The Role of Trust in European Food Chains: Theory and Empirical Findings

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Abstract

In Europe, consumer trust in food has become one of the most important factors for the stability of the food sector. An essential prerequisite for the ability to communicate the trustworthiness of food to consumers (B2C) is the creation, maintenance, and communication of trust between companies across the entire food value chain (B2B). For the management and preservation of trust in food chains it is important to know whether differences occur across European countries or whether distinct product chains show variations regarding trust. Based on a survey in five European countries with 747 respondents, this paper assesses the current level of trust between companies together with its influencing structural factors in European food chains and determines criteria allowing the active management of the level of trust in business relations in food chains by estimating a structural equation model.

Keywords: trust, levels of trust, determinants to trust, food chain management, trust management

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Introduction

In recent years, the issue of consumer trust and confidence in food has become one of the major factors for the stability of the European food sector (see Kjærnes et al., 2007). Much research has been done to develop strategies to communicate food safety and food quality to consumers (Verbeke, 2005). Communication strategies include information cues about where and how food products have been produced and transferred along the food value chain. One important factor for creating consumer trust in food is that European consumers react differently to food quality and safety communication strategies according to their home country and its cultural influence (Romano, 2005). For instance, it is known that British consumers have both the largest percentage of consumers who have trust in food and who distrust food as opposed to, e.g., The Netherlands where the group of distrusting consumers is less than half as large (Lobb et al., 2007). On a global level, cultural differences in consumer demands regarding food quality and safety are reflected in the demands of the European Union being the highest worldwide (Unnevehr, 2006).

An essential prerequisite for the ability to communicate the trustworthiness of food to consumers (B2C) is the creation, maintenance, and communication of trust between companies (B2B) across the upstream levels of food value chains. In addition to food quality communication, increased global competition and strategic developments towards networks of companies require trust among food companies (see Fritz et al., 2006). The economic relevance of trust between companies becomes apparent as it reduces transaction costs (see Dyer, 1997).

Little is known about the conditions of trust in European food chains and how to manage trust actively. For the management and preservation of trust in food chains it is important to know whether differences occur across European countries or whether distinct product chains show variations regarding trust. It is the objective of this paper to survey the level of trust between companies in European food chains together with influencing infrastructural factors and to analyze how the level of trust in business relations in food chains can be actively managed.

The paper first reviews relevant literature on trust in food chains and deduces a hypothesized model of trust emergence in food chains (see "Trust for Food Chain Management"). The Methodology section of this paper provides information about the survey and the evaluation methodology. Based on this information, an assessment of the levels of trust in European food chains is conducted and criteria allowing the active management of trust are analyzed (see "Results: Trust in European Agri-food Chains").

Trust for Food Chain Management

Relevance of Trust in Food Chains

The food sector is a complex network of companies involved in the production of food on different stages of the food production value chain from commodity production, processing and retailing to the consumer. Food products have search, experience, and credence characteristics (e.g., Peterson et al., 1997) and are processed at different stages of the value chain with different processing intensity, which may change their quality characteristics. In recent years in Europe, the issue of food quality and safety has become one of the major factors impacting the stability of the European food sector. Among others, this is reflected in the establishment of the European Food Safety Authority by the European Commission to study risks from food and to secure consumer confidence in the food sector and its products; food companies have established quality management and control schemes to secure food quality across the production chain.

As certain quality characteristics of food products cannot be scrutinized, any exchange of food products across the value chain induces perceived uncertainty and risks regarding potential opportunistic behavior of suppliers (see Akerlof, 1970, Nelson, 1970). To overcome uncertainties and perceived risks across food chains, mechanisms for the communication of food quality are in place. Various control mechanisms have emerged as communication device. They include quality signs, third party auditing, or guarantees (see Krieger, Schiefer, 2007). In addition, the enforceability of formal rules – the law – adds to the possibilities to control uncertainties in food chain business relations. The search, analysis, and monitoring of this information add to the costs of a transaction in the exchange of food across the chain (Williamson, 1985).

An important supplement and sometimes substitute for control in the exchange of food across the chain is trust between companies (Fynes et al., 2001). Literature provides many definitions of trust in business relationships, but their essence is that trust is one party's belief that the other party will not exploit its vulnerabilities (Barney, Hansen, 1995) and that trust builds on both obligations and future expectations (Koenig, Van Wijk, 1991). In general, trust is an expectation into the future behavior of others and a mechanism to reduce complexity in a social decision situation; it emerges after positive personal experiences (Luhmann, 2000). However, information can anticipate the creation of trust and confidence. Trust is a highly subjective concept with cognitive and emotional dimensions (Lewis, Weigert, 1985); its emergence in an individual depends on the risk attitude and perception of the reality.

