

Chain-Wide Consequences of Transaction Risks and their Contractual Solutions

*Managing Interdependencies in Differentiated Agri-Food Supply
chains*

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Chain-Wide Consequences of Transaction Risks and their Contractual Solutions

***Managing Interdependencies in Differentiated Agri-Food Supply
chains***

Mark Wever

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“Old truths have been relearned; untruths have been unlearned. We have always known that heedless self-interest was bad morals; we know now that it is bad economics. Out of the collapse of a prosperity whose builders boasted their practicality has come the conviction that in the long run, economic morality pays.”

Franklin D. Roosevelt, 1937, Second Inaugural Address

INTRODUCTION

The 2007-2008 subprime crisis showed how risks can be transferred and amplified in the interdependent business networks and economies which exist today. Insufficient monitoring by mortgage providers of the creditworthiness of borrowers in a relatively small sector of the American housing economy has contributed to the bankruptcy of banks and other financial institutions at the other side of the world (see Van Hengel and Knot, 2011; Jacobs, 2009). Inadequate monitoring activities were undertaken because the mortgage providers had little or no incentive that the borrowers repaid these loans; they had repackaged and resold (most of) the rights to receive the loan repayments to other investors (see Den Butter, 2011; Haldane, 2008).

Besides crippling the world economy, the crisis has also drawn renewed attention to those economic and managerial disciplines, like institutional economics, which examine transaction risks and failures resulting from conflicts of interests between transaction parties. For example, O.E. Williamson, who has studied the different types of inter-organizational contract forms that can prevent such failures, won the Nobel Memorial Prize in Economic Sciences in 2009.

However, many such studies, including those based on the work of Williamson (2000; 1991; 1985), focus mainly on transaction risks and failures, as well as their resolutions, in individual transactions. Such approaches ignore the consequences of a transaction failure for the wider business network or supply chain in which the transaction takes place.

The present thesis aims to make a modest contribution to addressing this issue, by examining: (1), how risks arise in the supply chain as a result of interdependencies between the various transactions making up the supply chain; and (2), what types of contracts are suitable for supply chain actors to implement in order to reduce or eliminate their exposure to these risks. The thesis focuses mainly on economic risks resulting from conflicts of interests between supply chain actors.

The empirical research conducted in this thesis has taken place in the context of agri-food supply chains, where the impact of failures is very large. Inadequate management of interdependencies and associated transaction risks can have not only economic consequences, but also public health consequences resulting from food quality problems. In the United States, for example, experts estimate that contaminated food causes around 76 million illnesses, 325000 hospitalizations and 5000 deaths each year (Smith DeWaal, 2003).

1. RESEARCH THEMES AND QUESTIONS

The present thesis addresses its subject from three different angles resulting in three sets of research questions which are addressed in four different studies. Each study focuses on a different approach taken by supply chain actors to manage interdependencies and associated transaction risks.

The first study, by using the EU pork industry as an example, focuses on the role of collective quality management systems in reducing transaction risks related to the coordination of quality, like under-investments in quality improvements or quality cheating by the supply chain actors. As supply chain actors are exposed also to other types of transaction risks, like price uncertainty, the second study examines a broader range of coordination mechanisms, including price, volume, quality and investment mechanisms. The third and fourth study examine how supply chain actors' attempts to differentiate their products to the consumer by means of brand names can lead to additional interdependencies and transaction risks in the supply chain. While the third study focuses on the types of contracts which actors can use to reduce their exposure to such risks, the fourth study examines a broader range of contractual options available to actors when risk minimization is not possible.

Study One: Alignment between collective quality management systems and supply chain contracts

Coordinating quality in agri-food supply chains is complex, as the quality of end-customer products (increasingly) depends on practices in preceding stages of the supply chain. For example, contaminated animal feed, sourced from a different continent, can lead to food safety hazards in a supermarket. This happens when the contamination also ends up in the consumer meat products which are sold from animals that have eaten the contaminated feed. Identifying the source of the risk and the extent of the contamination is difficult, as the contaminated inputs (e.g., soya) may have been mixed with other inputs (e.g., corn) to produce the animal feed. At farm level, a producer may mix different batches of feed in its silos. Also, animals which have eaten the contaminated feed are likely to have been mixed with animals from other, non-contaminated, farms in the slaughterhouse. As a result, it may be impossible to trace consumer meat products to individual farms, let alone to specific batches of feed inputs.

To manage interdependencies related to food quality risk, several European countries have developed collective quality management systems that cover the whole supply chain (Van

Plaggenhoef, 2007). These systems coordinate quality by setting quality standards, monitor compliance with these standards, and signalling compliance within the supply chain.

The adoption of collective quality management systems may not only solve or reduce some risks within the supply chain, it may also lead to other risks. For example, the interests of the various actors participating in a quality management system may not be aligned (Raynaud, Sauvé and Valceschini, 2005)¹. Although this can also be the case in supply chains without such a system, there may be fewer potential trading partners in a supply chain with a system. This can increase the risk of strategic behaviour by buyers (or suppliers), as it is more difficult to switch to alternative partners.

Supply chain actors can overcome some of the challenges of participating in collective quality management systems by implementing supportive contractual structures, which reduce some of these risks. This study aims to obtain insights into what types of contracts best match with the various types of quality management systems used by supply chain actors. To achieve this, the following research question is addressed:

Research question 1: What is the relation between the participation of supply chain actors in different types of quality management systems and their contracting choices?

Compared to previous research on this subject (see Raynaud, Sauvé and Valceschini, 2005; González-Díaz, Barcala and Arruñada, 2003; Humphrey and Schmitz 2001; Sporleder and Goldsmith, 2001) the present study: (1), examines a broader range of different types of quality management systems; and (2), formalizes the relation between quality management systems and contracts by means of various propositions. Considering the importance of both quality management systems and contracts for coordinating supply chain transactions, more specific insights into how they can best be combined is crucial.

Study Two: Use of contractual coordination mechanisms in differentiated and commodity supply chains

Besides transaction risks related to quality coordination, supply chain actors are also exposed to risks related to coordination of other aspects of transactions, like prices, volumes and investments. For example, a variable (fixed) price contract may increase (decrease) price uncertainty for (one of the) the parties to a transaction if they operate in an environment with highly uncertain prices (see Wilson and Dahl, 2009). Furthermore, a company may have

¹ For example, the production of high-quality food products could be more important for a retailer participating in the QMS than for a producer.

contractually committed itself to purchase a minimum amount of products from its supplier, but changing market conditions may make it difficult for the company to keep its obligation (see Goldberg and Erickson, 1987). Additionally, a group of farmers that plans to enter into the processing business may have to choose between pooling investments through a hybrid investment vehicle, like a (traditional) cooperative, or by means of equity-based investment vehicle, like an investor owned company (see Chaddad and Cook, 2004). In the former, farmers are exposed to risks associated with dispersed ownership of an organization, like a slow decision making process (Pozzobon and Zylbersztajn, 2011). In the latter, the continuation of the processing company as a collective entity may be difficult to guarantee, as concentration of ownership and control can be difficult to prevent.

Considering the broad range of risks to which supply chain actors are exposed, it is important to consider the role of contracts in coordinating various aspects of transactions. This study examines the mechanisms which are used within contracts to coordinate prices, volume, quality and investments. Actors' use of these mechanisms is compared across three different types of supply chains: commodity supply chains and two types of supply chains in which differentiated products are marketed to the consumer (collective brands and proprietary brands). Different types of risks are likely to arise in the different types of supply chains. For example, in collective brands, the actors pool reputational capital, which means that shirking² by one actor may damage the reputation of all other actors if no adequate measures are undertaken to safeguard this capital. In commodity chains, the actors do not market their products under a jointly owned brand and thus fewer interdependencies and associated risks exist in this regard. Thus, different types of contracts, which help to reduce different risks exposures, are needed in different types of supply chains.

The diversity of supply chains studied allows for the examination of a wide-variety of contracts and underlying coordination mechanisms. The following research questions are addressed:

Research question 2A: What types of coordination mechanisms are used within contracts?

Research question 2B: What differences can be observed in the use of these mechanisms across various types of supply chains (commodity supply chains, proprietary brands and collective brands)?

² Shirking refers to instances in which actors falsely claim compliance with brand standards or exchange conditions.

Compared to previous studies on this subject (e.g., Ménard, 2004), the contracts used by supply chain actors are analyzed in more detail. Furthermore, compared to previous studies (e.g., Goldberg and Erickson, 1987), a broader range of aspects of contracts are considered. To improve the practical relevance of research into this subject, an examination of a broader and more in-depth range of contractual coordination mechanisms is required.

Studies Three-Four: Interdependencies, risks and their contractual solutions in differentiated supply chains

In the first study, supply chains have been distinguished based on the manner in which quality is coordinated in *inter-company* transactions; i.e., based on what types of quality management systems are used to govern those transactions. In the second study, supply chains have been distinguished based on the manner in which quality is coordinated towards the *consumer*; i.e., based on whether products are marketed to the final customer under a brand (differentiated supply chains) or not (commodity supply chains). The third and fourth study focus on a sub-set of the supply chains examined in the second study; i.e., on differentiated supply chains³.

Supply chains that produce differentiated goods are interesting to study for at least three reasons. *First*, supply chain actors increasingly attempt to upgrade from commodity-oriented production towards production for high-end or differentiated markets (Humphrey and Schmitz, 2002). This means that differentiated supply chains are likely to become more common. *Second*, supply chain actors' attempts to differentiate their products will affect the attributes of the transactions (see Zylbersztajn and Farina, 1999) and can thus lead to additional risks within the supply chain. For example, participation in differentiated supply chains can lead to performance measurement difficulties as buyers cannot easily distinguish between differentiated and commodity inputs. *Third*, participation in differentiated supply chains does not only increase supply chain actors' transaction risk exposure, it may also limit the contractual options the actors have in managing these risks. This is because differentiation can increase interdependency between an actor's supply and demand side transactions (Wever et al., 2012).

The following research questions are addressed:

Research question 3A: What types of conditions lead to interdependencies in differentiated supply chains?

³ Note that the focus in the studies is not on the final transaction in the supply chain (between the retailer and consumer), but on how differentiation in this transaction affects the preceding inter-company transactions.

Research question 3B: What are the consequences of interdependencies for the transaction risk exposure of supply chain actors?

Research question 3C: What types of contractual options do supply chain actors have in managing the transaction risks arising from these interdependencies?

‘Conditions’ refers in the context of this thesis to the various attributes of transactions – like the extent to which transaction parties have difficulties in assessing each other’s performance – which affect contracting decisions. It is important to examine the conditions which lead to transaction interdependency because its occurrence may affect the transaction risk exposure of the supply chain actors. For example, the use of a supply side contract may not only affect the (supply side) risk exposure of the parties involved in the transaction, but its effect can spill over into increased demand side transaction risk or increased risk elsewhere in the supply chain (see Studies Three-Four).

