System Dynamics and Innovation in Food Networks
2009

Proceedings of the 3rd International European Forum on System Dynamics and Innovation in Food Networks, organized by the International Center for Food Chain and Network Research, University of Bonn, Germany
February 16-20, 2009, Innsbruck-Igls, Austria
officially endorsed by

EAAE (European Association of Agricultural Economists)
IAMA (International Food and Agribusiness Management Association)
AIEA2 (Assoc. Intern. di Economia Alimentare e Agro-Industriale)
INFITA (Intern. Network for IT in Agric., Food and the Environment)

edited by

M. Fritz, U. Rickert, G. Schiefer
The Role of Trust in Emerging Food Supply Network Relations

Melanie Fritz
Meckenheimer Allee 174, University of Bonn, Germany,
m.fritz@uni-bonn.de

1. Introduction

The food sector is the largest economic sector in the European Union (CIAA, 2005). It consists of a complex, global and dynamically changing network of trade streams, food supply network relations and related product flows (Fritz, Schiefer, 2008a). Food supply networks are subject to dynamically changing circumstances, which include fluctuations at primary production due to changes in weather or climate, impacting supply and demand and prices, and also impacting the quality of raw material, variations in food consumption due to seasonality or the westernization of diets in Asia (see e.g. OECD-FAO, 2006, Pingali, 2006), the development of alternative uses of raw material such as bio-fuel, and, not the least, from changing attitudes of society towards the consequences of the food system’s activities for environmental, social and economic issues, captured in the term of “sustainability” (Aiking, de Boer, 2004).

To cope with these challenges as an industry and to secure the global availability of food that is affordable, safe, and of the quality and variety expected by consumers, food supply networks will need to improve flexibility and efficiency of coordination activities within food supply network relations. Potentials for the achievement efficient, flexible and effective coordination of food supply networks lie in the emergence of innovative food supply network relations facilitated by Internet-based information and communication technologies (Swaminathan, Tayur, 2003, Simchi-Levi et al., 2003). Information and communication technologies provide proven potential for the improvement of efficiency in coordination and transaction processes through electronical support, which is also referred to as electronic commerce or e-business (Geoffrion, Krishnan, 2001). In recent years, a sophisticated e-commerce infrastructure for food supply networks has emerged (Fritz et al., 2004). However, in contrast to many other sectors of the economy, the adoption of such innovations to support the emergence of new types of food supply network relations for improved efficiency, flexibility and effectiveness is low in the food sector, especially by its SMEs (European Commission, 2005). Consequences of such developments become obvious as, for Europe, 99% of companies in food and beverage industry are SMEs creating 49% of the sector’s turn-over and employing 61% of the sector’s workforce (CIAA, 2005).

One important barrier to the integration of such technologies into food supply networks for emerging relations is that trust, which is prerequisite for exchange transactions, is not yet appropriately and sufficiently communicated in existing offers, especially for first time transactions with a new partner, which are necessary to cope with the dynamically changing environmental conditions (Berthon et al., 2008). Any supply network transaction intermediated by electronic support is more anonymous than traditional transactions due to the lack of personal contacts and therefore a lack of potential opportunities for the development of trust between transaction partners, which increases perceived risks and uncertainties in the transaction (Tan, Thoen, 2001).

Next to explicit and formally stipulated criteria such as quality certificates, informal, implicit and often subjective criteria, which are difficult to externalize, are necessary for transactions
and related decisions of actors in food supply networks; many of these informal criteria in transactions belong the concept of trust (Fynes et al., 2001). Such informal criteria and trust in food supply networks often develop within long-term, relatively stable relationships of a network of companies where personal contacts play an important role (Zylbersztajn, 1996). Any electronic environment for coordination and transaction support is based on information and communication technology. As a consequence, the provision and support of information and communication processes is inherent to such technologies, which offer a wide range of opportunities to exchange information and support communication between supply network actors, which in principle, is the basis for the generation of trust (Doney et al., 2007). Therefore, electronic coordination and transaction support might also provide opportunities for the creation of trust to facilitate emerging food supply network relations through information provision, transparency and communication in exchange to personal contacts. However, the conditions for the emergence of trust in electronic support for coordination and transactions in food supply networks, including the role of information and the development mechanisms of trust along the life cycle of a business relation, remain unclear. It is the objective of this paper to contribute to the understanding of the role of trust in emerging, electronically supported food supply network relations in order to facilitate the implementation of innovative, electronic coordination and transaction support opportunities for food supply networks.

