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# Perceived risks in cross-border transactions in agri- food chains

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**Abstract.** Nowadays, agri-food chains are more global than ever and are characterized by increased imports and exports and global sourcing of products, resulting in increased cross-border transaction risks. The objective of this paper is to identify the typical risks regarding agri-food supply chains involved in cross-border transactions and to assess their importance as perceived by agri-food managers. The analysis takes into consideration four different agri-food value chains (meat, grain, olive oil, fresh vegetables and fruits). Following an explorative approach and a qualitative technique, a series of face to face in-depth interviews was conducted. Results indicate that risk perception may be quite different across countries, value chains, tiers of the supply chain, as well as across respondents. The prevalence of Market dynamics risks was pointed out in most of the interviews, yielding the impression that many operators identify the market as the most difficult environment. Differences in risk perception between fresh produce (fruit/vegetables and meat) and processed food chains (grain and olive oil) are probably interrelated to the different degree of integration within these supply chains, the different level of standardization achieved and the different causes of risks that are inherent to the nature of the product.

**Keywords:** Perceived Risks, Cross-Border Transactions, Agri-Food Chains.

## 1. Introduction

There is no doubt that during the last decades we have witnessed a tremendous increase of the efficiency of agri-food supply chains. What is also clear is that agri-food supply chains are becoming more efficient, but at a cost of increasing vulnerability. The agri-food sector is a risk sensitive sector. For example, the race for cost efficiency in the late 1980s resulted immediately in food safety hazards and incidents (e.g. Bovine Spongiform Encephalopathy crisis) in the 1990s which were followed by tremendously increased risk concerns particularly at consumers' level. Many researchers have analyzed perceived risk at the consumers' level. Mitchell<sup>[1]</sup> for example, explored consumers' risk perceptions regarding food products in grocery retailing. Similarly, Fearné *et al.* <sup>[2]</sup> explored how quality assurance schemes reduced perceived risk and increased consumer confidence for beef products. Whereas in the past, agri-food companies were mostly concerned with reducing costs and risks at the consumers' level, we have recently witnessed companies placing more emphasis on risk-related issues taking place upstream in the agri-food chain. For example, today maintaining a continuous source of supply assuring a stable quality, while at the same time avoiding price fluctuations and transportation disruptions are some of the most crucial drivers for the success of agri-food companies. Given that perceived risk is contextually and culturally constructed<sup>[3]</sup>, in this paper four agri-food value chains (meat, grain, olive oil, fresh fruit and vegetables) are taken into consideration. The goal of this paper is to identify the typical risks regarding agri-food supply chains involved in cross-border transactions and to assess their importance as perceived by agri-food managers. The paper is structured as follows. In the next section a discussion on risk related issues is provided with specific emphasis on the agri-food sector. In section 3, a brief description of research design, data collection and data analysis is provided. Section four presents the results, while in the final section conclusions are drawn and key issues for further research are identified.

## 2. Vulnerability, risk and agri-food chains

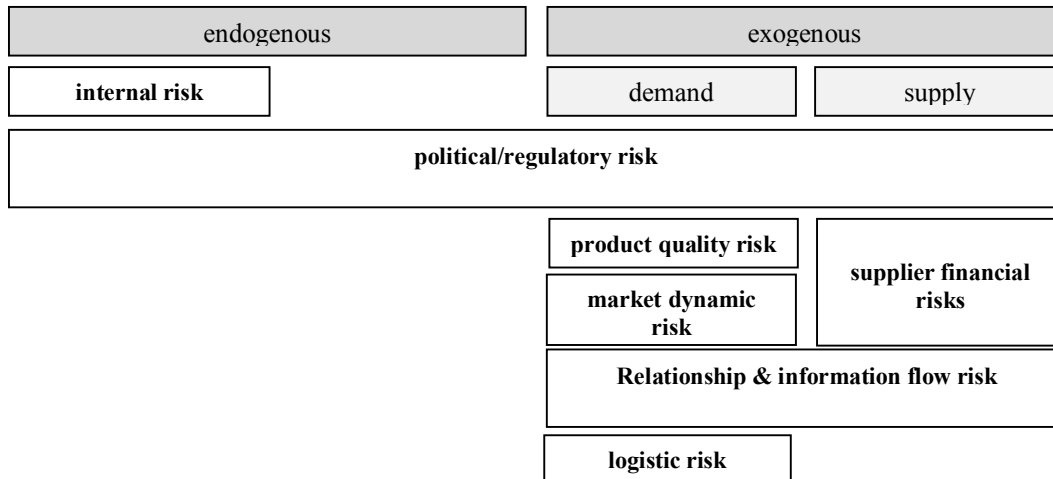
As modern supply chains become more global and complex, they face increased risk, which yesterday's companies didn't have to contend with<sup>[4]</sup>. This risk increase has also increased the vulnerability in supply