Compared to previous studies on this subject (e.g., see Roberts and Key, 2005), the present studies have a broader orientation on the supply chain as a whole. For example, within operations management literature, researchers have begun to study ‘triadic’ relationships, in which the focus mainly is on interdependencies between suppliers operating at the *same stage* within the supply chain or network of a (large) buying company (e.g., Wilhelm, 2011; Choi and Wu, 2009; Dubois and Fredriksson, 2008; Lazzarini, Claro and Mesquita, 2008). Studies Three-Four focus on interdependencies amongst (at least) three different supply chain stages. Furthermore, compared to previous studies which examine interdependencies within structures larger than the dyad (e.g., Galaskiewicz, 2011; Uzzi, 1996), the present studies have a more specific orientation on interdependencies related to the use of contracts.

2. THEORETICAL APPROACH

To help companies overcome the challenges of implementing a more supply chain-wide approach to managing interdependencies and associated transactions risks, the literature on this subject is of limited use. On the one hand, there are approaches, often based on Supply Chain Management (SCM) literature, which insufficiently take into account potential conflicts of interests between actors within the supply chain. On the other hand, there are approaches, often based on Transaction Cost Economic (TCE) literature, which insufficiently take into account the supply chain context in which individual transactions are embedded.

Limitation of Supply Chain Management theory

SCM has a wide range of definitions and applications (see Mentzer et al., 2001), but can probably be best regarded as a philosophy focused on managing the flows of goods or services between (original) producer and the final customer (Ellram and Cooper, 1990; Houlihan, 1988)). Literature on SCM has shifted in the 1990s from a focus mainly on the logistical processes required to managing these flows, to a broader perspective on the integration and management of (supportive) business processes (Lambert and Cooper, 2000). Amongst others, this shift has resulted in a rich body of literature on a wide range of tools which practitioners may use to manage or coordinate activities in their supply chain, like collaborative inventory management systems (Barrat and Oke, 2007; Sahin and Robinson Jr., 2005) or product tracking systems (Cooper and Tracey, 2005; Kumar and van Dissel, 1996).

According to Zylbersztajn and Farina (1999), many of such studies are based on the (implicit) assumption of costless cooperation amongst the supply chain actors. As a result, such studies do not fully take the costs of cooperation into account, nor the benefits that may accrue to certain supply chain actors for not cooperating. For example, Voeth and Herbst (2006) propose that actors improve their cooperation in pricing products in the supply chain, amongst others by being more transparent about their production costs. But, as the authors themselves (tacitly) acknowledge, when a customer will be able to extract rent if it has access to certain information (e.g., about production costs), the supplier is unlikely going to provide it.

Furthermore, Lee, Padmanabhan and Whang (1997) suggest that supply chain actors should increase the sharing of order demand information, to reduce excessive inventory investments amongst others. However, access to certain information (e.g., about market demand) may give a customer the opportunity to extract rent from it⁴. If so, the actor is unlikely going to share that information with its supplier for free⁵. Additionally, Galaskiewicz (2011) mentions that the build-up of trust is an important facilitator for improving information exchange in the supply chain. However, supply chain actors may incur significant costs in building-up and maintaining relationships; costs which may also lock them into certain suppliers (customers).

Limitation of Transaction Cost Economics

Transaction Cost-Economics (TCE), most often associated with the work of Williamson (2000; 1991; 1985) has arguably become the dominant theory for analyzing conflicts of interests

⁴ For example, a buying company may lose some of its bargaining power when its supplier has full insight in its demand.

⁵ In the first example, a supplier has access to information and it is not in its interest to share it with customers. In the second example, a customer has access to information and it is not in its interest to share it with suppliers.

between transaction parties, and how these interests can be re-aligned, through contracting decisions (see Geyskens, Steenkamp and Kumar, 2006; Leiblein, 2003; Ghosh and John, 1999). Amongst others, two important contributions can be attributed to TCE: (1), it has drawn attention to the diversity of contracts used in high performance economies; (2) it has given an efficiency-based explanation for this diversity (Raynaud, Sauvé and Valceschini, 2005; Williamson, 1991, Williamson, 1988). TCE's assumptions and explanations, which are outlined in the next chapters, have been extensively operationalized and empirically tested (see Rindfleisch and Heide, 1997). By and large, the empirical evidence supports the central assumptions underlying the TCE framework (Macher and Richman, 2008; Williamson, 2000).

However, insufficient attention has been given to a major shortcoming of TCE: its neglect of the wider supply chain context in which individual transactions take place (Wever et al., 2012). TCE studies often examine contracting decisions only in the context of bilateral transactions. This results from TCE studies unbundling the supply chain into dyads (Nickerson et al., 2001) and focusing on interdependencies which exist between the parties in each dyad (Williamson, 2002; 1991). Unfortunately, such approaches ignore the consequences of decisions made within one dyad for other transactions. For example, a change in the formula used to calculate the price in a farmer-processor transaction (e.g., changes to bonuses or penalties), may reduce the incentives for farmers to produce high quality products. This can increase the risks that low quality products are exchanged in the processor-retailer transaction.

A Transaction Cost Economics approach with a supply chain orientation

To improve the practical relevance of research into the subject of contract decision making in supply chains, the thesis has needed to address the above mentioned weaknesses in these two streams of literature. This has been achieved by shifting TCE's unit of analysis from a focus on bilateral transactions, towards examining transactions in a supply chain context. This shift in focus allows for the examination of transaction risks from a supply chain perspective. This has made it possible to examine, for example, how conflicts of interests between actors upstream in a supply chain can affect the transaction risk exposure of actors downstream in the supply chain.

Why an (extended) TCE approach and not (also) other theoretical approaches?

Although a wide range of theoretical frameworks have been developed to examine contracting decisions (e.g., Resource Based View of the firm, Real Options theory, Agency theory,

Property Rights theory), the present thesis analyses such decisions almost exclusively through an (extended) TCE lens. This is for three main reasons.

First, most of these frameworks – amongst others the Resource Based View of the firm and Property Rights theory – have not been operationalized nor empirically tested to the same extent as TCE (Kim and Mahoney, 2005; Whinston, 2003; Williamson, 2002; Williamson, 2000). This makes TCE arguably the most robust framework to use and build on.

Second, TCE is applicable in a much wider variety of contract decision making situations than most other frameworks. For example, while Agency theory applies mainly to situations in which (one of the) contracting parties have difficulty in monitoring, metering or measuring the contribution of the other party involved in the transaction (see Jensen and Meckling, 1976; Fama, 1980), Real Options theory is mostly concerned with situations in which investment decisions and associated contracting choices have to be made under conditions of uncertainty (see Trigeorgis, 2006; McGrath, Ferrier and Mendelow 2004; Folta and Miller, 2002)⁶.

Although earlier versions of the TCE framework had a somewhat narrow focus on situations involving the use of specific investments, subsequent extensions (e.g., Geyskens, Steenkamp and Kumar, 2006; Rindfleisch and Heide, 1997) have made it possible to examine most contracting situations through a TCE lens.

Third, and related to the previous point, considering the wide applicability of TCE, it was not considered beneficial to employ other frameworks besides TCE. Although recent studies have started to combine or integrate (aspects of) TCE with other frameworks, the benefits of such an integrated approach are not always clear. This is for various reasons: a), frequently, studies which combine frameworks use a simplified version of the TCE framework (e.g., see McIvor, 2009; Nickerson, Hamilton and Wada, 2001; Barney and Lee, 2000)⁷; (b), some studies reach conclusions which could have been reached without relying on other frameworks (e.g.,

⁶ Furthermore, Property Right theory (see Hart 1991; 1989; Grossman and Hart, 1986) is mainly applicable to situations in which asset ownership is the main mechanism by which (residual) control in a transaction is established (Holmström and Roberts, 1998).

⁷ For example, Nickerson, Hamilton and Wada (2001) examine how Porter's Strategic Positioning Framework can be combined with TCE. However, their study considers, of the various drivers of contracting decisions within the TCE framework, only asset specificity.

Sanchez, 2000)⁸; (c), other studies insufficiently consider whether the assumptions underlying the different theoretical frameworks are compatible (e.g., Hendrikse and Windsperger, 2011)⁹.

3. EMPIRICAL CONTEXT

To help to address the research questions, empirical research has been conducted in a specific sub-section of the agri-food sector: the pork meat industry. The role of empirical research in the thesis is twofold: (1), to illustrate the value en relevance for practitioners of the theoretical insights regarding contracting choices which have been developed in the studies; (2), to help refine those insights. To be able to achieve this, it is important to examine a wide variety of contract decision making situations. The meat industry is a particularly interesting industry to examine in this context because of at least four reasons.

First, a wide variety of different types of contracts are used, not only at different supply chain stages (e.g., feed producer or slaughterhouse), but also across different types of supply chains (e.g., branded or commodity supply chains) and different countries (e.g., North and South European countries).

Second, as is explained in the introduction to this chapter, the management of interdependencies and associated transaction risks is of particular importance in the meat industry because of public health consequences in case of food quality problems.

Third, related to the previous point, the meat industry has been one of the first to develop quality management systems that cover the whole supply chain. Although such systems can help actors in coordinating quality, they may also, paradoxically, increase interdependencies even further in the supply chain.

Fourth, a wide variety of different types of differentiation strategies are used within the pork industry, ranging from commodity producing supply chains to brands owned by a collective of chain actors. As is explained in Section 1, differentiation can increase interdependencies between contracting decisions at different stages within the supply chain.

⁸ For example, Sanchez (2000) combines insights from TCE and Real Options theory to examine contracting decisions under conditions of volume uncertainty. But, the TCE framework already considers (volume) uncertainty as one of the key drivers of contracting decisions.

⁹ Hendrikse and Windsperger (2011) use both Property Rights (PR) theory and TCE in their study, without addressing or reconciling key differences between the two frameworks. Amongst others, studies based on PR generally do not consider bargaining costs between transaction parties after initial contract terms have been established, while the presence of such costs are a key focal point within TCE (according to Williamson, 2002; Masten, 1999). Related to this, PR does not recognize any advantages an internalized transaction may have over a market transaction in adapting to (some) changing circumstances (Whinston, 2003; Williamson, 2002).

Although the empirical part of the thesis is focused on the pork industry, the thesis' main implications should be applicable also to other, non-agri-food, contexts. Amongst others, this is because the theoretical part of the thesis is arguably more important than the empirical part for answering the research questions. Related to this, the approach which is taken in the theoretical part of the thesis (see Section 2), and on which the empirical results are based, has not been developed specifically for the agri-food sector. Most of the literature which has been used to develop this approach has come from general management journals rather than from specific agri-food oriented journals. Furthermore, special care has been taken to assure that the managerial implications of the thesis are relevant for managers from a wide range of sectors and industries.

