micro, 6 small, 4 medium, 2 large
TOTAL	90 S	31 micro, 32 small, 22 medium, 5 large
90 Chain networks	90 FM	41 micro, 28 small, 21 medium
270 Respondents	90 C	39 micro, 28 small, 16 medium, 7 large

Micro: micro sized enterprise: < 10 employees, Small: small sized enterprise: < 50 employees, Medium: medium sized enterprise: < 250 employees, Large: large sized enterprise > 250 employees
S= Supplier, FM = Food manufacturer: food manufacturers, C = Customer

Annex 2. Items used for measuring innovation capacity (*on different scales*)

Human innovation efforts *(Frequency of spending time for improving human resources – 7-point frequency scale)* Courses and trainings Self-study (reading professional literature) Seminars Fieldwork (e.g. study tours visiting other companies) Experimental trials Other (Please specify):	**Adapted from:** (OECD, 2005; Batterink et al., 2006; Gellynck et al., 2007; Gellynck and Kühne, 2008)
Financial innovation efforts *(Structuredness of spending financial resources – 4-point scale)* Product development Process development Market research Organizational development	**Adapted from:** (SME-NET Survey; Noronha Vaz et al., 2004; OECD, 2005; Gellynck et al., 2007)
Innovation activities *(Yes-No for introduction of innovation activities)* Our company improved the packaging of our traditional product Our company improved the quality of our traditional product (through selected ingredients, raw materials, better uniformity of the product etc.) Our company improved the convenience of our traditional product Our company entered new geographical markets for our traditional product Our company improved marketing activities for our traditional product Our company introduced new management tools Our company improved management practices of research and development Our company increased participation in networks	**Adapted from:** (SME-NET Survey; Lundvall, 1995; Avermaete et al., 2004; Noronha Vaz et al., 2004; OECD, 2005; Gellynck et al., 2007; Gellynck and Kühne, 2008)
Innovation results *(Extend of significant contribution of applied innovation activity to business success -7-point Likert-scale)* Improving the packaging of our traditional product Improving the quality of our traditional product (through selected ingredients, raw materials, better uniformity of the product etc.) Improving the convenience of our traditional product Entering new geographical markets for our traditional product Improving marketing activities for our traditional product Introducing new management tools Improving management practices of research and development Increasing participation in networks	**Adapted from:** (Noronha Vaz et al., 2004; Gellynck et al., 2007)

Annex 3. Chain network characteristics, measured on a seven-point Likert-scale with 1 (totally disagree) to 7 (totally agree)

Trust	**Adapted from:** (Ganesan, 1994; Doney and Cannon, 1997; Jonsson and Zineldin, 2003; Batt, 2004)
Our supplier/ customer keeps promises	
Our company has high confidence in our supplier/ customer	
We believe that the information our supplier/ customer provides us is correct	
Our supplier/ customer considers how its decisions/ actions may affect us	
Economic satisfaction	**Adapted from:** (Mohr et al., 1996; Geyskens and Steenkamp, 2000; Jonsson and Zineldin, 2003; Batt, 2004)
Our business relationship with our supplier/ customer significantly contributes to our profitability	
Our business relationship with our supplier/ customer is very attractive because of getting fair prices	
Social satisfaction	**Adapted from:** (Dwyer, 1980; Mohr et al., 1996; Geyskens and Steenkamp, 2000; Batt, 2004)
Our supplier/ customer hardly considers our arguments when changing prices	
Our supplier/ customer leaves our company in the dark about what we ought to know	
Dependency	**Adapted from:** (Skinner et al., 1992; Ganesan, 1994; Batt, 2004)
Our company is not significantly dependent on our supplier's/ customer's resources (e.g. raw materials, packaging machines, transport facilities)	
Our company is significantly dependent on our supplier's/ customer's capabilities (soft skills, such as expertise)	
Our company can easily replace our supplier/ customer	
Rewarding power	**Adapted from:** (Skinner et al., 1992; Mohr et al., 1996; Geyskens and Steenkamp, 2000; Jonsson and Zineldin, 2003)
Our company receives benefits from our supplier/ customer when we regularly meet their needs /requirements (technical support/ free advice/ financial support/ market information etc.)	
Our supplier/customer rewards our company without requiring specific behavior in return (technical support/ free advice/ financial support/ market information etc.)	
Punishing power	**Adapted from:** (Anderson and Narus, 1984; Skinner et al., 1992; Geyskens and Steenkamp, 2000; Jonsson and Zineldin, 2003; Batt, 2004)
We can be sure that our supplier/customer will not retaliate our company when we do not accept our suppliers' / customers' business proposal (keep back important information / terminates contract, press down price, etc)	
We can be sure that our supplier / customer will not neglect our interests even if we fully meet the conditions detailed in the contract with our supplier / customer (keep back important information / terminates contract, press down price, etc)	
Reputation	**Adapted from:** (Ganesan, 1994; Doney and Cannon, 1997; Jonsson and Zineldin, 2003)
Our supplier/ customer is well-known for caring about its business partners	
Our supplier/ customer is well-known for its expertise	
Our supplier/ customer is well-known for its accuracy	
Conflict	**Adapted from:** (Anderson and Narus, 1984; Skinner et al., 1992; Mohr et al., 1996)
We disagree with our supplier/ customer on critical issues	
Our business interest doesn't match with that of our supplier/ customer	
Collaboration	**Adapted from:** (Noronha Vaz et al., 2004; OECD, 2005; Batterink et al., 2006)
Our company uses production equipments (e.g. machines for harvesting or packaging) jointly with our supplier/ customer	
Our company shares knowledge with our supplier/ customer systematically (personally, by phone, via email, via the internet/ closed access data bases)	
Our company has joint planning activities with our supplier/ customer (promotional activities, volume demands, sales forecasts etc.)	
Our company is involved in joint research and development activities with our supplier/ customer/peers/3rd parties (related to product, process, market, and/or organizational improvements)	
Integration*	**Developed by:** (Gellynck and Molnár, 2009)
Our business relationship with our supplier/customer can be characterized as:	
Spot market	
Non-contractual relationship with non-qualified partner	
Non-contractual relationship with qualified partner	
Contractual partnership	
Relation-based alliance	
Equity-based alliance	
Vertical integration	

*Seven-point scale representing the degree of integration 1= not at all integrated, 7= fully integrated

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