Structures and relationships in supply chains and networks: conceptual issues and application in German dairy sector

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Abstract

The increasing globalization of the world economy and internationalization of trade have lead to a growing intensification of the competition among global food industry stakeholders. Though the competitiveness of single companies strongly depends on the effectiveness of their production and marketing processes, more recently the role of effective supply chain structures and strategic chain partnerships has been gaining importance in agri-food sectors worldwide. The importance of global trade for the spread of food contaminations has been illustrated by a number of recent food scandals, which increasingly moved to the center of public and political interest. The scandals have contributed considerably to the awareness of food quality and safety among consumers and, thus, to the spreading of tighter forms of vertical coordination. The increasing integration of markets complicates the traceability of supply chains as well as the timely application of prevention and intervention measures in practice. As a result, there is a growing body of scientific literature studying the formation of interorganisational relationships as well as strategic and economic implications for the firms participating in strategic networks and partnerships. Although the concepts of supply chains and interorganisational relationships are not new, there is still a need to study their principles in practice. The German dairy sector is one of the most important sectors within the national agri-food economy and has also experienced the impact of these recent developments. Today many dairy products are produced in vertically integrated organizations or networks which are coordinated by big branded processing companies - also called ‘chain captains’ - monitoring all stages of the supply chain. In order to understand the formation of interorganisational relationships in German dairy sector, we critically review the literature on supply chains and networks and conduct a descriptive analysis of dairy supply chains in Germany.

Keywords: supply chains, networks, dairy sector, Germany
1. Introduction

The increasing globalization of the world economy and internationalization of trade have lead to a growing intensification of the competition among the global food industry stakeholders. The importance of global trade integration for the spread of food contamination has been illustrated by a number of recent food scandals, which increasingly moved into the center of public and political interest. The scandals have contributed considerably to the awareness of food quality and safety among consumers and, thus, to the spreading of tighter forms of vertical coordination. The increasing integration of markets complicates the traceability of supply chains as well as the application of prevention and intervention measures in practice.

Food scandal over the melamine poisoned milk in 2008 made it clear that trading interactions can cause diffusion of contamination to other food branches on the one hand, and other countries on the other hand (Chan et al., 2008; Ingelfinger, 2008; Okazaki et al., 2009). The effects of the melamine scandal were recalls of milk products and the associated economic damage of about 50 million U.S. dollars for a single company, as well as the death of six children and 300,000 reported illnesses (Xinhua News Agency, 2008; Duchowski et al., 2009). The melamine was not only in baby food but also in leaven, toffees, soy products, etc. According to Hennessey et al., (1996) the distribution of food is a decisive component of the spread of foodborne infections, which will gain more and more importance through increasing global trade (Henessey et al., 1996; European Commission, 2008).

Though the competitiveness of single companies strongly depends on the effectiveness of their production and marketing processes, more recently the role of effective supply chain networks and strategic chain partnerships has been gaining importance in agri-food sectors worldwide. The basic foundation for the analysis of commodity flows in supply chains and networks is the understanding the topography of the network (Christley et al., 2005; Keeling and Eames, 2005; Newman, 2011). The trade structures are, on one hand, a relevant factor for the spread of a contamination, but, on other hand, the knowledge about the structures also opens up the possibility of interventions in the trade system (Keeling and Rohani, 2008; Dubé et al., 2009; Chadés et al., 2011).
Germany, with a milk production of 29.6 million tons, is considered the biggest dairy manufacturer in the European Union (BLE, 2011). The globally produced milk yield in 2008 was about 700 million tons, of which about 70% was manufactured in dairies (IFE, 2010).

This article aims at understanding the formation of interorganisational relationships in German dairy sector by investigating the theoretical principles of relationship formation in supply chains and networks and by looking at those principles in practice using the example of German dairy supply chain. In order to fulfill our aim we pursue the following research tasks in our paper: 1) critical literature review on supply chains and networks as well as on formation of interorganisational relationships in the agri-food business; 2) investigation of supply chain structures and relationships in German dairy supply chains, using the theoretical findings of the first aim.