4. METHODOLOGICAL APPROACH

Studies One and Two include empirical data about the pork industry. To generate the data, a two phase, multiple case study approach was taken in which the unit of analysis was the pork supply chain. The thesis examined the transactions between the supply chain actors.

The objective of the first case study phase (Study One) was to obtain an overview of the variety of supply chain types which can be found in the pork industry and to characterize the contracts and quality management systems that are used within these supply chains. Seven supply chains in four European countries (Germany, Spain, The Netherlands and Hungary) were examined.

The second case study phase (Study Two) examined in more detail some of the supply chain types identified in the first case study phase. Commodity chains, proprietary brands and collective brands were examined. The objective of this case study phase was to compare the types of contracts used within these supply chains. Eight supply chains in five countries were examined (Denmark, France, Spain, The Netherlands and one non-European country, Brazil)¹⁰.

A case study approach was deemed most suitable in the context of this thesis for a number of reasons.

First, considering that the thesis aimed to examine contracting decisions within a supply chain context, it was important to examine the contracts used in the various transactions making up the supply chain. As a result, it would be difficult to obtain data from a large enough sample of

¹⁰ Note that, although the second case study phase builds on the work done in the first case study phase, particularly for the Dutch and Spanish cases, new research was undertaken in all of the countries (see Chapter Three).

supply chains to conduct quantitative research. Most quantitative research examines only two-stage supply chains; i.e., buyer-supplier relations. Furthermore, often buyers (suppliers) from *different* types of supply chains are ‘pooled’ into one group when results are analyzed. Such an approach is inappropriate when the objective is to examine interdependencies in contracting decisions between actors operating within the *same* supply chain.

Second, the thesis has attempted to obtain in-depth insight into contracts and the ‘real-life context’ in which they are used. Case study research is more suitable than quantitative approaches for obtaining these insights, as the focus of the latter is on ‘controlling’ rather than understanding this context (Yin, 1999). The human action and interaction which leads to the implementation, adjustment and potential failure of a contract to appropriately govern a transaction is difficult to fully understand without in-depth knowledge of the specific context in which the contract is used.

Third, although a lack of ‘generalisability’ has often been cited as an important limitation of case study research (Yin, 1981), this critique is not entirely justified. To be able to understand to what other contexts the results of a study may apply, it is important to clearly delineate the empirical domain in which the study takes place (Gibbert, Ruigrok and Wicki, 2008). This domain or context is often best understood and specified by means of case study research, as is explained in the previous point.

Fourth, with increased concentration in many industries, case studies of a couple of (large) companies may already lead to valuable insights. For example, the car industry is dominant by just a few companies world-wide, which makes it possible to obtain not only in-depth, but also characteristic results by means of case studies. Also the pork industry has become dominated by a limited number of actors. For example, the largest meat companies in Denmark and The Netherlands execute more than half of all of the pig slaughters in their respective domestic markets.

5. THEORETICAL AND MANAGERIAL CONTRIBUTIONS

The thesis has been written largely out of a desire to improve the practical relevance of the literature on inter-organizational contract forms. As is explained in Section 3, during the course of the study, it became clear that there were some gaps in the literature on this subject which made the current state-of-the-art-theory insufficient to answer the research questions. As a result, a significant part of the thesis is focused on theory development, in particular with regard to TCE, to be able to bridge these gaps.

The problems encountered by practitioners and the solutions implemented by them are often much more specific than the generic advice provided within TCE literature (e.g., see Raynaud, Sauvée and Valceschini, 2005; Barney and Lee, 2000; Williamson, 1991). Practitioners do not (only) require advice about whether to make or buy their inputs (outputs) or to implement a formal or a verbal contract with their supplier (customer). More importantly, they require advice on how to do it (e.g., to fix prices for a transaction or not). To address this issue, the thesis makes two important contributions¹¹. First, a typology has been developed which allows for a much more in-depth examination of contracts than previous typologies (see Chapter 3). As a result, more specific advice can be given to practitioners about the types of contracts that they should consider using. Second, contracts have been examined within the broader supply chain contexts in which they are used (see Chapters Four-Five in particular). Therefore, detailed advice can be given to practitioners about how they can optimize their contract use for the various supply chain transactions in which they participate.

6. MAIN CONCEPTS

This section characterizes some of the main concepts used in the thesis.

Supply chain

‘Supply chain’ is a broadly defined concept in the thesis. Following Mentzer et al. (2001) it refers to: *“a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer”*. Note that one entity may be involved in more than one stage of the supply chain; i.e., it may be its own source or customer. For example, a slaughterhouse may also raise the pigs it slaughters. The supply chains which have been examined in the first case study phase consist of seven stages: feed producer-breeder-farrower-finisher-slaughterer-processor-retailer. The second case study focuses on five supply chain stages, as the breeding and farrowing stage have not been examined.

‘Breeders’ produce semen, sows and boards. They supply the genetic basis for pig farming, which includes both farrowing and finishing. ‘Farrowers’ produce and raise piglets until they are approximately 25 kg. Subsequently, ‘finishers’ raise piglets from the previous stage until they reach their slaughter weight (which varies from 85 kg to more than 150 kg, depending on the type of pig used and type of market served). ‘Slaughterers’ kill the pigs and cut the carcass into various pieces. Meat parts are sold to processors or retailers directly. ‘Processors’ use the

¹¹ The thesis contributes also to other areas, amongst others to research into the organization of quality management systems. See Chapter Six for a more elaborate discussion of the thesis’s contributions.

meat parts (or carcasses) delivered by the slaughterer to prepare specific meat products (e.g., steaks, loins, ham, and sausages). ‘Retailers’ include, in the context of this thesis, all outlets in which consumers can purchase meat products (e.g., supermarkets, butchers, hotels).

Contract

The term ‘contract’ has various meanings within economics and management literature (see Masten, 1999; Ménard, 1997; Klein, 1992; Cheung, 1983; Williamson, 1979; Macaulay, 1963). In its most narrow interpretation, a ‘contract’ refers strictly to those arrangements which are implemented with the intention of creating legally enforceable rights and obligations for the parties involved in a transaction (Masten, 1999). In a broader interpretation, a ‘contract’ refers to the arrangements used, enforceable by legal or other means (e.g., by the threat of relationship termination), to govern transactions (Klein, 1992). This thesis uses the broader interpretation of the term ‘contract’. Both verbal and written contracts are included in this interpretation. Furthermore, the term also includes investment-based arrangements, like equity-alliances or vertical integration.

Other terms than ‘contract’ which are used by researchers to refer to arrangements between transaction parties, include: governance structure, form of economic organization and inter-organizational mode (e.g., see Raynaud, Sauvé and Valceschini, 2005; Ménard, 2004; Webster Jr., 1992; Williamson, 1992). In this thesis, the term ‘contract’ is used, amongst others because it is a term which is more accurately interpreted by scholars and practitioners which are not operating in the field of institutional economics.

Transaction risk

‘Risk’ may be defined as the possibility of a harmful outcome or event (e.g., a costs or a loss) (see Hallikas et al., 2004). The focus in the thesis is on ‘transaction risks’; i.e., possible harmful events resulting from the participation of an actor in transactions with other actors. A TCE perspective is taken on ‘transaction risks’.

Within the TCE framework, the main driver of contracting decisions is an actor’s exposure in a transaction to the risk of strategic, self-interested behavior by the counterparty to the transaction (Williamson, 1988). Strategic behavior refers to the attempts made by actors to exploit this counterparty, amongst others by renegotiating the conditions of the exchange (i.e., the risk of opportunism) or by falsely claiming compliance with exchange conditions (i.e., the risk of shirking). Strategic behavior is possible because contracts always include gaps and omissions (Williamson, 2008), which result from human constraints in information processing

capabilities (Simon, 1957). Furthermore, because of these constraints, actors cannot specify all changes in the circumstances surrounding a transaction in advance (Williamson, 1991). Actors entering into a transaction run the risk that the circumstances change (e.g., demand for a product falls) after the parties have agreed upon exchange conditions (e.g., after a large order is placed). These changes can expose the transaction parties also to the risk of maladaptation; i.e., the risk of a failure to adapt to environmental changes.

Interdependency

‘Interdependency’ refers to situations in which ties exist or arise between actors; i.e., when the behavior of actors, and the outcomes of their behavior, depends on the behavior of (some of the) other actors in the network or supply chain (based on Molm, 1994). Actors may be tied or interdependent through various channels or interfaces¹², but the focus in this thesis is mainly on interdependencies related to the transactions in which they participate¹³.

Transactions are regarded as ‘interdependent’ when supply chain actors’ exposure to supply (demand) side transaction risks affects their ability to manage exposure to demand (supply) side transaction risks. Interdependencies may lead to negative ‘transaction externalities’, as when the use of a supply side contract not only affects the (supply side) risk exposure of the parties involved in the transaction, but its effects spill over into increased demand side transaction risk or increased risk elsewhere in the supply chain (Wever et al., 2012). Note that only transaction externalities in the context of the supply chain are considered in this thesis; e.g., a spillover of supply (demand) side risks to the demand (supply) side transaction or elsewhere in the supply chain. See Roberts and Key (2005) for an analysis of ‘horizontal’, industry wide transaction externalities as opposed to the ‘vertical’ supply chain transaction externalities examined in this thesis.

Quality management system and Differentiation

In the thesis, supply chains have been distinguished based on the type of ‘quality management system’ used (in study 1) and on the type of ‘differentiation’ label or signal used (in Studies Two-Four). A ‘quality management system’ refers to the manner in which compliance with quality standards is monitored and signaled *between* supply chain actors; i.e., within the supply

¹² For example, actors may obtain credit from the same bank. For studies of interdependencies which arise between actors through other channels than the transactions between them, see Borgatti and Li, 2009; Burt, 1980.

¹³ As is explained in Section 1, the participation of supply chain actors in different types of quality management systems (see Study One) or different types of brands (see Studies Two-Four) is expected to affect the extent to which interdependencies arise through the transactions in the supply chain.

chain (based on Raynaud, Sauvée and Valceschini, 2005; Humphrey and Schmitz 2001; González-Díaz, Barcala and Arruñada, 2003). Quality management systems are distinguished in the thesis based on: (1), their ownership; (2), the extent to which they are used vertically across *different* supply chain stages; and (3), the extent to which they are used horizontally, by different actors operating at the *same* stage in the supply chain.

‘Differentiation’ refers to the manner in which quality is signaled *towards* the consumer (based on Raynaud, Sauvée and Valceschini, 2009). A distinction is made in the thesis based on: (1), whether the meat products are marketed under a brand name or not (commodity chain or branded chains); and (2), if the products are marketed under a brand, whether the brand is owned by an individual supply chain actor (proprietary brand) or by a collective of supply chain actors (collective brand). Note that a consumer quality signal may or may not be supported by a specific quality management system within the supply chain. Likewise, note that the use of a quality management system within the supply chain is not necessarily signaled towards the consumer.