2. Innovation needs in food supply network relations

Without innovations in food supply network relations towards improved flexibility and responsiveness through enhanced information availability (see Fritz, Schiefer, 2008b), increased exploitation of available resources, and a reduction of inefficiencies (e.g. Vorst & Beulens, 2002, Matopoulos et al., 2007), consumers’ need for affordable food without compromises in quality, and which continues to retain their trust, cannot be served in the long run. Consumers’ perception of food quality is a dynamic variable. It might focus on products, processes, process management, or management issues such as fairness in trade, working conditions, environmental consciousness, or the origin of products. Its understanding depends on lifestyles, cultures, etc. (Grunert, Wills, 2007, Lobb et al., 2007).

New types of efficient and responsive coordinated production, distribution, and communication networks (i.e., logistics networks) must emerge that can support these changing demands, taking into account varying quality parameters, organizational conditions, and different requirements of market segments (Bakker et al., 2003). This may include, for example, new organizational structures for flexible chain-encompassing distribution and logistics systems that utilize advanced technologies for communication, control, or tracking and tracing for transparency and trust. Focused information and communication concepts that serve the different transparency needs are the key for the dissemination of knowledge, for innovation, for risk containment, appropriate cooperation and coordination within the value chain, appropriate integration of SMEs in chain activities, and the establishment of trusted relationships between enterprises, consumers, and the society (Beulens et al., 2005).

Diversity in food is a strength of today’s food system. It is the basis for a further diversification in the production of tailor-made foods that specifically relate to people’s age, health status, activity, or any other criteria (Thiele, Weiss, 2003). New food supply network relations are required that are highly responsive to dynamic consumer and market demands, and at the same time, cost-effective (Storer, Taylor, 2006, Vachona, Klassen, 2006). This poses challenges for innovations in chain-encompassing production, distribution, and communication networks that can efficiently compete with classical systems in commodity markets. The continuous provision of affordable, quality food from a decreasing production base can be supported through process improvements involving, for example, reductions in losses which may amount to 25 to 50% of
total production depending on the source (Fehr et al., 2002), delivery on demand (just-in-time) to avoid oversupply, the efficient integration of new technological developments (e.g. in logistics or communication), and through an institutional environment that supports successful adoption of different principle technological developments.

Efficiency and flexibility are at the core of quality assurance in scenarios with changing consumer demands (Henningsson et al., 2004). The separation of functions in production and trade and the standardization of interactions could allow the identification of new flexible organizational alternatives. The focus is on new types of efficient, flexible, and responsive food supply networks that could reduce current inefficiencies, lower costs, and increase the creation of value and product differentiation (Landeghem, Vanmaele, 2002). New flexible food supply network relations are required that support the rebundling of functions across enterprise borders for better serving changing consumer needs.

To meet the challenges ahead (CIAA, 2007), food supply networks need to innovate in organizational relationships that reach beyond innovations in process improvement by building on the innovation potential inherent in enterprise networks and their flexibility in responding to customers’ and consumers’ demands (Pittaway et al., 2004). There is an urgent need to adjust the trend towards increased process integration along the value chain to the organization of a flexible and responsive network approach by utilizing the potential of technological change, of information and communication systems, and of institutional change (Murdoch, 2000). Furthermore, any improvement needs to be suitable for the small- and medium-sized enterprises (SMEs), which dominate the agriculture and the processing levels of the food chain. The provision and communication of trust between food supply network actors is prerequisite and integral part of any improvement activity.

3. Facilitators and barriers for emerging food supply network relations with electronic coordination and transaction support

As the current adoption rate of electronic support for the coordination of food supply networks is low (European Commission, 2005), this chapter 3 investigates potential facilitators and barriers for the implementation of innovative, electronically supported food supply network relations. The analysis puts special focus on the situative conditions of food SMEs; as food supply networks primarily consist of SMEs, especially at the agricultural production, trade, and food manufacturing chain levels, the suitability of any support option for food SMEs is of special importance. If potential solutions for improved coordination and transaction are not suitable for SMEs, these chain levels continue to remain a bottleneck for the efficiency and effectiveness of the entire food chain (see also Simchi-Levi et al., 2003). Potential facilitators or barriers may relate to the availability of an appropriate technological infrastructure, the opportunity for food supply network actors, including SMEs, to gain advantages from the adoption of electronic support, potential path dependencies from the information system structure currently in use at food supply network actors, or possible value-added in the traditional organizational arrangement not yet appropriately mirrored by electronic support, including relational trust.