Control and trust in business relations are highly interlinked (Das, Teng, 1998). For chain management, the level of trust between companies is of interest as it is less

costly than control (Zak, Knack, 2001, Chiles, McMackin, 1996) as it lowers transaction costs by reducing, e.g., the efforts for contracting or control and monitoring (Dyer, Chu, 2000, Wilson, Kennedy, 1999). This is why trust between companies is often considered as an asset creating value and supports competitiveness through facilitating, e.g., strategic alliances (Adams, Goldsmith, 1999) and exchange (Dapiran, Hogarth-Scott, 2003, Shapiro et al., 1992). For food networks, for instance, the impact of trust and social networks on the business performance has been compared by Sodano and Verneau (2006) for two tomato production networks in different Italian regions. In general, the significance of trust, relational and social capital for competitive advantages is underlined by the emergence of concepts such as relationship marketing (see Shet, Parvativar, 1995) and the relational view of the firm with th notion of "relational capital" (Dyer, Singh, 1998, Gulati et al., 2000).

Potential Structural Factors Influencing Trust in Food Chains

In general, the market structure of the food sector is characterized by a high degree of fragmentation on upstream commodity producing chain stages and increasing concentration on downstream levels with a peak in concentration at the retail stage (see McCorriston 2002, Hausen et al., 2006). Companies on the fragmented stages of the value chain are mostly small and medium sized enterprises (SMEs). For example, in Europe 99% of companies at the food processing stage are SMEs creating 49% of the sector's turnover and employing 61% of the sector's workforce (CIAA, 2005). SMEs are different from larger enterprises in institutional, functional, management-related and personal aspects (e.g., D'Amboise, Muldowney, 1988, Nummela, Hurmerinta-Peltomäki, 2001). As a consequence, differences in the prevalence to trust can be assumed for large enterprises as opposed to small or medium sized companies (see also Fritz, Hausen, 2007).

The food sector consist of different value networks related to the production and marketing of different food product groups such as fresh produce, meat and meat products, grain and cereal products or milk and dairy products. The product groups show different product characteristics; different requirements are the consequence to facilitate the exchange across the food chain (Hausen, 2005), which leads to different chain structures and governance forms, respectively (Fischer et al., 2007, Goldsmith, Bender, 2004, O'Reilly et al., 2003). Governance forms range from spot market transactions over networks of companies where repeated transactions and relatively stable relationships can be found between companies, to contractual relations (Zylbersztajn, 1996, Galizzi, Venturini, 1999) to vertical cooperation and strategic alliances potentially involving financial participation. The type of governance form is also related, among others, to the product strategy of companies involved. For instance, high quality meat products in Germany are exchanged within close company relations, standard quality meat is traded on the spot market (Schulze et al, 2006a).

Table 1: Characteristics of Product-Specific Food Chains, Stage Farmer–Processor

	Fresh produce	Meat	Grain	Dairy
Product characteristics	Perishable, seasonal and uncontinuous production	Batch production	Changing qualities due to varying production conditions	Milk: continuous production
Governance	Short term contracts, mediated by specialised traders (produce type, production region); long term relationships	Repetition of short term contracts between same partners	Mostly long term relationships with mutual bindings, investments and cooperation; seldom contracts	Mostly cooperatives; also contracts; also spot market mediated by trader
Market characteristics	Buyer's market, small margins	Increasing prices	Recently: increasing prices	Decreasing prices, EU: milk quota

Table 1 shows characteristics for different product-specific food chains for the farmer–processor stage of the value chain.

Governance forms involve different intensities of personal contacts between suppliers and buyers and therefore different foundations for the emergence of trust since experience from personal relationships and personal communication are important antecedents to trust (Luhmann, 2000). As trust evolves in longer term business relationships, it is both a prerequisite and result of strategic alliances and joint ventures (Sporleder, 1999, Adams, Goldsmith, 1999, Peterson et al., 2001).

With regard to governance and trust in food chains, Claro and Claro (2004) put emphasis on informal safeguard mechanisms in the chain relationships such as mutual trust, long-term orientation and joint actions in addition to formal contracts in international organic coffee supply chains from Brazil to the Netherlands. Along with experiences from relationship marketing (Hingley, Lindgreen, 2002) and supplier relationship management (Ryder, Fearne, 2003) in food networks, long-term relationships based on trust are discussed as alternative to vertical integration and contracts for the German pork sector (Schulze et al., 2006b). As a consequence, we assume that the level of trust in European food chains is influenced by the governance form, the stage of the food value chain, and the type of product with its requirements for trust.