7. THESIS OUTLINE

The remainder of the thesis is organized as follows.

Chapter Two (Study One) addresses the first research question ‘*What is the relation between the participation of supply chain actors in different types of quality management systems and their contracting choices?*’. The research question is addressed both theoretically (based on TCE) and empirically (by means seven case studies).

Chapter Three (Study Two) addresses research questions 2A ‘*What types of coordination mechanisms are used within contracts?*’ and 2B ‘*What differences can be observed in the use of these mechanisms across various types of supply chains?*’. To address the research questions, a typology of contractual coordination mechanisms is developed based on extant literature. Furthermore, the value of the typology is illustrated by comparing the use of these mechanisms across three types of supply chains: proprietary brands, collective brands, commodity chains. In total, eight cases are studied.

Chapter Four and *Chapter Five* address research questions 3A ‘*What types of conditions lead to interdependencies in differentiated supply chains?*’, 3B ‘*What are the consequences of interdependencies for the transaction risk exposure of supply chain actors?*’ and 3C ‘*What types of contractual options do supply chain actors have in managing the transaction risks*

*arising from these interdependencies?'. The research questions are answered through a TCE lens. *Chapter Four* (Study Three) first provides the theoretical justification for moving TCE's unit of analysis beyond the dyad. Subsequently, various stylized contract decision making situations are analyzed through both a dyad-oriented TCE lens and a TCE lens with a supply chain-wide orientation. While Chapter Four discusses mainly contracts which actors can use to reduce or eliminate their transaction risk exposure, *Chapter Five* (Study Four) examines a broader range of contractual options for actors when risk minimization is not possible. Furthermore, compared to Chapter Four, Chapter Five more explicitly considers risks resulting from non-sequential interdependencies in the supply chain.*

Chapter Six discusses the main findings of the studies and concludes the thesis. Several propositions are outlined which could be tested in further research. Furthermore, various implications are outlined for practitioners on how they can take a more supply chain-wide approach to managing their contractual relations.

ALIGNMENT BETWEEN QUALITY MANAGEMENT SYSTEMS AND CONTRACTS IN EU PORK SUPPLY CHAINS¹⁴

Although inter-company coordination of quality management is increasingly important for meeting end-customer demand in agri-food supply chains, few researchers focus on the relation between quality management systems (QMS) and the contracts used between the supply chain actors participating in these QMSs. However, failure to align QMSs and contracts may lead to inefficiencies in quality management because of high transaction costs. This paper addresses this gap in research by empirically examining the relation between QMSs and contracts in pork meat supply chains. Transaction Cost Economic theory is used to develop propositions about the relation between three aspects of QMSs – ownership, vertical scope and scale of adoption – and the use of different types of contracts in pork meat supply chains. To validate the propositions, seven cases are examined from four different countries. The results show that the different aspects of QMSs largely relate to specific contracts used in supply chains in the manner predicted by the propositions. This supports the view that alignment between QMSs and contracts is important for the efficient coordination of quality management in (pork meat) supply chains.

1. INTRODUCTION

Research into quality management is moving from studying quality management in an intra-company context to studying quality management in an inter-company context (Kaynaka and Hartley, 2008). This trend is related to a shift in the industry from competition between companies, to competition between supply chains (Nair, 2006). This shift is also apparent in agri-food supply chains. Importance of inter-company quality management is mainly related to two developments: (1), increased quality management demands following recent food crises (Trienekens and Van der Vorst, 2006); and (2), increased interdependencies between supply chain actors in meeting the quality demanded by the end-customer (Van Plaggenhoef, 2007).

¹⁴ The article on which this chapter is based has been published as “Wever, M., Wognum, N., Trienekens, J., Omta, O, ‘Alignment between chain quality management and chain governance in EU pork supply chains: A Transaction-Cost-Economics perspective’, *Meat Science*, (84), 2010, pp. 228-237.”

Although inter-company coordination of quality management is increasingly important for meeting end-customer demands in agri-food supply chains, few researchers focus on the relation between inter- or multi-company quality management systems (QMS) and the contracts used by the supply chain actors participating in these systems (Raynaud, Sauvée and Valceschini, 2005). However, insufficient alignment between QMSs and contracts can result in high transaction costs, amongst others by leading to under-investments in quality improvements, quality cheating, and difficulties in adjusting quality standards within the supply chain (Martinez and Zering, 2004). Besides reducing the (economic) efficiency in the supply chain, insufficient alignment is likely to lead to a reduction of food quality (González-Díaz, Barcala and Arruñada, 2003).

To address this gap in research, the paper empirically investigates the relation between QMSs and contracts in meat supply chains. The objective is to examine how QMSs are aligned with the contracts used in supply chain transactions. Meat supply chains are particularly well suited for this analysis because of recent quality management related developments in the industry. In response to severe food crises, and the accompanying loss of consumer confidence, supply chain actors have developed chain-wide QMSs (Van Plaggenhoef, 2008). The degree of participation of actors in these systems can be expected to have a large influence on relations within the supply chain.

The remainder of the paper is organized as follows. *Section Two* outlines the theoretical approach of the study. Using Transaction Cost Economic theory, it is argued that QMSs need to be aligned with contracts in order to reduce transaction costs. Based on this alignment principle, propositions are developed about the relation between three aspects of QMSs – ownership, vertical scope and scale of adoption – and the types of contracts used in meat supply chains. *Section Three* outlines the methodological approach taken to examining the propositions. A case study approach was used, as little previous empirical work was identified which examines the relation between QMSs and contracts in meat supply chains. Seven pork supply chains were examined in four EU countries. The pork industry, because of the diversity of QMSs and contracts found, provides a particularly rich context for the purpose of this study. Only EU pork supply chains were examined to provide for a relatively homogenous context. *Section Four* gives a background to the cases. *Section Five* outlines the main results of the study. Based on the three criteria – ownership, scope and scale – four different types of QMSs were distinguished in the EU pork industry. For each of the four types of QMSs, alignment between QMSs and contracts is for the most part in accordance

with the propositions developed in Section two. *Section Six* discusses the main findings of the study and highlights areas for further research.

2. QUALITY MANAGEMENT SYSTEMS AND CONTRACTS

Coordination of quality in the pork supply chain is achieved through a combination of (inter- or multi-company) quality management systems (QMSs) and contracts. QMSs may facilitate in the coordination of quality by setting standards, monitoring compliance with these standards and signaling compliance (and non-compliance) to the different actors involved in the pork supply chain (Raynaud, Sauvée and Valceschini, 2005). Contracts may facilitate in the reduction of transaction risks related to the coordination of quality (Martinez and Zering, 2004).

2.1. Quality management systems

QMSs consist of three elements (based on Raynaud, Sauvée and Valceschini, 2005; González-Díaz, Barcala and Arruñada, 2003; Humphrey and Schmitz 2001): quality signals, quality standards and quality monitoring mechanisms. ‘Quality signals’ are employed by companies to indicate product and process quality to their buyers (which may be other companies or consumers¹⁵; Raynaud, Sauvée and Valceschini, 2005; Sporleder and Goldsmith, 2001). ‘Quality standards’ and ‘quality monitoring mechanisms’ support quality signals (Ordóñez et al., 2006). Quality standards are set by the signal owner, which can be either a supply chain actor, or a public actor. Standard setting and monitoring compliance with those standards can be split; i.e., different actors can be responsible for each activity (Ponte and Gibbon, 2005; Humphrey and Schmitz, 2001).

2.1.1. Types of quality management systems

Based on the conceptualization of QMSs as is outlined above, and a literature review (e.g., Theuvsen and Spiller, 2007; Raynaud, Sauvée and Valceschini, 2005), QMSs can be distinguished along three dimensions: (1), the owner of (parts of) the system; (2), the scope of the system; (3), the scale of the system:

Owner of system

A general distinction can be made between public and private QMSs. In case of the former, the quality standard (and quality signal) is owned by a public actor(s). In case of the latter, the

¹⁵ In the context of the thesis, quality signals used in business-to-consumer transactions are not considered as part of a QMS (see Section 6 in Chapter One).

standard (and signal) is owned by a private actor(s). Importantly, as is outlined above, standard setting and monitoring compliance with the standard may be split, but ultimately, the actor(s) setting the standard may be regarded as owner(s) of the system.

Scope of the system

This dimension refers to the extent to which a QMS is adopted along the different stages of the vertical supply chain. QMSs can be company-to-company or chain-wide. Chain-wide QMSs cover all main transactions within the supply chain, while company-to-company QMSs cover only a single transaction in the supply chain.

Scale of system

This dimension refers to the extent to which a QMS is adopted horizontally across one (or more) stage(s) of the supply chain; i.e., the market penetration of the system. A QMS may have a wide scope (i.e., it is adopted by all stages of the vertical supply chain), but a small scale (i.e., it is adopted only by a few actors in each stage of the supply chain).

2.2. Contracts

‘Contract’ refers to the agreements used to govern transactions; i.e., it refers to the manner in which transactions are organized (within the supply chain). Transaction Cost Economics (TCE), most often associated with Williamson (2000; 1996; 1988; 1981) has been the dominant theory for analyzing contracting choices. Amongst others for this reason, a TCE perspective has been used in this study (see also Section 2 in Chapter One).

TCE has been criticized for various reasons¹⁶, amongst others of (1), neglecting the social (Uzzi, 1996; Granovetter, 1985) and institutional (Coase, 1988; North, 1986) context in which transactions occur; (2), focusing mainly on risks related to opportunism and shirking behaviour (see Section 2.2.2) as the primary drivers of contract choices, thereby paying little attention to other types of drivers (Gulati and Singh, 1998); (3), failing to take into account the relation between company characteristics and contract choices (Leiblein and Miller, 2003).

However, much of this criticism has focused on earlier versions of TCE (Rindfleisch and Heide, 1997). Recent TCE studies have started to address most of these points of criticism.

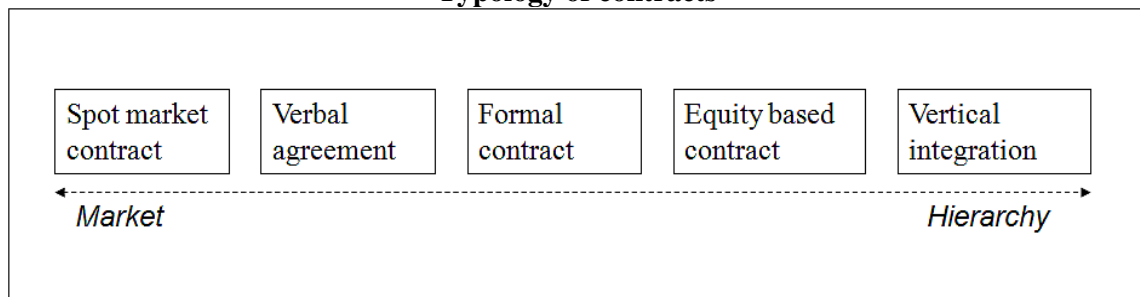
¹⁶ Next to the three points of criticism mentioned in the present study, TCE has also often been criticized of being a ‘static’ framework, which makes it difficult for example to examine path dependency effects in contract choices (Foss and Foss, 2000; Moran and Ghoshal, 1996). However, Williamson (1996, 2000) has reacted strongly to this criticism, stating that inter-temporal issues are central to the TCE framework.