3.1 Developing infrastructure for electronic coordination support in food supply networks

The availability of an infrastructure for innovative, electronic coordination and transaction support for food supply network relations may facilitate the emergence and implementation of innovative relations between food companies (see Fritz, Hausen, 2008). The availability of such an infrastructure represented by electronic trade platforms, also referred to as electronic marketplaces, is of particular importance for food SMEs as it reduces the need for companies’ own investments and therefore may lower the barrier for adoption of such technologies. Electronic
trade platforms have a principle advantage for SME based market situations as they may offer a bundle of diverse functionalities to SMEs such as coordination and transaction support, logistics services, market information, or financial services (Kaplan, Sawhney, 2000); in addition, trade platforms bundle supply and demand of a market, which is of particular relevance for market situations where value chain levels have different fragmentation degrees such as food chains, which results in a large number of transactions for one level of the chain; as a consequence, electronic trade platforms provide the potential to reduce the bottleneck of the SME based food chain levels

Four different models of electronic trade platforms providing coordination and transaction support services to food supply networks in Europe and North America were identified. With regard to the assessment of potential barriers to the implementation of electronic support in food supply networks, the observable diversity of highly differentiated platform models, each with a specific strategic focus and providing distinct services to different target groups of food supply network actors – chain levels, product groups – suggests that the availability of a supporting infrastructure has reached a high level of maturity. As a consequence, the availability of this differentiated infrastructure is, in principle, not a deficit for the introduction of electronic coordination support in food supply network relations.

With regard to assessing the further development tendencies of the supporting infrastructure for electronic coordination and transaction support on food supply networks, awareness of development tendencies of the electronic support infrastructure is necessary. Important evidence on development tendencies is that half of the platforms analyzed have started cooperation initiatives with other platforms, towards a networking of platforms. These development tendencies of the supporting infrastructure suggest a further coverage of food supply networks by electronic services and an adjustment to their requirements regarding coordination and transaction support. As a consequence it can be said that the current maturity level with the broad and highly differentiated electronic support offer together with the imminent development tendencies indicate that the availability of an infrastructure for electronic transaction and coordination support is not a deficit and barrier for the introduction of electronic support in food supply network relations.

### 3.2 Opportunities from electronic coordination and transaction support for complex, SME-based food supply networks

Food supply networks are shaped by a specific organizational structure with highly different fragmentation degrees at the different food chain levels (see Hausen, Fritz, Schiefer, 2006). Even though the food chain levels of agricultural production, trading, and food processing are structured by a high number of small and medium sized enterprises, different fragmentation degrees of the respective chain levels cause structural differences between trading partners. Consequence is an altering number of companies on the chain levels, which causes a changing number of process interfaces between companies, resulting in high coordination complexity of information and material flows along the chain.

Experimental studies were performed using a software prototype for electronic coordination and transaction support, which was tailored to reference transaction processes of the considered scenario and adapted to the requirements of the food supply network actors in terms of interorganizational relationships between the companies, the product characteristics, the electronic system operators, and the system users (see Hausen, 2005). Study I compared the transaction process efficiency of electronic support for direct order processes with regard to traditional direct order processes. Study II compared the scenario of electronic support for request for quote (RfQ) processes without negotiation with regard to the transaction process efficiency of traditional request for quote processes without negotiation. The experimental studies considered the
supply of agricultural producers (buyers) with agricultural input by traders (sellers). For the interpretation of the results, it is important to know that process efficiency is one criterion among others for the operating efficiency of a transaction process. The significance of the criterion process efficiency strongly depends on the application scenario of the transaction process. In addition, transaction efficiency is only one factor for the overall acceptance of electronic coordination and transaction support. However, as transaction costs may be considered as disadvantage (e.g. Picot, Wenger, 1988) and efficiency gains reduce transaction costs, these benefits may be a key driver for food network companies, including the SMEs, to start considering the improvement of the traditional coordination and transaction environment (see Favier et al., 2000) by adopting electronic support. Efficiency benefits as a major factor influencing the operational efficiency may be the basis for competitive advantages for food SMEs and their supply network; the suitability of electronic support for SME based market situations can be derived. With regard to the improvement of efficiency of the food supply network, the efficiency improvements at the SME-based food chain levels are of primary importance to move towards a global optimum of the entire food chain and to overcome the bottleneck created by the SME shaped food chain levels.

3.3 Current barriers for adoption of electronic food supply network coordination support

The awareness of reasons for the low current adoption rate of electronic support for coordination of food supply networks, especially at SMEs (European Commission, 2005), is important for the development and assessment of suitable solutions (see Fritz, Hausen, in press). One of the reasons may relate to the current occurrence of the IT system landscape implemented in food supply networks, together with potential differences on the chain levels, system breaks, and path dependencies resulting in legacy systems. Another reason may relate to potential value added of traditional coordination and transaction processes other than efficiency. Figure 1. Supply network management concepts and electronic support systems in the crop production shows on the left-hand side the current landscape of supply network management concepts in the food supply network for crop production, including different degrees of maturity of implementation; on the right-hand side, the figure shows the current implementation of electronic support systems related to supply network management and coordination, both cross company and company internal, also including different degrees of maturity of implementation.