2. Theoretical background on formation of interorganisational relationships in supply chains and networks

2.1 Supply chains and networks

The term “network” is used widely in the economic, social, technical and social sciences (Newman, 2003). According to the graph theory a network is formed out of nodes and edges, where nodes symbolize actors or objects and edges – relations between the nodes. Along the edges (trade connections), products are transported that are produced in the nodes (companies). Each edge connects two nodes, shows a direction orientation presented by arrows and indicates relations as well as their interdependences graphically (Männel, 1996).

Thorelli (1986) suggests viewing a network as consisting of nodes or positions (occupied by firms, households, and strategic business units inside a diversified concern, trade associations and other types of organizations) and links manifested by interaction between the positions. Networks may be tight or loose, depending on the quantity (number), quality (intensity), and type (closeness to the core activity of the parties involved) of interactions between the positions or members. He suggests that “…the entire economy
may be viewed as a network of organizations with a vast hierarchy of subordinate, criss-crossing networks” and calls a network “…two or more organizations involved in long-term relationships”, which contributes to the fundamental understanding of this concept. The idea that a network consists of more than two elements is also supported by a number of other authors (e.g. Lazzarini et al., 2001; Omta et al., 2001). For example, Anderson et al., (1994) define networks “as a set of two or more connected business relationships, in which each exchange relation is between business firms that are conceptualized as collective actors.”

The next characteristic of a network which is mentioned in the literature is the repetitive character of interactions among the network elements. Menard (2002) says that this term covers all arrangements defining recurrent contractual ties among autonomous entities. This view is supported by Todeva (2005) who posit that “networks are sets of repetitive transactions based on structural and relational formations with dynamic boundaries that comprise interconnected elements (actors, resources and activities)”. Having examined the concept of networks, let us clarify the meaning of supply chains and supply chain networks. A supply chain is a linked set of resources and processes that begins with the sourcing of raw materials and extends through the delivery of end products to the final customer (Bridgefeld Group ERP/Supply Chain Glossary, 2004). Stevens (1989) calls a supply chain “a system whose constituent parts include material suppliers, production facilities, distribution services and customers, linked together via the feed-forward flow of materials and the feed-back of flow of information and financial capital.” Another definition of a supply chain is provided by Christopher (1998), who claims that a supply chain is “a network of organizations that are involved through upstream and downstream linkages in different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.” So supply chains consist of three main stages: purchasing, production and distribution running in upstream and downstream flows. The flow of goods has a downstream character, whereas the flow of money and information is upstream, as consumer demands determine the variety of goods they want to buy.
Going one step further we come to the notion of supply chain networks. As mentioned previously, after forming supply chains, firms driven by vertical integration necessities tend to build more complicated structures and form supply chain networks. The concept of a supply chain network, introduced by Harland et al., (2001), tries to integrate the network and supply chain approach. She regards individual firms as a nexus with their own unique network of upstream and downstream partners. So the interesting question is: where does the supply chain stop being a supply chain and begin to represent a supply chain network? Van der Vorst (2005) refers to a supply chain network as a food supply network and calls it an interconnected system with a large variety of complex relationships such as alliances, horizontal and vertical cooperation, forward and backward integration in supply chains.

Supply chain networks are commonly characterized as firms that are embedded within a complex network of horizontal (i.e., strategic alliances, joint-ventures) and vertical (buyer and supplier) relationships (Lazzarini et al., 2001; Omta et al., 2001; Belaya and Hanf, 2008). A “supply chain network” can be understood as the joint and co-operative behaviour and actions of companies that are related by vertical product and information flows in the supply chain in order to provide a product or service to the end consumer (Belaya et al., 2007; Gagalyuk and Hanf, 2007; Gagalyuk et al., 2009). The objective of most of the supply chain networks is to produce higher quality and/or efficiency by cooperation rather than by full integration of the supply chain or by market transactions (Hanf and Kühl, 2002; Hanf et al., 2009).1