According to the results on the cultural influence on consumer trust in food (see Lobb et al., 2007), we can assume that cultural differences occur in business relations in food chains in different European countries as well. According to Hofstede and Hofstede (2005), cultures are coined by the dimensions individualism, power distance, masculinity, uncertainty avoidance, and short/long term

orientation, which all relate to the willingness to trust a business partner (see also Osinga, Hofstede, 2006, Doney et al., 1998). For example, individualistic and masculine cultures in Anglo-Saxon countries or Germany would place the legal system and anonym, formal control above personal bonds and trust in business relationships. Feminine cultures in Nordic countries would prefer trust and – even if being cheated – try to collaborate rather than compete. Figure 1 shows cultural differences in the five dimensions for a group of European countries.
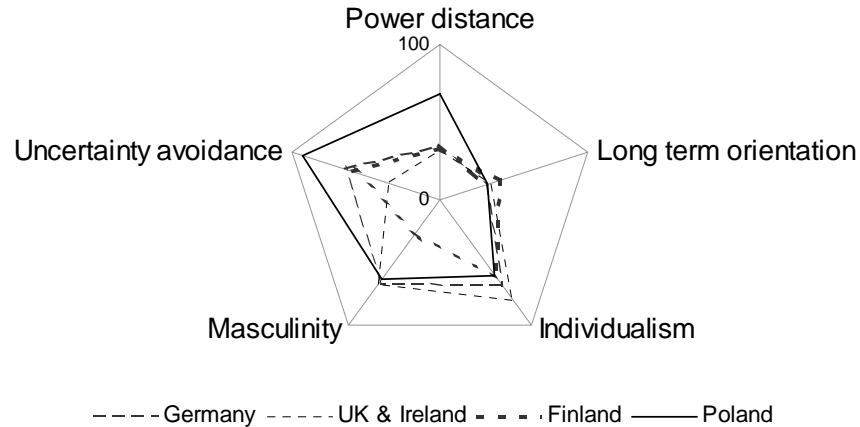

Figure 1: Differences in Cultural Dimensions across Europe
(based on Hofstede, Hofstede, 2005)

As a consequence, we can assume that the level of trust in European food chains is influenced by the cultural background of the country, the type of product with its requirements for trust in the relation and the stage of the food value chain involved.

Management of Trust in Food Chains

For the purposeful management of trust between suppliers and buyers or within an alliance or partnership, it is important to know the factors for the emergence of trust, which can be directly influenced by food companies. According to Luhmann (2000), the most important general trust factors are positive experiences, which have been made personally, the personal relationships between people evolving with the time provided that positive experiences have been made, and communication being the bridge to personal relations. Trust factors in business relations such as company networks, alliances, or partnerships relate to both interpersonal and interorganizational elements such as competence, benevolence, integrity, and communication (Ganesan, Hess, 1997, Blois, 1999, Tuten, Urban, 2001). In food chains, literature shows different results for trust factors. For instance, Batt (2003) identifies perceived honesty, credibility of information, reliability of promises, satisfaction with relation, goal compatibility, and

investments in relation as trust generating factors in the Australian fresh produce chain. Banterle et al. (2006) analyze the effects of voluntary traceability and therefore information exchange on coordination in the Italian dairy sector and identify increased collaboration and trust in chains with voluntary traceability. Hornibrook and Fearne (2003) point out the importance of personal relationships between chain members in contracts in beef chains in the UK. Trust factors for pork farmers are satisfaction with the slaughterhouse and the slaughterhouse's farmer orientation (see Schulze et al., 2006a).

Building on these results, the paper hypothesis that for the emergence and management of trust of buyers towards suppliers in food chains is determined by (see also Figure 2):

H1: *personal bonds* and personal relationships between the responsible persons in the respective companies,

H2: the experiences made during *past collaboration* with the supplier/buyer, which may be satisfactory or not and confirm perceived reliability and

H3: the *quality of communication*, which is influenced by the quality of the information content exchanged, e.g., in terms of its credibility, its structure, its timeliness, or its preciseness, and the frequency of communication, which in turn is a basis for the development of personal bonds,

H4: all factors are positively interrelated suggesting that, e.g., personal bonds enhance positive collaboration and quality of communication and vice versa.
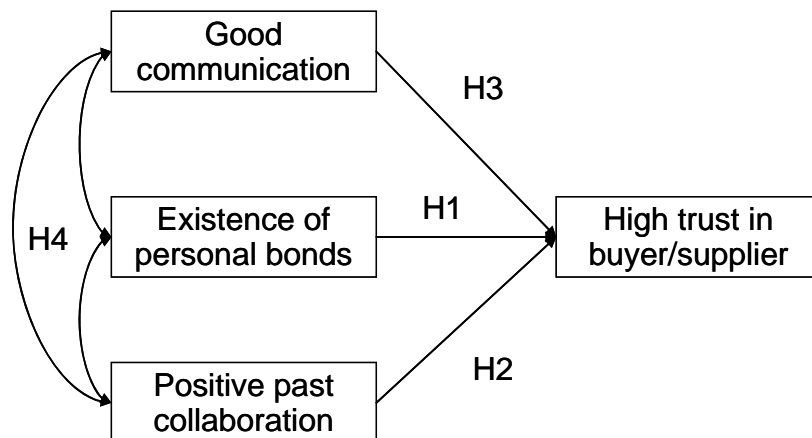