For example, Rooks et al. (2000) have examined how transactions are embedded within social relations, while Oxley (1999) has related aspects of the institutional environment (e.g., property rights regimes) to contract choices. Gulati and Singh (1998) have examined adaptation difficulties, next to opportunism and shirking, as drivers for contract choices. Furthermore, recent studies have started to address the criticism that TCE does not take into account the effect of company-specific attributes on contract choices, by incorporating company strategy in TCE models (Leiblein and Miller, 2003; Nickerson, Hamilton and Wada, 2001; Ghosh and John, 1999). The present study builds on these later studies by using a TCE framework to relate contract choices within supply chains, to differences in the QMS strategy¹⁷ chosen within the supply chains (see Section 2.3).

2.2.1. Types of contracts

In the TCE framework, contracts are distinguished based on the extent to which actors coordinate or control various phases of the production process (Williamson, 1991). Work based on the TCE framework generally distinguishes between contracts which rely on more market forms for coordinating transactions and contracts which rely on more hierarchical forms of coordination.

FIGURE 2.1
Typology of contracts



(based on Raynaud, Sauvé and Valceschini, 2005)

Market types of contracts rely mainly on price and competition for the coordination of the transaction (Martinez and Zering, 2004; Williamson, 1991):

- Different supply chain actors are autonomous parties;
- The autonomy of the parties makes market types of contracts more efficient than hierarchies in adapting to price changes;

¹⁷ QMS strategy refers here to the type of QMS chosen in the supply chain.

- The threat that buyers switch to other suppliers gives supply chain actors a strong incentive to adapt to price changes;
- Compared with hierarchies, actors with market contracts have less control over their buyers or suppliers (e.g., less opportunity to monitor the other's behavior and performance or to carry out punitive measures).

Hierarchical types of contracts rely mainly on administrative control for the coordination of the transaction (Martinez and Zering, 2004; Williamson, 1991):

- Different stages within the supply chain are not autonomous: in case of full integration, different stages are owned by a single actor;
- Stronger control mechanisms make hierarchies more efficient than markets in adapting to changes which require a coordinated response (e.g., changing quality requirements) but less efficient in adapting to price changes (e.g., because of inflexibility of wages).

In between the market and hierarchy polar forms, various intermediate forms of contracts exist, as is visualized in Figure 2.1. These types of contracts combine elements from both markets and hierarchical contract forms. The closer a contract is to one of the polar forms in Figure 2.1, the more closely the contract is expected to resemble that form. The typology of contracts shown in Figure 2.1 was used to classify the contracts found in the examined cases (see Section 3.2). Except for equity-based contracts, all types of contracts were found.

2.2.2. Transaction attributes and contract choices

According to TCE, transactions, which differ in their attributes, need to be aligned with specific contracts, which differ in their cost and aptitude, in an economically efficient manner (Williamson, 1981). Economic efficiency in this regard means that parties to a transaction should strive to minimize the cost of the transaction (Williamson, 2000), to the extent that value is maximized for both parties (compared to the next best alternative for each party; Ghosh and John, 1999). Three attributes of the transaction are important in this regard: level of asset specificity, level of performance measurement difficulty and level of uncertainty or adaptation difficulty (see Rindfleisch and Heide, 1997; Ghosh and John, 1999; Williamson, 1991):

- 'Asset specificity' refers to the extent to which the investments an actor makes to support a transaction ties the actor to the other party in the transaction. According to TCE, high levels of asset specificity means that the actor making these investments will seek more hierarchical types of contracts, with legally binding, contractual safeguards (i.e., formal contract, equity-based contract and vertical integration). This is

to reduce the risk of opportunism, which is the risk that the other party to the transaction will renegotiate the terms of the conditions, once investments are made (Williamson, 1988).

- 'Performance measurement difficulty' refers to the extent to which parties in a transaction can measure the benefits and costs the other party brings to the transaction. If information is more difficult to measure it is likely that more hierarchical types of contracts are adopted to reduce the risk of shirking behavior; i.e., the risk that parties put in insufficient effort (Ghosh and John, 1999).
- 'Level of uncertainty' refers to unanticipated changes in the wider context in which a transaction is embedded. These changes can lead to adaptation difficulties, as when the parties to the transaction fail to adapt to these changes. Depending on the type of changes, certain contracts are more suitable than others. For example, hierarchical types of contracts are more efficient than market contracts in adapting to changes which require a coordinated response amongst supply chain actors, such as changing quality requirements. Market types of contracts are more efficient than hierarchies in adapting to changes which favor autonomous adaptation of supply chain actors, such as price changes (Bijman, 2007; Gulati and Singh 1998; Williamson, 1991).

Different types of QMSs affect the attributes of the transaction in different ways (Raynaud, Sauvée and Valceschini, 2005). It is because of this reason that different types of QMSs need different types of contracts: unless parties to a transaction employ a contract which manages transaction risks resulting from the employed QMS – i.e., risks relating to asset specificity, performance measurement difficulty and uncertainty – a loss of value will occur, as supply chain actors may scale back investments and adapt less (Ghosh and John, 1999).

2.3. Types of quality management systems and contracts

Based on the review of the literature, it can be hypothesized that different types of QMSs are associated with different types of contracts. In particular, it is proposed here that the three dimensions of QMSs affect the need for certain types of contracts in the following manner.

2.3.1. Relation between scope of QMS and contract choices

As is outlined in Section 2.1.1, a distinction can be made between company-to-company QMSs and chain-wide QMSs. Based on the TCE framework, it can be argued that adaptation difficulties are more severe in supply chains with company-to-company QMSs, than in supply chains with chain-wide QMSs.

Agri-food supply chains require a coordinated response between supply chain actors to produce the quality demanded by the market (Martinez and Zering, 2004). In cases with chain-wide QMSs, this coordination is achieved through the QMS which (implicitly) aligns activities (Wognum and Wever, 2008). In cases with company-to-company QMSs, no

coordinated chain-wide response is achieved as the various bi-lateral partnerships adapt autonomously to (changes in) quality demands.

As autonomous adaptations to quality demands are less efficient than coordinated adaptations (Martinez and Zering, 2004), it can be argued that supply chains with company-to-company QMSs need additional mechanisms to achieve a coordinated chain-wide response. Given that stronger control mechanisms associated with hierarchies are more efficient in achieving a coordinated response (see Section 2.2.2), the following proposition can be formulated:

Proposition 1: Supply chains with company-to-company QMSs need, when compared to supply chains with chain-wide QMSs, more hierarchical contracts (i.e., formal contracts, vertical integration)

As is explained in Section 2.2.1, four types of contracts are examined in the study: spot market contracts, verbal agreements, formal contracts and vertical integration (no equity based contracts were used in the examined cases). For the purpose of examining the propositions, formal contracts and vertical integration are regarded as (more) hierarchical types of contracts. This is because these types of contracts are closest to the hierarchy polar form (see Section 2.2.1). See Section 3.2 for the operationalisation of the various types of contracts.

2.3.2. Relation between ownership of QMS and contract choices

As is outlined in Section 2.1.1, a distinction can be made between public and private QMSs. Based on the TCE framework, it can be argued that risks related to asset specificity and performance measurement difficulty are larger in transactions undertaken in supply chains with private chain-wide QMSs than in chains with public chain-wide QMSs.

In private QMSs, supply chain actors make specific investments amongst others in: (1), developing the QMS (e.g., investments by the standard owner in quality signals); (2), improving practices to meet new quality standards; (3), new quality measurement technologies (Martinez and Zering, 2004). In public QMSs, public actors provide (part of) the resources necessary for setting and monitoring compliance with standards in the supply chain (González-Díaz, Barcala and Arruñada, 2003). As a result, supply chain actors make fewer investments in specialized resources. Furthermore, supply chain actors can economize on the costs of monitoring other supply chain actors, as these activities are undertaken by public actors.

Given that the stronger control mechanisms associated with hierarchies are more efficient in dealing with risks related to asset specificity and performance measurement difficulty (Ghosh and John, 1999; Williamson, 1991; see also Section 2.2.2), the following proposition can be formulated:

Proposition 2A: Supply chains with private chain-wide QMSs need, when compared to supply chains with public chain-wide QMSs, more hierarchical types of contracts (i.e., formal contracts, vertical integration)

2.3.3. Relation between scale of QMS and contract choices

As is outlined in Section 2.1.1, QMSs can be distinguished based on the extent to which they are adopted across one (or more) stage(s) of the supply chain. Based on the TCE framework, it can be argued that risks related to asset specificity and performance measurement difficulty are larger for transactions in supply chains with private chain-wide QMSs, adopted on a small scale, than for transactions in supply chains with private chain-wide QMSs, adopted on a larger scale. In this last situation, actors have a larger number of potential trading partners to choose from at each stage of the supply chain. Investments are therefore less specifically related to other supply chain actors (Raynaud, Sauvée and Valceschini, 2005). Furthermore, large scale adaptation of QMSs makes outsourcing of monitoring activities to third-party certifying institutions more economical (Humphrey and Schmitz, 2001). In QMSs with a smaller scale, more specific investments need to be made to comply with the QMS requirements, because of fewer trading partners at each stage of the supply chain. Furthermore, due the lack of economies of scale, it might be difficult (or at least less economical) to outsource monitoring activities to third-party certifying institutions.

Given that the stronger control mechanisms associated with hierarchies are more efficient in dealing with risks related to asset specificity and performance measurement difficulty (Ghosh and John, 1999; Williamson, 1991; see also Section 2.2.2), the following proposition can be formulated:

Proposition 2B: Supply chains with private chain-wide QMSs that are adopted on a small scale need, when compared to supply chains with private chain-wide QMSs that are adopted on a larger scale, more hierarchical contracts (i.e., formal contracts, vertical integration)

3. RESEARCH METHODOLOGY

This section outlines the methodology used to examine the propositions developed in Section Two.

3.1. Selection of cases

The unit of analyses for the study was the vertical supply chain. More specifically, the study examined the various transactions within the supply chain (see Section 4.1 for an overview of the structure of the supply chain). To obtain the data necessary for characterizing EU pork supply chains, seven case studies were conducted in four different countries: Germany, Spain, Hungary and The Netherlands:

- DE: (1), Farmers' Cooperative (FC) owned QMS; (2), Retailer owned QMS.
- ES: (3), Fresh meat supply chain; (4), PDO supply chain.
- HU: (5), Fresh meat supply chain; (6), Specialty pig supply chain.
- NL: (7), Fresh meat supply chain.