2.2 Criteria for formation of interorganisational relationships in dairy sector

One of the most interesting areas is the way such relationships come into existence and the decisions regarding the selection of the right partner, which could be regarded as the glue that holds the relationships together. In fact, there is a great variety of suppliers and buyers available for different categories of products which have different quality and

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other factors important for conducting business. Therefore, choosing the appropriate partner is one of the main issues in order to secure the performance of the firm (Reid and Riegel, 1989). As mentioned by some researchers, the process of partner selection in general is a multi-criteria problem, since it involves decision-making process based on various criteria such as price, quality, delivery, etc. (Aguézzoul, 2008).

Some of the general criteria for partner selection are widely described in the literature. According to the study by Reid and Riegel (1989) buyers prefer suppliers who provide accurate and on-time delivery. Other studies (McGinnis et al., 1995; Menon et al., 1998) suggest that both the firm’s competitiveness strategy and external environmental are vital for the selection criteria. Besides, further general selection criteria include: consistent quality, reasonable pricing, willingness to work together, reasonable minimum orders, volume discounts, frequency of delivery, payment policies, technical competence, geographical distance, financial stability, creative management, responsiveness to unforeseen occurrences, integration level index, increment in market share; research and development ratio, environmental expenditures, and customer satisfaction index (Reid and Riegel, 1989; Meade and Sarkis, 2002; Efendigil et al., 2008).

Some criteria are common for all sectors, whereas some of them reflect specific features of the dairy sector in Germany. The price of milk is also mentioned among the economic factors influencing the choice of a partner by milk producers (Steffen et al., 2010). Since the settlement of the milk price in private dairies is usually done by price negotiation, this criterion deserves a special attention. In the end both groups of supply chain actors (milk producers and dairy processing companies) are business organizations and need to make a profit from their business partnerships. Therefore, we posit that the level of offered milk price by dairies is one of the essential factors influencing the decision of the farmer to enter a relationship with them.

The agreed price usually consists of a basic reference price and a unique contract bonus which is dependent on the duration of the contract. Therefore, one might also assume that such criteria as duration of contract, contract cancelation period, contract bonus payment as well as any additional payments for quality could make the relationship more or less attractive for dairy farmers and could also play an important role in the partner selection
process (Steffen et al., 2010). Whereas risk-averse farmers prefer contracts with a longer
duration and certain fixed prices, other less risk-averse farmers may want to choose a
contract with a shorter period of duration but with a possibility to negotiate a better price.
Steffen et al., (2010) describe a „cafeteria“ system of negotiating the right kind of contract
between German dairy farmers and processing companies. This system allows specific
components of the contract, including the absence or presence of sanction mechanisms, to
be chosen. Therefore, we posit that this criterion (absence of sanction mechanisms from
the side of the dairy processing company) might also play a role in choosing the right
partner in the dairy industry. Another experiment by Steffen et al., (2010) included an
exemplary contract with a regulated quantity of milk and specific mechanisms to avoid
oversupply of milk from some farmers. Therefore, one might also assume that this point
could also influence the decision of farmers to enter the relationships with a certain dairy
processing company.

Some of the mentioned general factors for selection of partners could apply for dairy
processing companies (e.g., milk price, duration of contract, contract cancelation period)
etc. Usually the contract duration between milk producer and dairy is two or three years
(Spiller and Schulze, 2006). However, one also has to mention that milk producers and
processors are probably driven not only by economic factors for selecting the right
partner, but also by a number of social and historical factors which are tightly connected
with traditions and emotional preferences. For instance, the milk producer’s willingness
to change to another company after the duration of contract has ended depends on the
quality of the business connection between milk producer and dairy (Gerlach et al., 2005).

From the milk producer’s point of view, the quality of the business connection is
influenced by the company’s sympathy to the milk producer’s market problems, the
agricultural orientation and the way of communication, as well as the dairy’s management
ability. Here the individual factors regarding the quality of business between the milk
producer and the dairy can be weighted differently.