The figure illustrates that the implementation and use of IT-based concepts for supply network management and the use of related electronic systems is dominant at network levels with large multinationals (process industry, agrochemical producers, food producers, retail). In the parts of the network with small or medium sized companies, however, their implementation and use is low and with heterogenic maturity due to the situation and type of these companies, which is a barrier to the further use of electronic support and which underlines the bottleneck character of the SME shaped food chain levels.

Concerning the further implementation and adoption of electronic coordination and transaction support, this currently observable diversity of the electronic support system landscape would require high integration efforts to link the diverse system types and their functionalities. Related investment requirements, however, cannot be tackled by small and medium sized enterprises; in addition, any previous investments in system infrastructures would be lost. However, this barrier to the further adoption and implementation of electronic transaction and coordination support is under the influence of the course of time and related advancements. With the availability of a sophisticated offer of electronic trade platforms (see chapter 3.1 Developing infrastructure for electronic coordination support in food supply networks) as an infrastructure offering services for electronic coordination and transaction support in food supply networks, it can be said that the currently diverse landscape of information systems implemented in food
supply networks is likely not to continue to be prevalent as a barrier to further adoption in the future.

Confronted with electronic coordination and support solutions adapted and tailored to the requirements of crop supply network, actors considered the lack of personal contact through an anonymization of the trading process as one of the most important reasons not to implement electronic coordination and transaction support (see also Fritz et al., 2007). Personal contact is not only occurs in the current process realization due to embeddedness in traditional company cultures, but is the source of value added for companies in food supply networks: personal contact in the business relationship is considered of uttermost importance as it is the basis for the emergence of long-term business relations and the creation of trust, which reduces uncertainties regarding the reliability of the trading partner. This evidence is in line with general literature about the role of trust in new business relations (see Oosterkamp et al., 2008 for an overview, see also Mentzer et al., 2000).

According to actors in the part of the food supply network dealing with agricultural supply, personal contact and trust facilitates the exchange of value added information about the exchange as well as the business environment. In the agricultural supply network, the creation of a trust-based customer relation is particularly important for the suppliers to secure market share in the long run; the creation of the relation is supported by communication-based services regarding advising or logistic planning. From the perspective of the supplier, business relations are important for their business results as maximum margins can be reached in long-term business relations where customers react less price sensitive. The personal relation is also the basis and prerequisite for the identification of the price, which is often set on an individual basis. Subjective perception of a good negotiation result in turn leads to more intensive business relationships. Personal relations are considered as source for trust, which then reduces the perception of uncertainties regarding payment behaviour of buyers and represent a business risk reducing asset. The use of electronic support for coordination and transactions would allow realizing efficiency gains, but is perceived to reduce the degree of personal contacts for the creation of trust between business partners and supplier-customer communication, service, and business risk

**Figure 1.** Supply network management concepts and electronic support systems in the crop production network
containment (Fritz et al., 2007, Briz et al., 2008)

However, in any traditional business relationship, personal contact and personal experience as sources for trust only occur once the relation has developed. As a consequence, to tackle the challenge of depersonalized exchanges in electronic coordination and transaction support through the creation of trust, the life cycle of the relation needs to be considered (see also Matopoulos et al., 2006) and potentially different preferability and means of electronic support along the life cycle phases might be the consequence. To support the establishment of a new business relation, information provision to create trust and confidence should be in focus (Luhmann, 2000) as it is obvious that information may be provided prior to the establishment of the business relation. Throughout the later phases of the relationships life cycle, efficiency of the transaction process together with the support of communication between the partners to further intensify the relationship as basis for further trust should be in focus.

4. Trust in traditional food supply network relations

To assess and understand potential mechanisms for the generation of trust in emerging, electronically supported food supply network relations, it is of critical importance to first understand the role and development mechanisms of trust in traditional food supply network relations, especially with focus on the relevance of personal contact and other, alternative trust creating mechanisms such as the provision of information.

4.1 The role of trust in European food supply networks

Little is known about the current level and sources of trust in European food supply networks. Based on a survey in five European countries – Germany, UK, Ireland, Poland, and Finland – with 747 respondents, the current level of trust between companies is assessed together with its influencing structural factors in European food supply networks (see Fritz, Fischer, 2007). Sources of trust in business relations in food supply networks are determined by estimating a structural equation model. Special focus is given on the extraction of those sources of trust, which can be actively managed as these are of particular interest for potential use in electronic coordination and transaction support.

Figure 2. Results of the structural equation model for the creation of trust shows the results regarding the creation of trust in food supply networks. In the relationship between the food chain levels farmer – processor, three variables have a positive and statistically highly significant impact on the measured trust levels in a supplier/buyer: good communication, the existence of personal bonds and a positive past collaboration experience. The most important determinant is collaboration experience, followed by good communication and the existence of personal bonds. All three determinants are positively and statistically highly significantly correlated to each other, suggesting that the existence of personal bonds contributes to good communication and to positive collaboration, and vice versa. Overall, using only these three determinants, 52% of the variance in the observed trust levels can be explained.