chains. Disruptions nowadays may occur at any time, and range in scope from weather-related incidents, to supplier problems, to transport congestion. Security issues and acts of terrorism can also come into play, making the risk associated with supply chains much more serious. According to Christopher<sup>[5]</sup> and Peck<sup>[6]</sup>, most important sources of supply chain vulnerability include: a focus on efficiency rather than effectiveness, the globalization of supply chains, focused factories and centralized distribution, the outsourcing trend, and finally the reduction of the supplier base. Although all factors could be of increasing importance in the context of the agri-food sector, in this paper emphasis is given on the globalization of chains, due to the fact that cross-border transactions are vital for the development of the agri-food sector.

Undoubtedly, the agri-food sector is by definition a risk intensive one, since uncertainty is a basic feature of agricultural production. Uncontrollable factors such as climate, farmer's capacity and long production lags due to biological processes, cause volatile markets and fluctuating prices. However, nowadays, the requirements of the enterprises in the agri-food sector are becoming increasingly complex. Due to changed conditions in trade and changing demand situations, enterprises are looking worldwide for potential new suppliers<sup>[7]</sup>. Transactions with new trade partners cause different uncertainties and risks, particularly with complex products such as, for example, agri-food products<sup>[7]</sup>. Risks are present everywhere in the agri-food sector. In the era of globalization particular regard is paid to handling, and the control of risks in the procurement of goods is a challenge for the customer-supplier relationship<sup>[8]</sup>. In international agri-food procurement additional sources of risk can exist<sup>[9]</sup>. These risks may arise either as a result of cultural differences or as a result of weaknesses in achieving undistorted information flows due to the lack of information technology related applications.

Several risk definitions have been proposed in the literature. As Christopher and Peck<sup>[10]</sup> suggest, risk definitions in the literature as well as the measurement tools strongly depend on the field of research. Similarly, categorizing and classifying risks has been approached in many different ways. Waters<sup>[4]</sup> for example, distinguished between internal risks (that appear in normal operations) and external risks (that come from outside the supply chain). A more detailed view of supply chain risk was provided by Mason-Jones and Towill<sup>[11]</sup>. They identified three major types of risks: internal ones (that arise from operations within an organization), supply chain risks (that are external to the organization but within the supply chain) and external risks (that arise from interactions with company's environment). Christopher<sup>[5]</sup>, for example, identified five major sources of risks: supply risks, demand risks, process risks, control risks and environment risks. Handfield and McCormack<sup>[12]</sup> classified risk into six sources, namely: financial risk, operational risk, brand and reputation risk, legal risk, environmental risk and technical risk. An alternative is to consider risks to the three related supply chain flows, namely material, information and financial where: material flows, represent physical product flows from suppliers to customers, information flows, represent data capture, order transmission, order tracking etc. Finally, financial flows, represent cash flows, debt, credit terms, payment schedules etc<sup>[13, 4]</sup>.

For the purpose of this paper the definition and risk classification suggested by Kersten *et al.*<sup>[14]</sup> and Kersten *et al.*<sup>[15]</sup> are the most suitable. Kersten *et al.*<sup>[14]</sup> defined a risk in a value chain as: "the damage – assessed by its probability of occurrence – that is caused by an event within a company, within its supply chain or its environment affecting the business processes of at least one company in the supply chain negatively". Their approach in comparison to other researchers takes into consideration the two dimensions needed for risk assessment (the probability of occurrence and the caused damage) as well as the supply chain perspective. With respect to risk classification, following Kersten *et al.*<sup>[15]</sup>, seven risk groups (Figure 1) were considered for investigation and assessment: "Product quality risks", "logistics risks", "market dynamic risks", "supplier financial risks", furthermore "political /regulatory risks", "relationship and information flow risks" and "internal risks".



**Figure 1.** Risk classification<sup>[15]</sup>

### 3. Research Design

Regarding risk analysis, a supply chain perspective was considered, largely due to the fact that nowadays, more often than in the past, there is a cumulative effect, caused by the increased complexity of supply chains. In particular, five factors are of importance to define a risk in a supply chain:

- The risk itself (what kind of risk)
- The source of the risk
- The effect of the risk
- The probability of occurrence of the risk
- The potential damage of the risk for the company (ies) in the value chain.