Gerlach et al., (2005) showed in an empirical analysis that the influence on the quality of
business connections is dominated by intrinsic factors as opposed to extrinsic factors.
Intrinsic factors are inner motivations to establish, maintain and deepen trade
connections, for example commercial support for milk producers with difficulties on the dairy market. In contrast, extrinsic factors are governed by economical, logistical and technical considerations, such as milk producer’s price contentment (Gerlach et al., 2005). The consolidation of the commitment between the supplier and the processing company through an effective supplier management can boost a dairy’s potential for success inversely by securing the commodity receipts and the connected planning reliability for the company (Spiller and Wocken, 2006).

Finally, we used the discussed points for summarizing our findings on criteria of partner selection in German dairy sector by differentiating among milk producers, dairy processing and food retailer companies (App.1).

3. Study of German dairy supply chains

3.1 Material and methods

In order to investigate how the supply chains and networks are formed and how they function in German dairy sector we tried to describe the existing structures and relationships by using the so called description model. The description model helps to describe the complex systems with their components, functions and interactions. The description of the system regarding the dairy distribution grid was designed with information contained in literature. The description of the system was then amended by the data analysis of the year 2004, 2006 and 2010. The data for 2004 were allocated by the Bavarian State Ministry for Nutrition, Agriculture and Forestry (StMELF) on behalf of the German Federal States. This data included the German dairies’ locations in counties that source their milk from the milk producer and the corresponding number of farmers, including the locations of each dairy. This data was collected uniquely for 2004. At this point 327 dairies and 106,963 milk producers existed, situated in 385 different counties. The data for 2006 and 2010 is based on the observation of the market for the German milk industry and were allocated by the Federal Institute for Agriculture and Nutrition (BLE). The data for 2006 provides information about the trade volume between the milk producers and dairies over the period from 2000 to 2006.
To measure the smoothing\(^2\) production \((S_i^F)\) per state \((F)\) and special year \((i)\) the difference between the quantity produced \((P_i^F)\) and the milk delivery to dairies \((D_i^F)\) in each province was formed for the years 2000 and 2006 (BLE, 2006). Then, the difference per state in terms of total volume produced in Germany \((\sum_F P_i^F)\) was calculated for both years in order to make statements about the absolute amount of smoothing production per state \((\Delta S_F)\) for the entire quantity produced (Formula 1).

\[
S_i^F = \frac{P_i^F - D_i^F}{\sum_F P_i^F} \quad i \in \{2000, 2006\} \text{ and } P \geq D \forall i, F
\]

\[
\Delta S_F = \frac{S_{2000}^F}{S_{2006}^F} - 1
\]

Then the change in the proportion of smoothing processes \((\Phi_i^F)\) to the overall amount of smoothing production in Germany \((\sum_F S_i^F)\) for the period 2000 to 2006 was calculated (Formula 2).

\[
\Phi_i^F = \frac{S_i^F}{\sum_F S_i^F} \quad i \in \{2000, 2006\}
\]

\[
\Delta \Phi^F = 1 - \frac{\Phi_{2000}^F}{\Phi_{2006}^F}
\]

The data for 2010 includes the purchase and sales volumes between the dairies which were needed to create a description of the system.

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\(^2\) The term “smoothing” implies in this case that milk producers trade with another dairy, which is not in the same federal state.
3.2 Description of structures in German dairy sector

The description of the system encompasses the trading structures and relationships among the supply chain actors in the German dairy industry. In Germany there are 220 dairies which process 96.8% of the raw milk and which can be classified into cooperative and private dairies. Cooperative dairies process 70% of the milk and stand out due to the milk producers are co-owners in the dairies. In Germany, 93,497 milk producers produce 29.6 million tons of raw milk. Large dairy companies can usually afford to collect milk from a bigger region, implying longer travel distances and higher transportation costs. The increase in the amount of dairy products and processed milk would require an expansion of the milk collection area. Smaller dairies might not be willing to pick up milk from a supplier situated far from the processing facilities.