Figure 2: Hypothesized Relationships between Trust-Determining Factors

Methodology

To test our hypotheses, we study the trust situation in five different EU countries (Germany, UK, Finland, Poland and Ireland) for two different commodities/products (meat and cereals) and two different value chain stages (upstream: farmers–processors and downstream: processors–retailers).

Research Context

The empirical investigation for this paper is embedded in the EU FP6 FOODCOMM project[1], which aims at analyzing the key factors influencing economic relationships and communication in European food chains.

Following the review of the academic literature, as a second step, a pilot study on economic relationships in agri-food chains involving expert interviews was conducted with key informants mostly coming from large companies and industry/trade associations, most of them holding senior management positions. The procedure and outcome of these expert interviews are described in Fischer et al. (2007).

Questionnaire Development and Data Collection

Based on the pilot study findings, a survey instrument was developed in order to validate the previous results but mostly to expand the acquired understanding of the relationship situation in EU agri-food chains. While industry experts are a valuable source of information, experts are often obliged to offer 'official' and 'consensus' views. Consequently, a richer picture (in terms of completeness and level of detail) may be obtained by surveying involved businesses directly. The questionnaire needed to be used in different countries, therefore considerable effort was spent on the wording, the response formats (i.e., measurement scales) and the clarity of instructions. After translation into the respective languages, the survey instrument was pre-tested separately in the different countries, which resulted in some minor changes in its design.

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[1] 'Key factors influencing economic relationships and communication in European food chains' (FOODCOMM, SSPE-CT-2005-006458) which is funded by the European Commission as part of the Sixth Framework Programme. The collaborating laboratories are: Department of Agricultural and Food Market Research, University of Bonn, Germany (Co-ordinator); Land Economy Research Group, Scottish Agricultural College (SAC), Aberdeen, UK; Institute for Agricultural Development in Central and Eastern Europe (IAMO), Germany; The Ashtown Food Research Centre (AFRC), Teagasc, Dublin, Ireland; Ruralia Institute, University of Helsinki, Finland; Institute of Agricultural and Food Economics (IAFE), Poland and Department of Agricultural Economics, Agri-Food Research and Technology Center (CITA), Spain.

The collection of the data differed across the collaborating countries. Overall, the obtained samples are self-selecting, i.e., neither randomly drawn nor quota-based (with the exception of the Finnish sample which was randomly drawn). The main contact method was the use of mailed questionnaires (together with follow-up phone calls or a subsequent mailing to remind participants). In some countries, personal interviews were conducted (mostly with farmers) or respondents were interviewed by telephone. In parallel, an online survey platform was established (which also provided a benchmarking functionality for participants as an incentive and immediate feedback mechanism), which was advertised using a wide range of public relation and marketing measures aimed at maximizing the chances that relevant businesses get to know of the survey and thus have the opportunity to take part. In addition, active collaboration with sector organizations and trade/industry associations was sought which informed relevant farmers and companies using (i) newsletters, (ii) press releases, (iii) animated website banners, (iv) telephone calls, (v) emails, (vi) SMS and/or (vii) project flyers. The cross-country, multi-commodity survey of farmers, food processors and retailers was still ongoing in some countries at the time of the production of this paper. The subsequent analysis is based on the 747 so-far obtained valid responses. A more detailed description of the representativeness of the obtained data and various reliability and construct validity tests can be found in Appendix A.

Model Estimation

Structural equation modeling (SEM; also called covariance structure analysis) is used in order to empirically test our research hypotheses.[2] In its most general form, SEM consists of a set of linear equations that simultaneously test two or more relationships among directly observable and/or unmeasured latent variables. While SEM serves purposes similar to multiple regression, differences exist between these techniques. As an extension of the general linear model, SEM is built on more flexible and thus more realistic assumptions about the data to be used. In particular (see Bollen, 1989), SEM allows (i) interpretating of estimation results even in the face of multicollinearity between regressors, (ii) using of confirmatory factor analysis to reduce measurement error by having multiple indicators per latent variable (i.e., testing constructs), (iii) testing models overall rather than coefficients individually, (iv) testing models with multiple dependents, (v) modeling mediating variables, (vi) modeling error terms, (vii) testing coefficients across multiple between-subjects groups, and (viii) handling difficult data (in particular non-normal or incomplete data). A technical description of the statistical methodology

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[2] We use the AMOS software package (version 6.0), with unbiased covariances as input matrix. Missing values are present in our dataset and consequently maximum likelihood estimation was the preferred estimation method. We test for univariate and multivariate normality of the key variables using standard routines; however, we do not find worrying deviations from these distributions.

underlying SEM estimation and a description of common measures to assess estimation goodness is provided in Appendix B.