Differences can be observed in QMSs within the different regions within the EU. Because of this reason, supply chains from countries in the different regions were included in the study. This made it possible to include QMSs with different scale, scope and ownership, which was necessary for the examination of the propositions. The cases were examined through collaboration with researchers from the selected countries (see Appendix A for the Case Study Protocol)¹⁸.

3.2. Methods

To gather data for each of the cases, in-depth interviews were conducted with scientific and industry experts, as well as with supply chain actors in each of the cases¹⁹. With regard to QMS aspects, the interviews focused on: (1), identifying which QMSs were used in the cases; i.e., by asking questions about the types of signals, standards and monitoring mechanisms used in each stage of the supply chain; (2), the scale, scope and ownership of these QMS (see

¹⁸ The original case selection included also cases from China, South Africa and Greece. Cases from outside the EU were excluded from the analysis in order to provide for a relative homogenous context for the study. The Greek cases were excluded because the data were incomplete.

¹⁹ Although numerous researchers participated in the process of generating and categorizing data for the cases, contributions were mainly made by: Dr. Brinkmann and Dr. Ellebrecht (University of Bonn); Prof.dr. Várkonyi (Central Food Research Institute); Prof.dr. Briz and Dr. Peña (Universidad Politécnica de Madrid); Dr. Wognum (Wageningen University). These researchers have also helped to validate the cross-case analysis presented here. Furthermore, they have contributed to the second case study phase, together with Dr. Sauvé and N. Rakotonandraina (LaSalle Beauvais); and Dr. Pozzobon (Universidade de São Paulo, Brazil).

Section 4.2 in Appendix A²⁰). With regard to the contractual aspects, the interviews focused on the nature of the communication supporting the transaction, the duration of the transaction, the formality of the transaction, and the delineation of organizational boundaries (see Section 4.1 in Appendix A). Previous research (e.g., Raynaud, Sauvée and Valceschini, 2005) has shown that these aspects are useful for distinguishing between the various types of contracts as shown in Figure 2.1.

Obtained data were analyzed by a set of coding rules. The main coding rules for QMSs are outlined in Table 2.1

TABLE 2.1
Coding rules for QMSs

Element of QMS	Rule
<i>Scope of QMS</i>	A QMS is regarded as company-to-company when it covers only bi-lateral partnerships. A QMS is regarded as chain-wide when it covers three or more stages in the supply chain. Furthermore, the QMS should cover at least the following three key stages in the chain: producer, slaughterhouse and processor*.
<i>Ownership of QMS</i>	A QMS is regarded as public when the quality standard is owned by a public actor, or the public actor provides (part of) the resources (e.g., public certification) necessary for monitoring and signaling compliance with this standard.
<i>Scale of QMS</i>	A QMS is regarded as having a large scale, if more than 10% of the pigs produced in a country are produced under the QMS. All other QMSs are considered small scale.

* Theoretically, other types of QMSs could exist (e.g., QMSs which cover just two stages). However, such QMSs were not found in the examined cases.

No useful constructs were found in the literature for operationalising ‘scope’, ‘scale’ and ‘ownership’ of QMSs. Therefore, the coding rules have been developed based on interviews with industry experts. The coding rules proved useful in the context of this study. For example, small and large scale QMSs could be clearly distinguished in the actual cases. On the one hand, systems like IKB and QS (see Section 4.4.2) covered more than 90% of the pig production in The Netherlands and Germany, respectively. On the other hand, small-scale systems used in German supply chains, as well as in the Hungarian specialty supply chain, covered 1% or less of the pig production in the respective countries.

An overview of the main coding rules for contracts (based on a previous study by Raynaud, Sauvée and Valceschini, 2005) is presented in Table 2.2. Contracts have been classified in five groups, based on the typology of contracts shown in Figure 2.1, namely spot market contracts (M), verbal agreements (VA), formal contracts (C), equity-based contracts (EC) and vertical integration (VI). However, the results show that no equity-based contracts were used

²⁰ Also data generated through Section 4.3 of the Protocol were used to analyze the QMSs used in the cases.

in supply chain transactions. Therefore, only four groups have been distinguished in the final analysis: M, VA, C, VI.

TABLE 2.2
Coding rules for contracts

Contract	Rule
<i>Spot market contract</i>	A contract (invoice) for instant exchange of goods or services. No commitment exists for future transactions.
<i>Verbal agreement</i>	Exchanges not formalized into written, legally enforceable contracts. A verbal commitment exists for future transactions. Performance or behavioral standards are unlikely to be specified, but if so, they are not formalized.
<i>Formal contract</i>	Legal enforceable, written contracts are used to govern the transaction. A written commitment exists for future transactions. Performance and behavioral standards are likely to be specified in the contract.
<i>Equity-based contract</i>	An actor owns stock (and has the accompanying shareholder voting rights), but less than 50%, of (one of) its suppliers/ buyers.
<i>Vertical integration</i>	An actor owns more than 50% of the stock (and has the accompanying shareholder voting rights) of (one of) its suppliers/buyers.

(adapted from Raynaud, Sauvé and Valceschini, 2005)

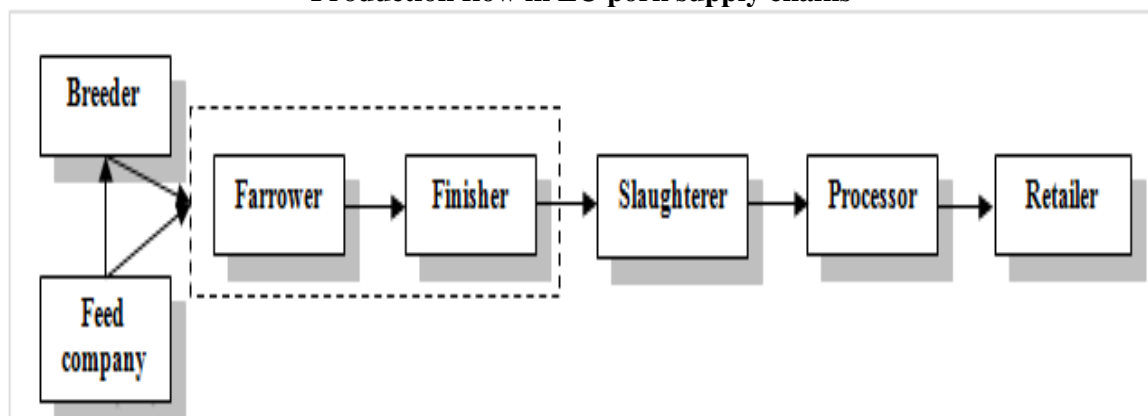
4. BACKGROUND TO CASES

This section gives a short background to the cases by describing elements common to all of the cases. The section describes the basic structure of the pork supply chain, as well as baseline EU quality standards.

4.1. Supply chain structure

The EU pork supply chain covers the following processes: Feed-production – Breeding – Farrowing – Finishing – Slaughtering – Processing – Retailing (see Figure 2.2). Farrowing and finishing can be performed by separate farms, but often they are combined into a single organization.

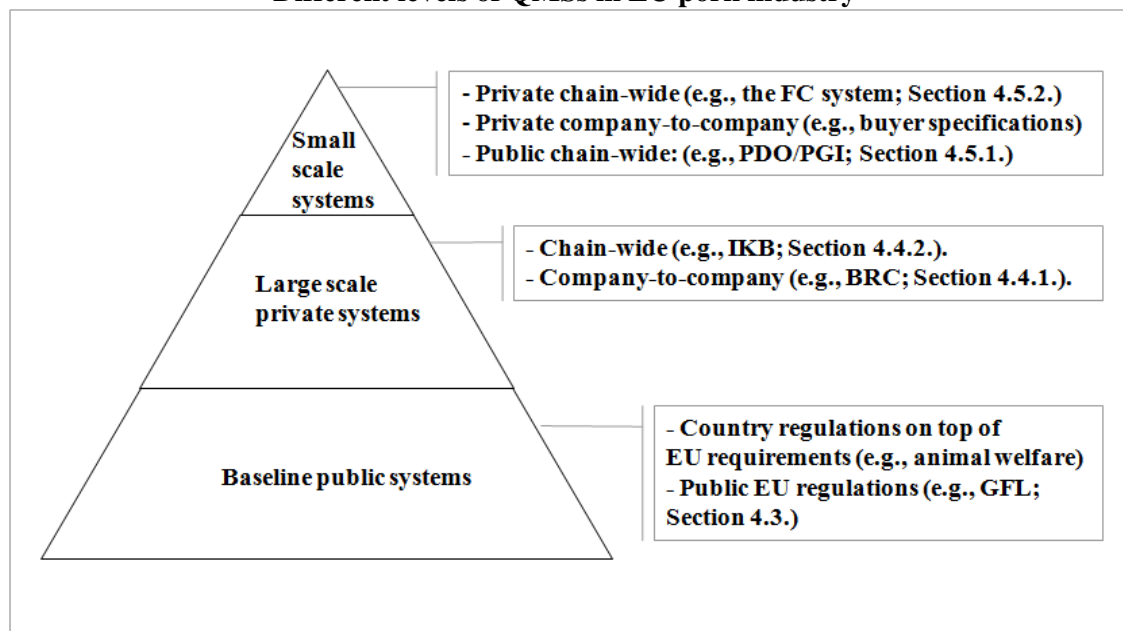
FIGURE 2.2
Production flow in EU pork supply chains



4.2. Different levels of quality management systems

In the EU pork industry, different levels of QMSs can be distinguished: (1), public baseline systems, (2), additional widely-accepted private systems adopted on top of public baseline systems, (3), additional systems, both public and private, used by a small amount of industry participants, adopted on top of widely-accepted private systems (or on top of public baseline systems in case no widely-accepted private systems exist in a country). This is visualized in Figure 2.3.

FIGURE 2.3
Different levels of QMSs in EU pork industry*



(adapted from Trienekens and Zuurbier, 2008)

*The various quality management systems shown in Figure 2.3 are discussed in Sections 4.3-4.5.

As is shown in Figure 2.3, and also explained earlier, systems can also be distinguished based on the scope of the system (i.e., company-to-company or chain-wide) in addition to a distinction based on ownership of the system and the scale by which the system is adopted across the industry.

4.3. Baseline public systems: EU food law and pork industry

The EU has developed a wide range of legislative demands with regard to food safety. In 2002, the cornerstone of the new EU food law was laid through passage of Regulation 178/2002. This regulation is often referred to as the 'General Food Law' (GFL). Its main objective is to secure a high level of protection of public health and consumer interests with

regard to food products. The GFL, active since January 2005, gives food (and animal feed) companies primary liability in the event of unsafe products. This necessitates implementation of monitoring systems at company level. Information from these systems should make it possible to determine the source of safety or quality risks in the supply chain. In addition to the general EU regulation 178/2002, EU hygiene regulations 825/2004, 853/2004 and 854/2004 are particularly important for the pork industry. These demand implementation of self-regulation by food companies (Trienekens et al., 2008; Van Plaggenhoef, 2007).