Appendix 2 makes clear that smoothing processes took place in 8 of the 12 shown federal states between 2000 and 2006. The minimum share of smoothing processes amounts to 4% (State 1) and the maximum share amounts to 74% (State 11). Contradictory developments can be found in four federal states. In these four states, the share of the smoothing processes decreased, referring to the total amount of produced milk.

The results of the data analysis show that in some federal states the share of the smoothing processes related to the total amount of smoothing processes is around 53%, e.g., in federal State 11. In State 8 the development points to a low share of smoothing processes during the passage of time. In this state the share of the smoothing processes decreased by 190% related to the total amount of smoothing processes (App. 2).

The comparison of the initial situation shows for some federal states, like States 2, 6 or 7, that smoothing processes took place, but that the share of smoothing related to the total amount of smoothing processes in Germany decreased. The data analysis in 2004 showed that one dairy is supplied on average by 327 milk producers and that the milk producers are on average 68 km away from the dairies (Fig. 1). The maximal distance according to the 2004 data was 557 km and the lowest 0 km. For the distance analysis the center of the county between the 327 dairies and 106,963 milk producers was chosen. As one administrative district is, on average, only 60 km wide, there is an interval of 0-60 km in which the milk producer has the lowest distance to the dairy. Generally that is to say that
96.3% of the milk producers are within a distance of 0-100 km from their dairy. Raw milk is obtained at a distance of more than 100 km by 3.7% of the milk producers (Fig. 1).

![Bar chart showing frequency of distances between milk producer and dairy](chart.png)

Fig. 1: Distance between milk producer and their dairies

However, in order to be cost-efficient, dairies pay attention not only to the geographical distance of collection points and farmers, but also to the density of the area. Therefore, towns with a greater number of suppliers would be preferred due to low travel and transportation costs. In contrast, stand-alone farms situated far from other farms would have fewer chances to be chosen as supplier if the quantity of the milk to be collected is not sufficient to fill the milk car.

Besides the direct trade connections between milk producer and dairy, there are also indirect trade connections among the trade network through interconnected actors. Interconnected business partners are, for example, national dairies that sell their milk to other dairies. The dairies move quantities of milk among each other by purchasing and selling (smoothing of production capacities= trade within a supply chain). This should lead to a harmonization between the dairy’s capacity and its need for raw material.
According to estimations, the trading volume has a percentage of 30% in the whole delivery quantity in Germany (Fig. 2).

Fig. 2: Purchase and sales volume of milk between the dairies

The trade interactions between the companies serve to reach the companies’ goals more efficiently more through cooperation and effectiveness than by competition (Bidlingmaier, 1967). Therefore the potential of cost reduction, but also gain in efficiency, realization of competition advantages and the modification of market barriers are very important for the cooperation (Rotering, 1993). Especially synergetic effects, access to new markets and the distribution of investments are supposed to be realized through horizontal cooperation. Wegmeth’s studies in 2002 showed that horizontal cooperation in the dairy industry is entered especially in the production sector. Here big distances can have a negative effect on a cooperation because of the high transport costs between the cooperation partners (Wegmeth, 2002). The data analysis in 2004 showed that the average distance between the dairies was around 340 km.

Dairies that do not have any own delivery, which means that they do not get the raw milk from farms, are called “purchase companies” on the supply chain.
Other interconnected trade partners are milk collection companies who collect the raw milk but do not process it and sell it to the dairies and at the same time settle up with the farmers. The bundling quantities of the milk collectors amount to 32% of the whole delivering quantity. Considering the background of the milk flow must be noted that the dairies distribute their milk on their business enterprises as well. Here they produce other products and thus follow other trade networks per business enterprise. For example whey, which emerges as a by-product in the cheese production. The whey can be transported back to the farmers for the purpose of feeding.