In the processor–retailer relationship, the situation is very similar to the upstream situation, with the exception that the existence of personal bonds does not have a statistically significant influence on the observed trust levels. In this case, with only two variables, good communication and a positive past collaboration experience, 63% of buyer/supplier trust can be explained. As before, the two determinants reinforce each other positively and highly significantly.

The estimation results imply that trust is positively effected by good communication and a positive past collaboration. The existence of personal bonds, however, does not always play a role but still seems to be important when dealing with farmers. The estimations suggest that trust – at least to a large extent – can be actively built by companies by communicating effectively and
by collaborating positively over a longer term period. As a consequence, for any active management and creation of trust in food chains, the quality of the communication, realized by the frequency of communication and the quality of the information, together with the collaboration experience are the most important determinants. It must be added though that the emergence of trust to a large extent depends on positive collaboration experiences, which only evolve over time.

**Figure 2.** Results of the structural equation model for the creation of trust

Notes: .00 = standardized estimated parameters: farmers <-> processors (n=533); processors <-> retailers (n=205); *** statistically significant at least at the 99% confidence level; .00 = squared multiple correlations (R²); Model fit measures: CMIN/DF = .913 (p = .455); NFI = .997; RMSEA = .000.

However and of crucial interest for the creation of trust for electronic coordination and transaction support at the beginning of a relationship life cycle, even though to a comparatively smaller extent, with the quality of the information communicated impacting the level of trust at a business partner in food supply networks, a management means to actively increase the level of trust ex ante and ad hoc at the business partners is available even for “first-time” transactions where no past collaboration history exists. This implies that increasing the quality of the transmitted information, all other things being equal, trust may instantly be created at a business partner who anticipates from the availability of high quality information on the reliability and trustworthiness of his future business behavior. The appropriateness of the quality of information and the frequency of communication for ad hoc and ex ante trust generation is of particular interest for trust generation for electronic coordination and transaction support at the beginning of the relationship life cycle in food supply networks as information and communication technology is highly suitable for the transmission of information and the support of communication. As a consequence, a depersonalized means of trust generation is given.

### 4.2 The role of trust in the life cycle of food supply network relations

To better understand the interdependence between trust and information-based control in hybrid governance structures, and its influence on the further alignment of the governance structure, three case studies analysing the relationship life cycle from the supplier selection and relationship establishment process as well as the further developing governance between Italian retail-
ers – Grande Magazzini Fiorini (GMF), Coop Italia, Coop Centro Italia (CCI) – and their suppliers were conducted (see Fritz et al., 2008). The case studies were selected with respect to the institutional environment the governance structure deals with (two cases relate to cooperative firms, rooted in a comprehensive cooperative environment), geographical location and size. Special focus is on the above considered areas information exchange and communication, risk perception, control mechanisms, trust. The results are presented in the form of a cross-case analysis to underline the differences and similarities among the different case studies and to facilitate the deduction of implications for trust in electronic support for food supply network relations.

The role of communication, understood as sum of information exchanges between retailers and their suppliers, is of uttermost importance in all case studies analyzed. This also projects on the importance of collaboration among the different food chain levels, which facilitates ex-post transaction cost reduction. Based on a trust emergence strategy, GMF aims at developing stable relationships with its suppliers based on long-term contracts; communication plays a central role in these relationships as it is essential to guarantee the efficiency of transactions and to reduce the modification of risk perception. This means that the emergence of trust leads to cooperation among the supplier and the buyer, thereby enabling stable transactional relationships and consequently reducing the risks of free-rider behaviors. The economic consequence lies in the reduced need for control mechanisms, which leads to saving transaction-monitoring costs and to a stable risk perception. Coop Italia has developed a systematic structure of communication, which makes the information flow with its suppliers easier. The cooperative approach and the search for a common cooperative decision-making mechanism gives trust an important role, although the complex structure of this firm relies on incentives and production protocols in order to gain transactional efficiency. Authority is the main mechanism of coordination among firms: the imposition of productive protocols makes risk attitudes homogeneous for all suppliers, while trust is balanced by a control mechanism, which became more important than in GMF.

In CCI strategies, the roles of control and collaboration are considered as very important. Law strongly influences its suppliers’ behaviors, whose cognition-based trust requires a relationship with CCI based on trust and, at the same time, on collaboration. The necessity for information and knowledge on productive processes, associated with monitoring and control mechanisms, allows CCI to prevent behavioral risks. At the same time, developing a strategy based on collaboration and continuous assistance makes cooperation a specific asset of transaction, which is expressed in terms of less integrated coordination forms and which allows CCI to reduce transaction costs, though faced with a higher risk perception.