4.4. Large-scale private systems

This section will focus on large-scale private QMSs that exist on top of public regulations for coordinating quality in agri-food supply chains. Small-scale systems are discussed in Section 4.5.

4.4.1. Company-to-company systems

Relatively recently, supply chain actors have developed large-scale initiatives to commit their suppliers to strict QMSs. For example, large European retailers have developed comprehensive systems with regard to food safety, product and process management, and personnel hygiene. The systems were developed to help retailers fulfil legal obligations and protect consumers, but they now include more stringent demands for food safety and quality than required by law. Examples include BRC²¹, IFS²² and GFSI²³. These three systems have been adopted on a large scale across the EU pork industry: BRC is required by (major) British retailers, IFS by (major) French, German and Italian retailers; GFSI by (major) Dutch and Belgium retailers (Trienekens et al., 2008; Van Plaggenhoef, 2007).

In most of the examined cases, large-scale company-to-company systems are used (e.g., IFS in the German Farmer Cooperative supply chain; GFSI – i.e., Dutch HACCP code – in the Dutch fresh pork supply chain).

4.4.2. Chain-wide systems

In various EU countries, chain-wide QMSs are emerging that encompass most quality management processes in the pork supply chain. So far, Northern European countries like the

²¹ British Retail Consortium Standard (BRC), originated from British retailers. Aims at processing/distribution stage of the chain.

²² International Food Standard (IFS), originated from German, French and Swiss retailers. Aims at processing/distribution stage of the chain.

²³ Global Food Safety Initiative (GFSI) in particular was set-up with direct suppliers of retailers, such as food manufacturers, processors, and traders, in mind.

Netherlands (IKB²⁴), Germany (QS²⁵), and Denmark (QSG²⁶) are up-front in implementing these kinds of systems. IKB, QS, QSG have been adopted on a large scale across the industry: all three systems cover more than 90% of the pigs produced in the respective countries (Trienekens et al., 2008). The IKB case, as an example of a large scale, private chain-wide system is discussed in Section 5.2. QS is briefly discussed in Section 5.3, as part of the two German cases examined in the study. QSG has not been examined in the study, as already two large-scale chain-wide QMSs (IKB and QS) were included in the case selection. QSG is briefly discussed in Section 6, as a possibly interesting case for further research.

4.5. Small-scale public and private systems

Apart from the large-scale private QMSs described above, there are also less widely adopted systems, often oriented towards regional or specialty products.

4.5.1. Public chain-wide systems

Regional systems like PDO (Products of Designated Origin) and PGI (Protected Geographical Indication) can be distinguished mainly in Southern European countries. Special attention is given in these countries to (further) development of regulations and standards to protect the brand names of these products (Trienekens et al., 2008). PDO and PGI systems tie products to a specific region. Because of this, the scale by which these systems can be adopted is limited by the (natural) boundaries of the region. PDO and PGI systems may be considered as chain-wide QMSs. This is because quality standards are set across (large parts of) the supply chain while compliance with these standards is also monitored. PDO and PGI systems may also be considered public. Although specific PDO and PGI systems need not be necessarily directly under public ownership, public actors remain ultimately responsible for: (1) setting the quality standards; (2) monitoring compliance with the standards; (3) the credibility of the quality signals in these supply chains. Public actors may delegate (some of) these responsibilities to the regulatory council, the collective organization in which the supply chain actors are organized (Raynaud, Sauvé and Valceschini, 2005). An example of a PDO system is discussed in Section 5.4.

4.5.2. Private chain-wide and private company-to-company systems

Also private actors develop small-scale, chain-wide QMSs mainly to assure the quality of regional or specialty products. Such systems can be found in most countries in Europe. An

²⁴ IKB: Integrated Chain Control. The chain-wide QMS used in The Netherlands.

²⁵ QS: Quality and Security. The chain-wide QMS used in Germany.

²⁶ QSG: The chain-wide QMS used in Denmark.

example of such a system, in this case a system owned by a farmer's cooperative (FC) in Germany, is discussed in Section 5.3.

Customer-specific quality demands, laid down in written documents, supported by monitoring mechanisms, and the signalling of compliance with the standard to the next stage in the supply chain, may be regarded as a small-scale private company-to-company system²⁷. Customer-specific quality demands could be found in most of the cases (see Section 5.1-5.4). It should be noted, however, that demands were not always formalized into written documents.

5. RESULTS

The results show that four main types of systems for coordinating quality management in EU pork supply chains can be identified: one public baseline QMS, two private chain-wide QMSs and one public chain-wide QMS. The four types of systems largely relate to contracts as predicted by the propositions developed in Section 2.3. The four systems are outlined in Section 5.1-5.4. Each section discusses one of the seven examined cases in more detail to illustrate the functioning of the systems.

5.1. Public baseline QMS

Supply chains with this type of system do not have a QMS covering the main stages in the supply chain. Without a chain-wide (private) quality policy, the actors adhere solely to the public baseline quality standards. Supply chain actors may set additional company-to-company private standards. Supply chains with this type of system can be found in the fresh meat case in Spain (see Box 2.1) and the fresh pork meat case in Hungary.

²⁷ Depending on the size of the actor making the demands, some of these systems may be regarded as large scale.

BOX 2.1

Fresh pork meat supply chain in Spain

Contracts

Most relations in the Spanish fresh pork meat chain have been formalized into written contracts. An important actor in this regard is the feed producer, who coordinates the upstream part of the supply chain.

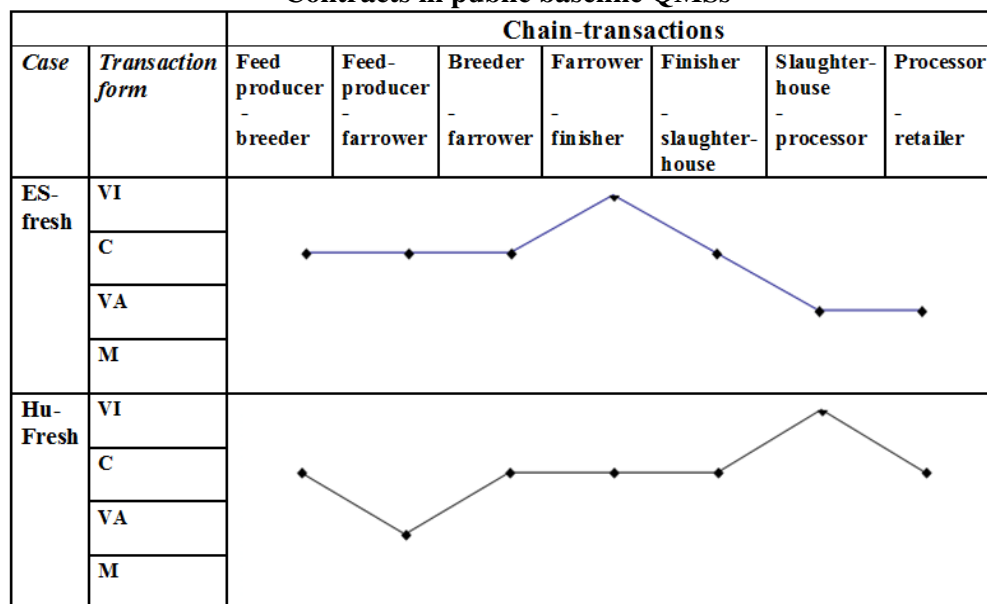
Quality management system

The Spanish national government, as well as regional governments, set baseline quality standards for the sector. No chain-wide private quality standard is used; only company-to-company standards are set. An important standard setter in the supply chain is the feed company who, as is outlined above, coordinates the upstream part of the supply chain. In general, the private standards used in company-to-company relations have a relatively small scope.

Compliance with legislative requirements is monitored (for a large part) by the Regional Ministries of Agriculture. Monitoring of compliance with private standards is mostly undertaken by supply chain actors themselves (although also third-party certifying agencies monitor the larger supply chain actors). In the upstream part of the supply chain, monitoring activities are mostly undertaken by the feed producer

With regard to the contracts used in these supply chains, mainly hierarchical types of contracts were used, especially formal contracts (see Figure 2.4). In the Spanish case, formal contracts are mainly used upstream in the chain, while formal contracts can be found in most stages in the Hungarian case. Overall, the relation between QMSs and contracts found in the two supply chains seems to follow the logic of proposition 1: the lack of a chain-wide QMS means that vertical coordination needs to be achieved by more hierarchical contracts.

FIGURE 2.4
Contracts in public baseline QMSs



(M = market; VA = verbal agreement; C= formal contract; VI = vertical integration)

5.2. Private chain-wide QMS as industry standard

Supply chains with this type of system have a private chain-wide QMS on top of public baseline standards. The chain-wide QMS has a very large scale. Actually, it is so widely adopted across the industry that it forms the industry standard. Supply chain actors may set additional private standards for the immediate linkages in the supply chain. These additional company-to-company standards are generally also widely adopted among the respective horizontal stages of the supply chain. These types of supply chains can be found, amongst others, in the fresh pork meat industry in The Netherlands (IKB), Germany (QS) and Denmark (QSG) (see Section 4.4.2). The Fresh pork meat supply chain in The Netherlands is one of the cases examined in this study (see Box 2.2), the fresh pork meat supply chain in Germany was not examined as a separate case, but QS is briefly discussed in Section 5.3. QSG has not been examined in the study, but is mentioned in Section 6, as a possibly interesting case for further research.

BOX 2.2

Fresh pork meat supply chain in The Netherlands

Contracts

Different contract types can be found at different stages in the supply chain. For example, while a formal contract governs the farrower-finisher transaction, market contracts can be found in farmer-slaughterhouse transactions. Overall, formal contracts are relatively rare in the supply chain: even though most relations are long-term, the relations have often not been formalized into written contracts.

Quality management system

The Dutch government sets baseline quality standards for the sector, which exceed EU legislation in some regards. Additional standards are set by the private QMS IKB. More than 90% of the pigs produced in The Netherlands are IKB pigs. IKB is a chain-wide system: it sets requirements for each linkage in the supply chain. Supply chain actors (may) make demands on top of IKB requirements.

Compliance with legislative requirements is monitored mainly by two public inspection agencies. Inspections are based on a risk-based system, meaning that companies performing very well on QMS aspects will receive fewer inspections than companies performing poorly. In addition, the Dutch accreditation council monitors third-party certifying institutions. Monitoring of compliance with private standards is mostly outsourced by supply chain actors to third-party certification institutes like Lloyds and SGS.

IKB is signalled only in inter-company transactions. The major retailers have stopped using the IKB label to signal quality to the end-customer. Retailers use their house labels instead.