Results: Trust in European Agri-food Chains

In this section, first we report trust levels across different agri-food chains, countries, value chain stages and governance forms. Second, the results from the SEM estimations are discussed.

Trust levels

Tables 2 and 3 list the measured trust levels for two different commodities/products (meat and cereals) and separately for the value chain stages (i.e., the farmer-processor and processor-retailer relationships).[3] The perceived average trust levels across the different assessed EU countries and for different governance forms are displayed.

In the meat chain (Table 2), trust levels are overall high. In the downstream relationship, trust levels are generally higher, although Germany seems to be the exception. These differences between these chain stages are overall statistically significant at the 99% confidence level (using univariate ANOVA testing). Within the chain stages, the differences between the countries are also statistically significant the 99% confidence level. However, these differences seem to be too small to have practical implications. Nevertheless, in downstream as well as in the upstream relationship, Finland seems to have the lowest trust levels while Poland has the highest. These results are interesting in so far as the cultural dimension theory (see "Potential Structural Factors Influencing Trust in Food Chains) would have led to different expectations. Comparing the trust levels across different governance forms, it is shown that no major differences between them seem to exist. Only for the 'financial participation arrangements' category the trust levels are considerably lower in the farmer-processor relationship. In the downstream relationship, this finding is confirmed. However, in both relationships the reported trust levels are not statistically significantly different at the 95% confidence level.

In the cereal chain (Table 3), trust levels are equally relatively high and in general higher in the downstream relationship (with the exception of Germany again). However, in this case, these differences are overall not statistically significant at the 95% confidence level. Within the individual relationships, in the farmer-

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[3] The given scores are averaged across farmers and processors in the 'Farmer–Processor' relationship and across processors and retailers in the 'Processor–Retailer' relationship. While it is likely (and indeed the case) that upstream and downstream stakeholders rate the respective relationships differently, in this paper we are interested in comparing the two chain-level relationships rather than the different stakeholders.

Table 2: Trust Levels* in B2B Relationships in EU Meat (beef, pig) Agri-food Chains

		Farmer–Processor	Processor–Retailer
Country	Germany	5.7 (17)	5.0 (10)
	UK & Ireland	5.6 (71)	6.1 (15)
	Finland	5.0 (66)	5.7 (15)
	Poland	5.7 (222)	6.1 (105)
	Total	**5.6 (376)**	**6.0 (145)**
Governance Form	Spot market	5.6 (62)	5.8 (2)
	Repeated market transactions with same supplier/buyer	5.6 (176)	6.0 (9)
	Contracts	5.6 (67)	5.9 (97)
	Financial participation	4.6 (13)	6.3 (4)
	Mixed	5.5 (33)	5.6 (5)

Notes: * Measured as a single item, using a seven-point rating scale (1 = very poor, …, 7 = very good). In parentheses: no. of observations.

Table 3: Trust Levels* in B2B Relationships in EU Cereals (wheat, barley, rye) Agri-food Chains

		Farmer–Processor	Processor–Retailer
Country	Germany	6.0 (39)	5.4 (17)
	UK & Ireland	5.7 (89)	6.0 (29)
	Finland	5.4 (10)	6.0 (2)
	Poland	--	--
	Total	**5.6 (138)**	**5.8 (48)**
Governance Form	Spot market	5.3 (23)	5.0 (1)
	Repeated market transactions with same supplier/buyer	6.1 (33)	5.7 (19)
	Contracts	5.5 (33)	6.1 (13)
	Financial participation	5.0 (1)	--
	Mixed	5.5 (25)	5.9 (5)

Notes: * Measured as a single item, using a seven-point rating scale (1 = very poor, …, 7 = very good). In parentheses: no. of observations.

processor case the differences are statistically significant at the 95% confidence level between the individual countries but in the processor-retailer relationship they are not. However, as in the meat chain, the differences are too small to have any real practical implications. Across the different relationship types, the situation seems to be similar to the meat chain, with the lowest trust levels for the 'financial

participation' governance form in the upstream relationship. However, as before, since those differences fall into the sampling error range, and are small in practical terms, no reliable conclusion can be drawn.