The main conclusion of the case studies is the corroboration of the hypothesis that conditional trust emerges as a consequence of the relationship development pattern among parties predefined by the hybrid governance structure. The three cases contribute to corroborate the hypothesis and emphasize the role of communication, risk attitude and the trade-off between trust and control. The differences among the three cases could be related to the specific history of each company, whereas the more intensive profile of trust in the case of GMF could be interpreted as a consequence of the non-cooperative institutional setting. A similar pattern can be observed for the development process of the relationship between retailers and their suppliers. Once the selection has been realized using intense information exchange and communication as well as control activities regarding the real product quality, a trust-based relationship with collaboration, strongly simplified contracts and decreased control activities can be observed.

Of particular interest for considerations regarding the intensity and focus areas of electronic coordination and transaction support of food supply network relations and the role of trust is the evidence on the interplay and nexus between information provision and trust along different life cycle phases of the relationship. Crucial evidence is that trust does evolve at the beginning
The Role of Trust in Emerging Food Supply Network Relations

through information exchange in a situation where no prior collaboration, including positive experience, between the parties has existed. At the beginning of a new relationship, information exchange and communication between potential trading partners, e.g. about production protocols, is necessary and suitable for the creation of a level of trust sufficient for the relationship to continue. Hence, information exchange and communication is a means for depersonalized trust generation. Electronic support for information exchange and communication between the parties might present advantages regarding the efficiency and efficacy; suitability of electronic support is suggested for this phase. During the further development of the relation, monitoring and control information is exchanged and increases the level of trust; electronic support for information exchange and communication processes regarding monitoring and control activities may present advantages as well. Once the continued development of trust during the life cycle of the relation has contributed to an alignment of the governance structure towards increased efficiency, necessity for information exchange and communication processes between the trading partners decreases. In this mature life cycle state in later transaction frequencies, electronic support may focus on the increased efficiency of the settlement of the transaction. As a consequence, the strategic development of electronic support needs to focus on a dynamic adaptation to the changing requirements of the transaction frequency along the life cycle of the relation. Information provision at the first time transaction between new trading partners seems to be most critical and challenging with regard to trust creation in electronic support.

5. The role of trust in emerging, electronically supported food supply network relations

Based on the evidence of the role, the sources, and the development of trust along the life cycle of relations in traditional food supply network, this chapter has the objective to contribute to the understanding of the role and generation of trust in emerging food supply network relations supported by electronic coordination and transaction support.

5.1 Conceptual considerations on trust creation in emerging food supply network relations

Based on the results presented in chapter 4, especially on the role of information as source for trust in business relations, also at the beginning of a relationship life cycle, the position of trust creating information provision in a transaction process will be investigated (see Fritz, 2007). For the generation of trust as basis for the implementation of electronic coordination and transaction support in food supply networks, it is necessary to identify appropriate information and communication elements for each of these phases, but with special focus on the information and negotiation phases. Requirements from decision making regarding information provision and the mechanisms for the creation of trust through information and communication have to be linked to the transaction phases, taking into account the position of the transaction in the life cycle of the relationship between buyers and sellers. As a consequence, information provision for the creation of trust as a transaction decision variable might be different in the transaction phases of different transaction frequencies along the relationship life cycle (see also Figure 3. Transaction frequencies and process phases along a relationship life cycle 3).

In transactions, information provision to actors on

- the transaction situation for the company with potential gains and advantages as well as risks or losses regarding the outcome, and
- the transaction environment with external influences creating trust and being control mechanisms or hazards and risks
may lead to transaction decisions at the actors involved (Tan, Thoen, 2001). Transaction decisions are taken in the information and negotiation phases of a transaction process and are the result of an unstructured, fuzzy reasoning process (Turban, 1988).

**Figure 3.** Transaction frequencies and process phases along a relationship life cycle

Integrating the results and implications presented in chapter 4, Table 1. Suggested suitability and necessity of electronic support for trust creation along relationship life cycle summarizes the suggested principle suitability and necessity of electronic information provision and communication support for the creation of trust in emerging food supply network relations. It takes into account the transaction phases and the position of the respective transaction in the relationship life cycle and differentiates between information-based trust, which develops ex ante, before any personal experience has been made, and ex post trust, which develops based on the provision of monitoring and control information after the transaction has been settled. As efforts for the creation of trust in electronically supported food supply network relations can decrease with the evolvement of the business relationship along the life cycle as trust between the trading partners has already been established before, potential efficiency of the coordination and transaction support increases.