The spot market’s integration on the producer level causes another marketing possibility. This channel of distribution allows the producers to sell the raw milk’s short-term excess or remaining quantities for the current price and to sell them to any dairy that offers the highest price. The percentage of the traded raw milk on the spot market is estimated to be 0.03% and is connected to a price and customer risk for the producer (Bahr et al., 2010). Moreover there are two more commodity flow quantities on the producer level because there is no trade connection between the dairy and the producer. Of the raw milk that is not processed in dairies, measured on the total production, up to 2.7% is fed and up to 0.2% marketed directly by the producer (BLE, 2011).

After the processing, the finished dairy products enter the food retailing sector, the food industry, the pharmaceutical industry, schools and the wholesale trade, as for example to hospitals and canteens. A special consumer of dairy products is the food retail trade that markets about 40% of the dairy products that are produced in Germany. From these 40%, about 54% of the products are sold by discounter shops. 44% of the dairy products are exported and 16% are distributed on the formerly named channels of sales (BKartA, 2009).
4. Summary and conclusions

In this paper we aimed to understand the formation of interorganisational relationships in German dairy sector by investigating the theoretical principles of relationship formation in supply chains and networks and by applying the theoretical knowledge using the example of German dairy supply chain. In order to fulfill our aim in the first step we conducted a critical literature review on supply chains and networks taking into account the factors influencing the formation of interorganisational relationships in the agri-food business in general and in German dairy sector. The essential characteristics of networks mentioned in the scientific literature could be summarized as follows. Networks can be viewed as systems consisting of more than two elements, which are connected among themselves through linkages and relations of repetitive character, through which they exchange resources. Supply chains integrated into networks lead us to the concept of supply chain networks. Thus, the supply network concept appears to be more complex than the supply chain concept. Supply chain networks are firms that are embedded within a complex network of horizontal and vertical relationships with an aim to provide a higher quality product or service to the end consumer. Besides, we also used the discussed points about the factors responsible for formation of interorganisational relationships and summarizing our findings on criteria of partner selection in German dairy sector by differentiating among milk producers, dairy processing and food retailer companies.

The second research task addressed the investigation of supply chain structures and relationships in German dairy supply chains. The different trade interactions in the dairy sector are affected by numerous interconnected actors and trade cycles, for example, through the return of the whey from the dairy to the milk producer, and by means of intermediaries. In this context it is evident that several dairies have to approach several regions to save their commodity receipts. The proper choice of business partners is a decisive factor for the consumers’ supply with an optimal product quality, as well as for the survival of the company with regard to the loss of reputation should damage occur. The choice also affects a company’s success and strengthens the international competitiveness for a dairy company. In several German states the results of the choice of
business partners are quite obvious: dairies in certain German regions process about 4-74% for the total produced quantity of milk in these regions. The remaining milk of the milk producers is delivered to other dairy companies, which are not situated in the same region as the milk producers. Basically, the mentioned smoothing processes can turn out higher for each federal state, because the smoothing processes cannot just proceed from the milk producers, but also from the dairy in each federal state. In this context the mentioned results provide no information on whether the milk is processed in the respective federal State (App.2). Therefore the dairies have to use their capacities fully by purchases of milk collection companies which can be situated in other regions, or respectively, to the purchase of other dairies (Fig. 2).

From the point of view of food-security and traceability, these trade connections are defining the spread of food-contamination, as they were in the case of the melamine scandal. The commodities with inadequate quality can be passed from one partner to other partners of added value chain through the trade connection. This can lead to an increasing infection cascade: on the one hand in different dairy products and different food sectors, that for example add milk to their products, and on the other hand, in other countries because of cross-border transactions. These international transactions are becoming more a focus of the dairy sector because of the glut on the local markets and could be affected by the trade connection. The cross-linked and complex commodity flows make the traceability and the connected transparent form of supply chains difficult.