Given that comprehensive description of all the possible risks in a supply chain is not feasible, as risks vary from every supply chain<sup>[16, 17, 18]</sup>, we decided to identify especially those risks, which were from the business leaders point of view the most important in terms of potential damage for the companies and likelihood of occurrence. Considering this exploratory approach, the data collection was based on a qualitative research technique and respondents were asked to name the most important risks in the transaction process describing them using their own words. This approach was chosen in order not to influence the respondents in advance by pre-defined risks or risk categories.

With respect to data collection, the sample included 81 SMEs qualitative expert interviews from seven European Union member countries (Austria, Germany, Greece, Italy, the Netherlands, Slovenia, and Spain) and three non-EU countries (Brazil, Turkey and the USA). The interviews were performed by the partners of the European research project “e-trust” (FP6-CT-2006-043056) in 2008. Face to face in depth interviews were conducted in the respondent’s workplace. This method was considered appropriate as it allows for longer interviews providing thus the opportunity for more detailed data collection. Since the study focuses on the buying side of the transaction process, respondents mainly were selected from the general management or from the purchase department of the companies in the sample. In total, in all ten countries the 81 respondents mentioned 365 risks (365 risk entries). A post-classification of the risks mentioned and available in the interviews transcripts was performed.

A significant amount of literature refers to the risk map matrix with a classification of risk into four segments<sup>[eg. 19]</sup>. However, for our purpose the risk map from Hölscher<sup>[20]</sup> was considered more appropriate for two reasons. First of all this risk matrix only discriminate between two risk types, therefore major risks can be distinguished easily from moderate risks. Second, with this method risks with a low probability but a high damage potential are identified as major risks, which is of special importance for the agri-food sector<sup>[see 21]</sup>.

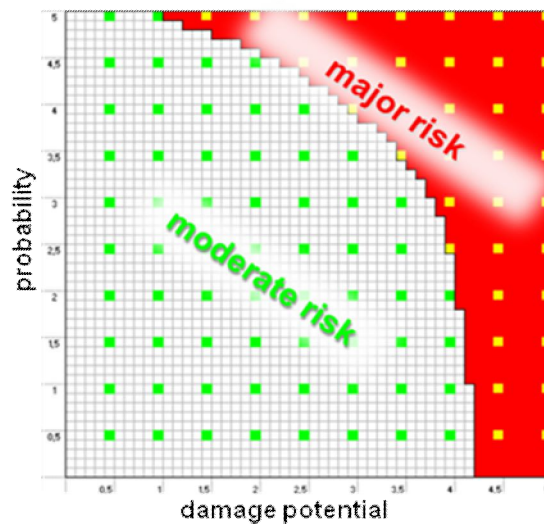


Figure 2. Risk matrix<sup>[20]</sup>

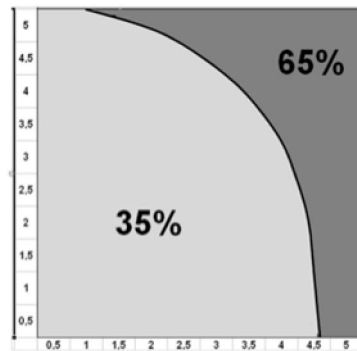
The matrix is useful to assess the risks when dealing with a single respondent and his specific situation, but it is more difficult to use the aggregate data, since assessment comparability between the respondents is not easy to achieve. To be able to apply this risk matrix to the data derived from the qualitative technique adopted a risk classification procedure was needed, since the evaluations obtained from the open questions of the qualitative assessment are rarely converging on the same risks. In order to classify the risks properly, the cause of a risk and its effect were used to understand the nature of the risk. Especially the cause of risks was a crucial factor for the classifications, because it defines the place of origin of the risk more precisely. In order to understand the nature of the seven risk categories, table 1 shows the risks named by the respondents and the assignment of these risks to the overall category.