**Table 1.** Suggested suitability and necessity of electronic support for trust creation along relationship life cycle

<table>
<thead>
<tr>
<th>Position of transaction in relationship lifecycle</th>
<th>Transaction phase</th>
<th>Ex-ante, information-based trust creation</th>
<th>Ex post, monitoring experience-based trust creation, facilitated through control information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Information</td>
<td>XXXXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Negotiation</td>
<td>XXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Settlement</td>
<td>XXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 After-Sales</td>
<td>XXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Information</td>
<td>XXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Negotiation</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Settlement</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 After-Sales</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Information</td>
<td>XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Negotiation</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Settlement</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 After-Sales</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**5.2 Creation of trust for emerging food supply network relations**

To facilitate the implementation of electronic coordination and transaction support in food supply networks, the essential question is how to communicate which information content to create
trust as decision variable for transactions in emerging food supply network relations (see Fritz, Canavari, 2008). Based on the principles of trust generation in traditional food supply network relations, trust creation in electronic coordination and transaction support, and the focus on the information and negotiation phases of a transaction process, a hierarchical catalogue with informational trust elements was developed, which also includes experience based elements from the electronic coordination and transaction support system environment.

Figure 4. Trust generating factors for electronic coordination and transaction support in food supply networks shows the hierarchical model with the trust creation elements for in electronic coordination and transaction support in food network relations. It splits the objective of “transaction trust” into “transaction partner” and “control mechanisms”, which are split into dimensions of trust criteria contributing to the generation of trust. Trust criteria for electronic coordination and transaction support (see also Oosterkamp et al., 2007, Kohlhaas et al., 2008) were allocated to the appropriate trust dimensions of the model hierarchy with special focus on the information and negotiation phases of a first-time transaction with a new partner.

![Figure 4](image-url)

**Figure 4.** Trust generating factors for electronic coordination and transaction support in food supply networks

As food supply networks consist of different subnetworks such as fresh produce, meat and meat products, grain and cereal products or milk and dairy products with differences in governance forms in the food subnetworks, differences in the antecedents for the generation of trust in electronic transaction support might occur. Different food subnetworks may have specific demands regarding trust generation for electronic transaction environments. To identify preferences re-
Regarding trust generation in electronic transaction environments in different types of food supply networks, the analytic hierarchy process (AHP) was used (Saaty 1990). The prioritization assessment was performed for fresh produce, grain, milk and meat at the food chain level primary production – manufacturing where the need for improvements and support of vertical coordination is particularly high (Taylor, Fearne, 2006).

**Figure**. Patterns in priorities regarding trust creation for emerging food supply network relations

With regard to trust generation of electronic coordination and transaction support environments for food supply networks, these different patterns of priorities towards informational elements for trust generation imply that different solutions for customized to the requirements of different food supply network scenarios are necessary. In addition to the need for distinct electronic support for different transaction frequencies throughout the relationship life cycle, the differentiation of the trust generation for electronic support is required for different food supply network scenarios.

Furthermore, the results imply (see also Haas et al., 2009) that different food supply network scenarios might have different suitability levels for trust generation in electronic support; different suitabilities of different food supply networks for electronic support throughout the relationship life cycle may be the consequence: The suitability of electronic coordination and transaction support for food supply networks where experience-based trust criteria play a primary role might be lower with regard to first-time transactions at the beginning of a relationship life cycle, even though first experiences with a new transaction partner can also be made during the negotiation phase of a transaction process. Electronic support of later transactions within a relationship life cycle with focus on the efficiency of the transaction process might be preferable in such scenarios.

### 5.3 Trust and transparency through tracking and tracing

In the food sector, an ever increasing demand for food quality and safety has lead to the legal requirement for traceability of food products in the Regulation No 178/2002 of the European Parliament. Traceability in food supply networks refers to transparency regarding the source and destination of a product and supports the identification and elimination of potentially contaminating batches (Poignée, 2008). By providing transparency and evidence on the origin of a food product – including producers, traders and manufacturers, tracking and tracing is a means...
to create trust in food supply network transactions (Hobbs, 2004). By offering information about the product’s destination in the food chain, traceability also provides the opportunity to focus recall activities in case of quality or safety failures and therefore to reduce financial risks for food companies related to recall situations. This may be an additional value of traceability contributing to the creation of trust between actors in food supply network relations to reduce uncertainty (see Fritz, Schiefer, in press).

Until now, traceability in food supply networks and related activities have been considered and realized separately from efficiency focused activities supporting coordination and transactions in food supply networks such as electronic trade platforms. This separated realization has been caused by different development paths and objectives of both activities. However, there is no justifiable reason for the separated realization of these activities; for several reasons, the combination of both activities would offer synergies and might even lower the barriers for introduction of both.