Overall, it appears that trust levels are comparatively high across the investigated EU countries, commodities/products, chain stages and governance forms. In addition, no meaningful differences can be detected. The only larger difference seems to be across the downstream and upstream relationships, with trust levels generally being higher in the latter one (with the exception of Germany).

SEM Estimation Results

Given that trust levels are relatively similar, the data from the different countries and commodities were pooled into one single dataset for the purpose of investigating the determinants of trust. We only explicitly control for potential differences in the upstream and downstream relationships, as there seem to be more visible differences, at least in the meat chain. Following our theoretical discussion above, we now proceed to test the model hypothesized in Figure 2 (above).
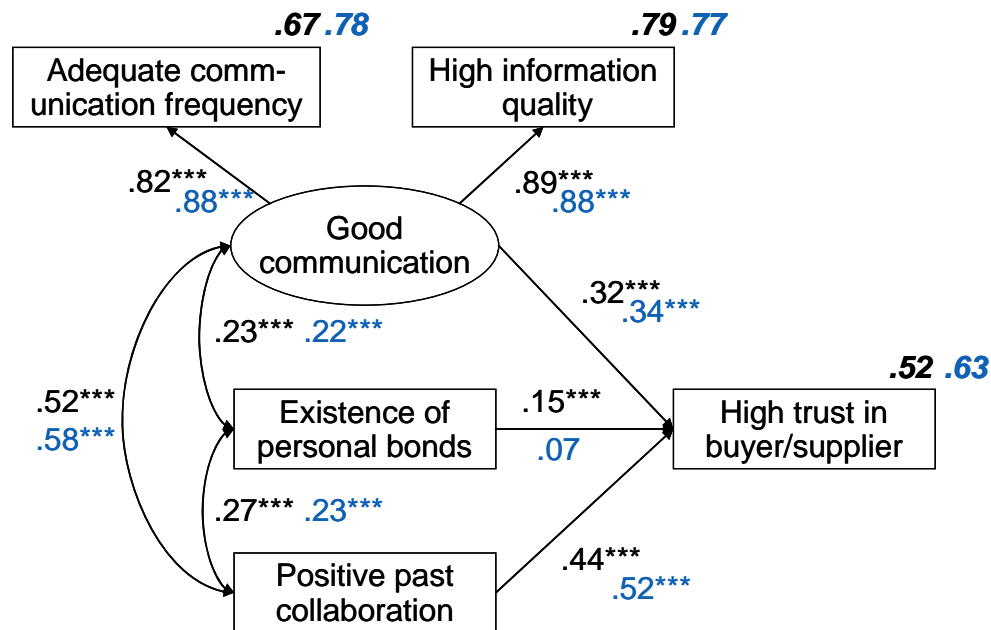

Figure 3: SEM Estimation Results

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.

Figure 3 displays the estimation results, separately for the downstream and upstream relationships (implemented as multi-group analysis). Overall, the model fits the collected data very well, with all goodness-of-fit measures are far above the recommended acceptance levels (CMIN/DF = .913 (p = .455); NFI = .997; RMSEA = .000).

In the farmer–processor relationship, 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. This confirms our hypotheses H1 to H3. The most important determinant is the collaboration experience (with a standardized regression weight of .44), followed by good communication (.32) and the existence of personal bonds (.15). 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 (confirming H4). Overall, using only these three determinants, 52% of the variance in the observed trust levels can be explained.[4]

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 (i.e., here H1 is not confirmed). In this case, with only two variables, good communication (standardized regression weight of .34) and a positive past collaboration experience (.52), 63% of buyer/supplier trust can be explained. As before, the two determinants reinforce each other positively and highly significantly (thus confirming H4).[5]

In summary, the estimation results imply that trust is positively effected by good communication and a positive past collaboration. However, the existence of personal bonds does not always play a role but seems still to be important when dealing with farmers. Our estimations suggest that trust – to a large extent at least – can be actively built by companies by collaborating positively over a longer term period and by communicating effectively.

Managerial Implications

For an active management of trust in food chains, the quality of the communication, which is 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 said that the emergence of trust to a large extent depends

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[4] In the 'good communication' construct, both indicators are equally important (factor loadings of .82 and .89 respectively), and more than 65% of their information is used in making up the construct.
[5] Here, the 'good communication' construct is equally formed by both indicators and more than 75% of the indicator variance is used for it.

on positive collaboration experiences, which only evolve over time. However, although to a comparatively smaller extent, with the quality of the information communicated impacting the level of trust at a business partner in food chains, 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" cases where no past collaboration history has existed. This implies that increasing the quality of the transmitted information, all other things being equal, trust may immediately 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.