Table 1. Overview of the classified risks

Product quality risk	Logistic risks	Market dynamics risks	Supplier financial risks	Political / regulatory risk	Relationship & information flow risk	Internal risks
Bad product quality	Delivery delay	Change in prices	Loss of receivables	Sanitary / safety standards	No relation-ship between partners	Damaged packaging
Quality risk	No delivery	Crises / scandals	Insolvency of supplier	Specification	Misunderstanding	Production mistakes
Product standardization	Transport / logistic problems	Product Scarcity	Insolvency (from customer)	Political regulations	Bad communication	Employee mistakes
Lack of homogeneity	Late Delivery	Crop failure	Credit risk	No declaration	Lack of information	Technical mistakes
Bad raw materials	Delivery of raw materials	Price fluctuation	Delay in payment of customer	Wrongly declared product	Cultural differences	Wrong production practice
Quality variability	Cut off delivery	Climate change	Safety in payment	No documentation	Distrust of partner	Sudden strikes
Ullage	Shipping risks	Currency fluctuation	Economic risks	No traceability and back-tracing	Foreign supplier not known	Inattentiveness of workers

## 4. Empirical Findings

By using the above mentioned classification, the risk matrix was applied to each risk category, in order to identify those risks that were most important from the respondents' point of view in terms of likelihood of occurrence and damage potential for the company. In the following figure (figure 3) an application of the risk matrix to the "Market dynamics risk" is presented. The figure shows that 65 percent of the total risk entries that were evaluated are in the area of the major risks (dark grey area). Similarly, respondents mentioned market dynamics risk more often than any other risk. Therefore, it can be stated that market dynamic risks are the most important risks compared to all other risk categories. This is largely due to the fact that the category "Market dynamics risks" includes market changes caused by supply and demand. In addition, price fluctuations, due to low production, scarcity of raw materials caused by environmental disasters, can also cause increased market dynamics risks. Finally, another main cause are the changes in currency exchange rates in the international currency market. To make the orientation easier, the risk categories are marked in dark grey, if more than 50 percent of the named risks were evaluated by respondents as major risk, and in light grey, if the majority of risks was evaluated in the moderate risk area (table 2). If the sample is too small to evaluate the importance of a risk category (less than ten percent of the sample), the field is marked white.



**Figure 3:** Results for market dynamics risks

**Table 1:** Risk results for all sectors

All Sectors Risk	Threshold 37	
	Number of entries	%
Market dynamics risks	79	65%
Supplier financial risks	29	52%
Product quality risks	50	48%
Relationship and information flow	65	48%
Logistic risks	70	47%
Political & regulatory risks	50	42%
Internal risks	22	32%
<b>Sum of entries</b>	<b>365</b>	

Apart from market dynamics risks, logistics risks as well as risks related to the relationship and the information flow with the supplier were also mentioned. However, these risks were usually not evaluated as important, and they are positioned in the moderate area of the risk matrix.

In order to gain some closer understanding of these results, data were also analyzed separately by sector. As table 3 shows, differences in the evaluation of the different risks between the four sectors can be observed.

**Table 2: Results by sector**

Sector Risk	Grain		Meat		Fruit / veg.		Olive oil	
	Base	%	Base	%	Base	%	Base	%
Market dynamics risks	26	50%	15	73%	23	65%	15	80%
Supplier financial risks	8	50%	7	57%	8	50%	6	50%
Product quality risks	18	28%	11	55%	13	77%	8	38%
Relationship and inf. flow	14	50%	14	79%	24	29%	13	46%
Logistic risks	19	37%	23	52%	21	52%	7	43%
Political & regulatory risks	12	8%	16	50%	15	60%	7	43%
Internal risks	7	43%	5	20%	2	100%	8	13%
<b>Sum of entries</b>	104		91		106		64	

In the grain sector, for instance, no severe risk became apparent with all risks being assessed in the moderate area. With respect to risk importance it seems that “market dynamics risks” and “risks concerning relationship and information flow” were rated more important by the respondents than the other risk categories. Concerning “market dynamics risks” price changes are an important factor for the interviewed firms – especially price fluctuations and increasing fuel prices. Also notable risks are crop failures and consequentially bad product quality. Within the risk category “Relationship and information flow risks” catchwords like “unreliable suppliers”, “misunderstandings in communication”, “insufficient cooperation” etc. were mentioned.

Compared to the grain sector, the meat sector on the other hand shows a completely different picture. For business leaders in the meat sector several risks were evaluated as major ones. In particular, “relationship and information flow risks” (79%) is the most important risk, followed by “market dynamic risks” (73%), “product quality risks” (55%) and “logistics risks” (52%). When having a closer look at the answers from respondents in the meat sector, it is obvious that “relationship and information flow” risks are mainly caused by human mistakes and lack of information related to material and documentation. Information asymmetries result in misunderstandings in communication. Additionally, the untrustworthiness and reliability of suppliers and customers constitute an additional risk. The relationship and information flow seems badly influenced by non-formal contracts. “Market dynamics risks” are mainly influenced by demand and supply conditions change in the world market, as mentioned before in the general results. Interestingly again “product quality risks”, are mainly related to the quantity and quality of raw materials. Fierce competition among suppliers may cause bad product quality, and is therefore one of the most mentioned concerns of respondents. An insufficient quality standard system of the supplier or a lack of hygiene and variations in temperatures influences the product quality. Besides the contamination of herbicides and pesticides, the wrong product specifications or ullage (shrinking of meat due to water in the meat) depicts a risk of product quality. “Logistic risks” are mainly influenced by transport and logistics problems. The variations of temperature in the cooling chain caused by driver mistakes or technical problems leads to the main logistics risks. Additional problems related to “logistic risks” are damages of the packing or/and the product. The outsourcing of the logistic system enforces logistics risks.