So the cooperation’s of companies in networks have to be arranged in a way that the consumer in the milk supply chain can rely on the temporal, quantitative but also on the quality of the dairy products. The transparent form of the supply chain and the connected exchange of information between all actors of the supply chain build the basis of food security. Thus, a strong vertical integration of the milk producers towards the dairies and traders could influence the exchange of information and the transparency in the food chain. The generated knowledge on the formation of structures in German dairy supply chains could be used for effective detection of food contaminations (e.g. opens up the possibility of interventions in the trade system) and determination of the associated economic losses in case of food scandals.
5. References


Acknowledgements

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## Appendix 1. Economic factors for the choice of partners in the German dairy sector

<table>
<thead>
<tr>
<th>Milk producers</th>
<th>Dairy processing companies</th>
<th>Dairy processing companies (Wegmeth, 2002)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Milk price (Steffen et al., 2010)</td>
<td>- Milk price (Steffen et al., 2010)</td>
<td>- Economies of scale</td>
</tr>
<tr>
<td>- Duration of contract (Steffen et al., 2010)</td>
<td>- Duration of contract (Steffen et al., 2010)</td>
<td>- increased in productivity</td>
</tr>
<tr>
<td>- Contract cancelation period (Steffen et al., 2010)</td>
<td>- Contract cancelation period (Steffen et al., 2010)</td>
<td>- higher capacity utilization</td>
</tr>
<tr>
<td>- Contract bonus payment (Steffen et al., 2010)</td>
<td>- Milk producers structure (Density of milk producers’ location and structure of the milk producers) (Buschendorf, 2008)</td>
<td>- optimized allocation factor</td>
</tr>
<tr>
<td>- Additional payment for quality (Steffen et al., 2010)</td>
<td>- Geographic or transportation distance (Buschendorf, 2008; Reid and Riegel, 1989)</td>
<td>- Expansion of product range and optimal product range design</td>
</tr>
<tr>
<td>- Absence of sanction mechanisms from the side of the dairy processing company (Steffen et al., 2010)</td>
<td>- Costs of transportation of raw milk from milk producers to dairy processing company (Buschendorf, 2008)</td>
<td>- higher know how</td>
</tr>
<tr>
<td>- Flexible quantity regulation (Steffen et al., 2010)</td>
<td>- Negotiation costs (Porter, 1990)</td>
<td>- distribution of risks</td>
</tr>
<tr>
<td>- Competence (Reid and Riegel, 1989)</td>
<td>- Quantity of deliveries (Steffen et al., 2010)</td>
<td>- common pool resources</td>
</tr>
<tr>
<td>- Responsiveness and readiness to solve problems together (Reid and Riegel, 1989; Gerlach et al., 2005; Spiller and Wocken, 2006; Aguezzoul, 2008)</td>
<td>- Raw milk quality (fulfilment of hygiene and microbiological for raw milk) (Buschendorf, 2008)</td>
<td>- Distribution of investments</td>
</tr>
<tr>
<td>- Financial stability of the dairy processing company (McGinnis et al., 1995; Menon et al., 1998)</td>
<td>- Stability and competitiveness of the suppliers (Porter, 1990)</td>
<td>- Better Market position</td>
</tr>
<tr>
<td>- Service offered by the dairy processing company (consulting services, etc.) (Meade and Sarkis, 2002)</td>
<td>- Performance of the suppliers (Meade and Sarkis, 2002)</td>
<td>- specialization effects</td>
</tr>
<tr>
<td>- Business success of the dairy (Gerlach et al., 2005; Spiller and Wocken, 2006)</td>
<td></td>
<td>- Geographic</td>
</tr>
<tr>
<td>- agricultural orientation of the dairy (Gerlach et al., 2005; Spiller and Wocken, 2006)</td>
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</tbody>
</table>

Food retailer (BKartA, 2009)

- Quantity delivered
- Geographic or transportation distance
- Sales price

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*between milk producer and dairy*

*between dairies*

*Between dairy and retailer*
Appendix 2. Smoothing production per federal State in Germany