A lack of information is considered to be connected to poor decision making. On the other hand, the problem of information overload seems to increase in an era of widening communication media and decreasing costs of communication. Low and Mohr (2001) use the indicators of relevance, accuracy, reliability and timeliness to characterize quality of information relying on the work by O'Reilly (1982). *Relevance* means that information is useful and significant for the decision process, or for achieving special objectives. *Accuracy* stands for clear and precise formulation and transmission of information. *Reliability* corresponds to the trustworthiness of the information. *Timeliness* characterizes information distribution in time; up-to-date information allows the receiver to react appropriately. Finally, the consistency of the transmitted information may also be important, meaning in particular that when several communication channels are used simultaneously the transmitted information should be the same. Hence, agribusiness managers should always actively considering meeting these criteria whenever they communicate with other businesses and/or consumers.

The factors of relevance and accuracy do not refer solely to information quality, but also to information quantity. Information should be delivered in appropriate quality and quantity. Previous research shows that managers tend to believe that more information is better (O'Reilly, 1980) but certainly, information overload needs to be avoided. However, while information quality can be improved immediately, finding out the adequate communication frequency and implementing it may require more time, thus not being an *ad hoc* measure for improving trust.

Conclusions

In Europe, consumer trust has become one of the most important factors for the stability of the food sector. An essential prerequisite for the ability to communicate the trustworthiness of food to consumers is the creation, maintenance, and communication of trust between companies across the entire food value chain. This paper has assessed the level of trust between companies together with its influencing factors in European food chains and estimated a structural equation model to determine factors allowing the active management of trust in food chains based on a survey in five European countries with 747 observations.

Important results are that in the observed European food chains, the perceived level of trust of buyers towards the respective supplier is considerably high with only some minor derivations and differences. This confirms earlier results by Lobb et al. (2007) which show that consumer trust is rather similar across different EU countries. With regard to the structural factors including the country, the stage of the value chain, the product, and the governance form it can be said that only small differences could be observed.

For an active management of trust in food chains, the quality of the communication, which is realized by the frequency of communication and the quality of the information, together with the collaboration experience are the most important determinants. It is interesting that personal relationships do not in all observed situations impact the level of trust, but they are important when dealing with farmers. As our empirical results suggest, the emergence of trust to a large extent depends on positive collaboration experiences, which only evolve over time. However, by actively improving the quality of the information transmitted to business partners in food chains, trust may immediately be created even in "first-time" cases where no past collaboration history has existed.

Further research may involve other countries and commodities or products. In addition, other company-internal factors determining trust levels could be included in a more comprehensive analysis. Finally, future studies should regard in more detail the implementation of trust-building processes in business relations in agri-food chains and networks.

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Appendix A: Sample Representativeness, Key Informant Quality, Non-Response Bias and Measurement Validation

The representativeness of the obtained sample was assessed using two criteria for which complete target population information is available across the different countries: regional distribution of company location and farm/company size (as measured in terms of arable land size, no. of livestock, no. of employees and annual turnover). While the representativeness of the collected data differs across collaborating country, in general the obtained responses reflect the most important location- and business size-related disparities.

Overall, 82% of survey respondents claim to be in upper management positions or being (part-) owner of the surveyed businesses, thus giving confidence in the quality of the obtained answers. Yet, no specific control question was included in the questionnaire that tested how knowledgeable a respondent actually was about the most important business relationship investigated.

Non-response bias was assessed by comparing early collected survey responses to late collected ones, using multivariate analysis of variance on key demographic characteristics (Armstrong and Overton, 1977). However, no statistically significant differences were found. In addition, nonparametric "Runs" tests were performed on these key variables in order to test for randomness in the survey responses. While neither non-response nor random tests can compensate the deficiencies resulting from non-random sampling, these tests nevertheless can show whether systematic problems are present in the data. In our case, no such shortcomings were detected.

In the analysis, one construct (made up of two items) is used. All other used variables are measured as single items (see Appendix C for a full description of the employed items). The construct regards "good communication" and its measurement reliability as assessed by Cronbach's Alpha (.851) is highly satisfactory. In order to check for unidimensionality, we apply principle component analysis to the two communication items (adequate communication frequency and satisfaction with the obtained information quality). Only one component is extracted (using the typical cut-off of an eigenvalue of 1.0) which represents 87.0% of the two variables' variance (exceeding the recommended level of at least 60%, see Shook et al., 2004). The factor loadings of the two used items are in excess of .8 and statistically significant at least at the 99% confidence level. Given that only one multi-item factor is used in the analysis, other validation tests such as convergent and discriminant validity (Anderson and Gerbing, 1988) are not applicable in this case.