As table 3 shows a number of risks in the fruit and vegetables sector were mentioned to be of higher importance. Product quality was mentioned as being negatively influenced by the lack of knowledge in producing fruit and vegetables and poor orchard management. The weather and natural conditions affect the quality and homogeneity of the products. A lack of supplier control or wrong production process demonstrates a risk for product quality. “Market dynamics risks” were often related to weather and climate changes. A lack of raw material and plant diseases depicts risks for the market and is related to the quality and quantity of the raw material. Market saturation and price changes at the world market concerning raw material, energy or oil have impact on market dynamics risks. “Market dynamics risks” were also related to cheaper production in developing countries like China. “Political and regulatory risks” in the fruit and vegetables sector are related to commercial barriers, non-compliant contracts and law risks. A lack of supplier control leads to a missing product safety. A change of grade of goods and wrongly declared products depicts risks in political and regulatory risks. Concerning “logistics risks” the variation in the temperature and the weather conditions are of vital importance. The longer the distance

from producer to port the higher the transport costs. In addition, traffic jams and failure in the transport system cause logistic risks and delays and stock outs.

In the olive oil sector only one risk was evaluated as a non-acceptable risk. Currency fluctuation displays the principal “market dynamics risk”. Weather conditions like draught or flood leading to a bad crop quality is also interpreted as a market dynamics risk. The traditional way of doing business in the olive oil sector is preferential and may cause market opacity. The unorganized and large number of small-scale producers as well as weak supply and procurement management enforce economic instability.

## 5. Conclusions

In this paper, we performed an evaluation of several risks emerging from different tiers of different supply chains in different countries. The explorative approach and the qualitative technique we adopted allowed us to collect a huge amount of information, much richer than the short description we presented here. From the analysis of the risk assessments (major/moderate risks) and of the post-classification of the risks in seven categories, we obtained a picture of the perceptions of risks by practitioners working in food supply chains. As a general and heuristic conclusion, we had the impression that risks are basically considered as a part of game by many of the operators, and that for some risks they had a certain perception of control, while for other risks they somewhat disarmed.

The methodology we adopted has the advantage of the simplicity, but it also presents some drawbacks. For instance, risks are classified on the base of likelihood of occurrence and expected damage, but the former could be influenced by the perceived/actual control, i.e., the possibility to introduce measures able to effectively eliminate the risk or transform it into a moderate risk. Therefore, the technical capacity and competence of the respondent may play a role in the risk assessment. Furthermore, although the number of interviewed companies is not negligible, and sensibly higher than other studies based on similar qualitative approaches, we cannot take the results as conclusive, since the sampling method and the data collection technique were not designed to analyze the results quantitatively. However, general indications and hypotheses for further research can be drawn.

The consideration of the qualitative information derived from the interviews suggest that risk perception may be quite different across countries, value chains, tiers of the supply chain, as well as across respondents. The prevalence of Market dynamics risks may be pointed out in most of the interviews, yielding the impression that many operators identify the market as the most difficult environment, while they feel more confident about the level of control they achieved in the supply chain and, above all, within the company.

This is coherent with the recent emphasis and investments in quality control and the success of vertical integration as a strategy to achieve a better competitiveness, which are apparent in the food sector. Differences in risk perception between fresh produce (fruit/vegetables and meat) and processed food chains (grain and olive oil) are probably interrelated to the different degree of integration within these supply chains, the different level of standardization achieved and the different causes of risks that are inherent to the nature of the product. In our opinion, for instance, it is still an open question whether the prevalence of horizontal/vertical integration within a specific supply chain in a certain country is exogenously determined by strategic market management determinants (e.g., foreign investments, struggle for market power, etc.) and incidentally causes a lower risk perception and a higher inter-organizational trust, or it may be considered as a consequence of a development towards a better control of the supply chain specifically aimed at reducing the major risks and increasing trust in the food system.

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