First, both activities build on the existence of an information system infrastructure (see Hannus, 2008). As a consequence, a joint infrastructure providing either services on a joint platform would allow for advantages for both activities and therefore increase the attractiveness of either activity and lower potential barriers for introduction. The diffusion of food chain wide information infrastructures for tracking and tracing could be used for the support of coordination and transactions in food supply networks and vice versa. In the sense of converging technologies, this might have a mutually reinforcing effect on the readiness of food supply network actors to implement both services. Second, obtainable traceability of a food product might be an additional factor for trust generation in electronic coordination and transaction environments for food supply networks. Availability of transparency information might reduce the information provision need at the beginning of a relationship life cycle between two new business partners as the product origin is made certain. In addition, traceability may reduce the monitoring need in later phases of the relationship life cycle and therefore add to the efficiency of the transaction process. The provision of information related to tracking and tracing of food products in the information phase of a transaction process would have the potential to create trust for electronic coordination and transaction support in food supply networks in the early stages of a relationship life cycle. Furthermore, the monitoring in later stages of the relationship would be supported and enhanced as well though the availability of tracking and tracing information for cases where deficiencies in quality or safety occur.

In addition, as both tracking and tracing applications as well as applications for improved coordination and transaction process efficiency are confronted with adoption barriers in food supply networks and both activities require an information system infrastructure, the combination of both on a joint platform infrastructure would allow for synergies. Synergies relate to the fact that tracking and tracing applications provide transparency and trust on products, which is of crucial importance for the introduction of electronic support for coordination and transaction for efficiency in food supply networks. Barriers for the introduction of both services could be lowered through the combined provision.

6. Potential impact of emerging food supply network relations on the food system

So far, the strategic considerations for the introduction of electronic coordination and transaction support for food supply networks have focused on potential advantages for food supply networks and their actors. However, in view of the question whether the introduction of electronic coordination and transaction support for food networks should be encouraged and possibly subsidized, a wider perspective on potential impacts on the food system is required. This chapter has the objective to present a framework for a cost-benefit-type of approach to assess potential impacts of changes in the efficiency of food supply network processes on the food system and
its actors (see Fritz, Schiefer, 2008c). The framework is supposed to support potential decisions on whether subsidizing the introduction of electronic support is reasonable and therefore provides policy decision support.

The assessment of potential impacts of electronic coordination and transaction support in food supply networks focuses on domains of interest to policy makers who design the institutional environment, which includes, e.g., subsidies for a specific economic activity. Such domains of interest involve subjects like, e.g., public welfare, the environment, public services or the economy but may also focus on effects related to specific groups like, e.g. enterprises or consumer groups (Adler, Posner, 2001). The framework presented here takes the perspective of the policy maker to support his or her decisions by providing information on the effects of changes of the institutional environment, e.g. on subsidizing certain economic activities of food supply network actors, on the food sector and its actors.

This framework models a scenario where one can capture appropriate data from a variety of sources including statistical data, case studies, or even expert knowledge for the analysis of effects of policy regulations in domains that are of policy interest. However, this model does not cover a complexity where the outcome of any policy initiative might be partly beyond the control of the policy decision maker but be influenced by decisions of other groups. If past developments do not allow the analysis of their expected behaviour through statistical analysis, the model has to be complemented by models that provide information of the effects of policy initiatives on these groups and their potential reactions. Of specific relevance in this context is the differentiation between different objects of analysis, e.g., between the levels of society (and policy), the level of individual actors which might include enterprises, consumers, and others, and the levels of the sector identified as the relevant groups of individual actors.

Critical points are relationships between levels. On the lower (e.g., enterprise) level the focus is usually on individual enterprises, on the level of society on impact domains or impact areas. The necessary transformation in information exchange has to consider these issues. Examples are activities in food safety and food quality where enterprises are responsible for food safety and quality, but where consumers expect policy to guarantee food safety and at least a baseline quality.

7. Conclusions

This paper has been driven by the objective to contribute to the understanding of the role of trust in emerging, electronically supported food supply network relations in order to facilitate the implementation of such innovative, electronic coordination and transaction support. To realize this objective, the thesis has followed a sequential procedure and has built on ten research papers. Further research is required to analyze potential differences in trust creation requirements in different food product lines in different countries in order to take into account possible cultural influences on the perception of informational trust creation and, as a consequence, the validity of these elements in different scenarios. Due to the global character of food supply networks, the intercultural relationship of trust development in cross-country transactions is of particular interest and necessary to facilitate the implementation of electronic coordination and transaction support for these exchange scenarios. In addition, further research is needed to precisely specify the operationalization of electronic trust elements for electronic support in food supply network relations, including potentially different needs towards operationalization in different food supply networks regarding the product exchanged and the cultural backgrounds of the respective trading partners. In addition, the integration of the concept of trust in emerging food supply network relations with the wider concept of sustainability, especially with its social dimension is of high interest. Furthermore, the impact assessment of emerging, improved food supply network relations through electronic support using the framework presented in this thesis is neces-
sary to decide on the preferability and necessity of potential political actions to support the implementation.

References