Appendix B: Technical Description of SEM Modeling

In technical terms, the measurement of constructs can be defined as

$$\mathbf{x} = \mathbf{\Lambda} \cdot \mathbf{\xi} + \mathbf{\delta} \tag{1}$$

where $\mathbf{x}$ is a vector of indicator variables, $\mathbf{\Lambda}$ a matrix of factor loadings, $\mathbf{\xi}$ a vector of latent factors and $\mathbf{\delta}$ a vector of measurement errors. Under suitable and fairly general assumptions (see Bollen, 1989), the covariance matrix $\mathbf{\Sigma}$ of the observed variables $\mathbf{x}$ can be expressed by the three parameter matrices $\mathbf{\Lambda}$, $\mathbf{\Phi}$ and $\mathbf{\Theta}_{\mathbf{\delta}}$:

$$\mathbf{\Sigma} = \mathbf{\Lambda}\mathbf{\Phi}\mathbf{\Lambda}' + \mathbf{\Theta}_{\mathbf{\delta}} \tag{2}$$

where $\mathbf{\Phi}$ and $\mathbf{\Theta}_{\mathbf{\delta}}$ are the covariance matrices of factors $\mathbf{\xi}$ and measurement errors $\mathbf{\delta}$ respectively. The objective of covariance structure analysis is to estimate the unknown elements of these matrices (i.e., the missing model parameters) such that the covariance matrix generated by the model

$$\hat{\mathbf{\Sigma}} = \mathbf{\Sigma}\left(\hat{\mathbf{\Lambda}}, \hat{\mathbf{\Phi}}, \hat{\mathbf{\Theta}}_{\mathbf{\delta}}\right) \tag{3}$$

reproduces the empirical covariance matrix $\mathbf{S}$ as exactly as possible. The estimation of the missing parameters results from solving the minimization problem

$$f_{\mathbf{S}}\left(\mathbf{\Lambda}, \mathbf{\Phi}, \mathbf{\Theta}_{\mathbf{\delta}}\right) = F\left(\mathbf{S}, \mathbf{\Sigma}(\mathbf{\Lambda}, \mathbf{\Phi}, \mathbf{\Theta}_{\mathbf{\delta}})\right) \rightarrow \min \tag{4}$$

The exact algebraic form of the discrepancy function F depends on the chosen estimation method (e.g., maximum likelihood, generalized least squares, etc.).

In order to judge the goodness of fit, the following criteria are commonly used (Shook et al., 2004)[6] (i) the Chi-square Test, (ii) the Normed Fit Index (NFI) and (iii) the Root Mean Square Error of Approximation (RMSEA). The chi-square fit index tests the hypothesis that an unconstrained model fits the covariance/correlation matrix as well as the given model. The chi-square value should not be significant if there is a good model fit. If it is not significant, the model is rejected as not being a good fit to the data (there is a significant deviation of the model from the data). A problem with this test is that the larger the sample size, the more likely the rejection of the model. The chi-square fit index is also sensitive to violations of the assumption of multivariate normality. More commonly used is the minimum sample discrepancy divided by degrees of freedom (CMIN/DF). Values as large as 5 are

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[6] There are various other measures which can be used in special situations (for a complete discussion see Bollen, 1989). Not all of them are widely accepted as reliable statistics. Two of the more common ones, the Goodness of Fit Index (GFI) and Adjusted GFI (AGFI) cannot be calculated in an unbiased way when maximum likelihood estimation based on data with missing values is used.

accepted as adequate fit, but more conservative thresholds are 2 or 3. The NFI varies from 0 to 1, with 1 equals the perfect fit. By convention, NFI values below .90 indicate a need to re-specify the model. The RMSEA incorporates a discrepancy function criterion (comparing observed and predicted covariance matrices) and a parsimony criterion. By convention, there is good (adequate) model fit if RMSEA is less than or equal to .05 (.08).

Appendix C: Description of Used Items

Short Item Description	Full Item Description and Measurement Scale
High trust in buyer/supplier	Our trust in our supplier/buyer in our most important business relationship *Seven-point rating scale (1 = very poor, …, 7 = very good)*
Adequate communication frequency	Satisfaction with the communication frequency of our supplier/buyer in the most important business relationship *Seven-point rating scale (1 = completely dissatisfied, …, 7 = completely satisfied)*
High information quality	Quality of received information from our supplier/buyer in the most important business relationship *Seven-point rating scale (1 = completely dissatisfied, …, 7 = completely satisfied)*
Existence of personal bonds	This relationship is characterized by strong personal bonds *Seven-point Likert scale (1 = fully disagree, …, 7 = fully agree)*
Positive past collaboration	Our collaboration with this buyer/supplier in the past *Seven-point rating scale (1 = very poor, …, 7 = very good)*