In the Dutch pork meat supply chain, vertical integration and formal contracts between supply chain actors are relatively rare (see Figure 2.5); mostly verbal agreements and market contracts can be found. With this, the relation between QMSs and contracts follows the logic of proposition 1: vertical coordination is achieved by means of a chain-wide QMS (IKB), making more hierarchical coordination of supply chain transactions not necessary. Furthermore, the relation between QMSs and contracts follows the logic of proposition 2B:

chain-wide private QMSs do not need more hierarchical contracts if the QMS is adopted on a large scale in the industry.

FIGURE 2.5
Contracts in large scale, private chain-wide QMS

<i>Case</i>	<i>Transaction form</i>	<i>Chain-transactions</i>						
		Feed producer - breeder	Feed-producer - farrower	Breeder - farrower	Farrower - finisher	Finisher - slaughter-house	Slaughter-house - processor	Processor - retailer
NL-fresh	VI							
	C							
	VA							
	M							

(M = market; VA = verbal agreement; C= formal contract; VI = vertical integration)

5.3. Private chain-wide QMS (on top of industry standard)

Supply chains with this type of system have adopted an additional private chain-wide QMS on top of an industry-wide and chain-wide private QMS. This additional private chain-wide quality system has a small scale; it is adopted by relatively few supply chain actors. These supply chains can be found in the two cases examined in Germany, namely, the supply chain coordinated by the farmer's cooperative (FC; see Box 2.3) and the retailer-coordinated supply chain. Also, a private small-scale and chain-wide QMS exist in the specialty supply chain in Hungary. However, unlike the German supply chains, in the Hungarian supply chain the QMS is adopted on top of a public baseline QMS.

BOX 2.3**German pork meat supply chain coordinated by a farmer's cooperative***Contracts*

Coordination in the supply chain is organized by the farmer's cooperative (FC). Mostly long-term (exclusive), formal contracts govern the transactions between the supply chain actors.

Quality management system

The German and regional government set baseline quality standards for the sector. Additional standards are set by the private chain-wide QMS QS. Around 95% of the pigs produced in Germany are QS pigs. An additional chain-wide QMS is used on top of QS. This system is used on a small scale: around 0.9% of German pigs are produced under this system. Owner of the system is the FC. Additionally, larger supply chain actors have adopted horizontal quality standards like GMP+ and IFS, which are used on a large scale in the German industry.

Compliance with legislative requirements is monitored by public inspection agencies including public veterinarians. Compliance with private standards is monitored by means of QS audits and inspections by farmer's cooperative. Additionally, the larger supply chain actors are monitored by third-party certification institutes.

Use of the system is signalled, by means of a label, in inter-company transactions, as well to end consumers. Other signals used in inter-company transactions are GMP+, IFS, ISO 9001.

In both the German cases, as well as in the Hungarian case, long-term supply chain relations exist, which are, for a large part, formalized into written contracts (see Figure 2.6). The relation between the QMSs and contracts found in the cases follows the logic of propositions 2B: to safeguard the specific investments made by supply chain actors to meet the additional requirements of the private, small-scale QMS, more hierarchical contracts are needed.

FIGURE 2.6
Contracts in small scale, private chain-wide QMSs

Case	Transaction form	Chain-transactions						
		Feed producer - breeder	Feed-producer - farrower	Breeder - farrower	Farrower - finisher	Finisher - slaughter-house	Slaughter-house - processor	Processor - retailer
DE-FC-Chain	VI							
	C							
	VA							
	M							
DE-Retail Chain	VI							
	C							
	VA							
	M							
Hu-Specialty chain	VI							
	C							
	VA							
	M							

(M = market; VA = verbal agreement; C= formal contract; VI = vertical integration)

5.4. Public chain-wide QMS

Supply chains with this type of system have adopted a (voluntary) public chain-wide QMS on top of the baseline quality standards, set, signaled and enforced by the EU, the state, and other public actors. Mostly, these are regional systems e.g., PDO and PGI systems, which tie production to a specific region. This type of system is used in the Spanish PDO supply chain (see Box 2.4).

BOX 2.4 PDO supply chain in Spain

Contracts

Coordination in the supply chain is organized by the Control Board (the independent regulatory council responsible for setting standards and monitoring compliance with these standards). All supply chain actors are registered with this board. Contracts between the actors are mostly spot market or relational in nature.

Quality management system

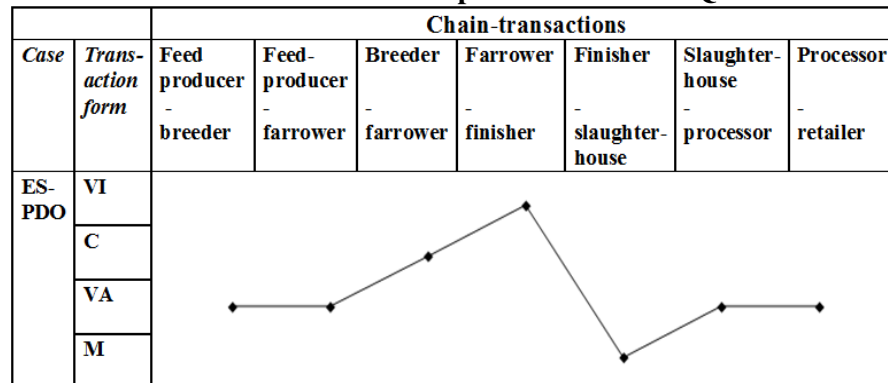
PDO systems are protected by EU regulation. This protection is given only when certain strict conditions are met, e.g., the product's characteristics must be linked to the specific geographical location. Furthermore, the PDO is subject to general regulation on meat production. The regional government is responsible for protecting the reputation of the PDO, as well as the supply chain actors using the quality signal. The regional government delegates this responsibility to the regulatory council, a legally independent entity in which the supply chain actors are organized. Supply chain actors who want to use the PDO label, have to be approved by the regulatory council. The Spanish PDO is used on a low-to-medium scale in the industry: around 1% of the dry-cured ham (and around 10% of the Iberian cured ham) annually produced in Spain is produced under this label.

Compliance with legislative requirements is monitored by public inspection agencies. The monitoring of compliance with the PDO requirements is carried out by an independent monitoring organization, as well as the regulatory council itself.

The PDO label is signalled in inter-company transactions as well as to the end consumer. Other signals used in inter-company transactions are, amongst others: ISO 9001, ISO 14001.

Section 5.3 has shown (see also proposition 2B) that private chain-wide QMSs need to be supported by more hierarchical contracts if the QMS is adopted only on a small scale within the industry. However, in the Spanish PDO supply chain, with its relatively low-scale QMS, exchange relations are not hierarchical, but mostly informal (i.e., verbal agreements) or market-like in nature (see Figure 2.7). This can be explained by the fact that in this supply chain, public actors provide (part of) the resources necessary for safeguarding the investments made by supply chain actors. Since supply chain actors can economize on the costs of monitoring other supply chain actors, less hierarchical contracts are sufficient (see also Raynaud, Sauvée and Valceschini, 2005). With this, the relation between QMSs and contracts found in the Spanish PDO supply chain follows the logic of proposition 2A: public supported QMSs do not need hierarchical contracts between supply chain actors.

FIGURE 2.7
Contracts in additional public chain-wide QMS



(M = market; VA = verbal agreement; C= formal contract; VI = vertical integration)

6. DISCUSSION AND FURTHER RESEARCH

This chapter has given insight into the relation between QMSs and contracts in the context of the EU pork industry. In the study, first a conceptual analysis of the relation between QMSs and contracts was given, based on Transaction Cost Economic theory (see Sections 2.1-2.3). Three propositions have been developed about the relation between QMSs and contracts (see Sections 2.3.1-2.3.3). Case study results show that four main types of systems can be distinguished for coordinating quality management in EU pork supply chains: one public baseline QMS, two private chain-wide QMSs and one public chain-wide QMS. The four types of systems largely relate to contracts as predicted by the propositions (see Section 5). The patterns found between QMSs and contracts indicate that Transaction Cost Economic considerations help to explain QMSs choices. This supports the view that alignment between QMSs and contracts is important for the efficient coordination of quality management in (meat) supply chains. This should encourage researchers to focus on examining the relation between QMSs and contracts.

The results presented in this chapter give (some) insight into what suitable contractual solutions are for the efficient coordination of quality management in (pork meat) supply chains. Further research is needed to examine whether the relations between QMSs and contracts found in this study also hold true for other types of supply chains, both within the (pork) meat industry, as well as in other (agri-food) supply chains.

Other research directions could consist of investigation of relations between contracts choices with more specific quality management practices. For example, QMSs could also be

distinguished based on the (the extent to which) different types of monitoring mechanisms are used (e.g., on-site inspections, inspection of inputs, outputs or documentation).

Furthermore, research could focus on the dynamics of QMS and contract choices. For example, to what extent do QMS practices and requirements change over time and to what extent do these changes affect contract choices? In the discussion of the Dutch case (see Section 5.2), it was mentioned that retailers have stopped signaling the QMS used in the supply chain (IKB) to the end-customer, to be able to source products also from outside The Netherlands (where IKB is not used). This suggests that changes in QMS practices do influence the relations between actors in the supply chain and highlights the importance of more in-depth research into this area.

In addition, alignment between QMSs and contracts needs to be related to supply chain performance, both with regard to economic and food quality performance. In particular, such research should focus on comparing the performance of cases in which similar types of QMSs are supported by different types of contracts. In the European pork industry, for example, IKB, QS and QSG can all be regarded as similar types of QMSs (see Section 4.4.2). However, secondary data (Hobbs, Kerr and Klein, 1998) suggest that QSG is supported by more hierarchical types of Contracts, when compared to IKB and QS. If this is indeed the case, then other research could: (1), attempt to explain the differences; and (2), relate these differences to supply chain performance. This type of research should give (more) insights into what types of contracts and QMSs solutions are suitable for improving performance in different types of supply chains.

OPENING THE BLACK BOX OF SUPPLY CHAIN CONTRACTS: TOWARDS AN INTEGRATED TYPOLOGY OF UNDERLYING COORDINATION MECHANISMS²⁸

Besides the coordination of quality, supply chain actors also need to consider the coordination of other aspects of economic activity, like price setting. Much of this coordination takes place in the context of contracts between the actors. However, few studies examine the relation between the mechanisms used to coordinate these activities and the contracts in sufficient detail. As a result, studies often prescribe generic contracts to situations which require a specific mix of coordination mechanisms. This includes Study One (Chapter 2) in which only a limited range of contracts were considered. The present study aims to address this issue by: (1), developing a typology of coordination mechanisms used within contracts; (2), illustrating the value of the typology in an empirical context. Based on extant literature from a variety of disciplines, the typology integrates four types of coordination mechanisms: price, volume, quality and investment. To illustrate its value, case study research is presented from 8 pork supply chains. Three different types of supply chains are included in the case selection – commodity chains, proprietary brands and collective brands – to be able to examine a broad range of coordination mechanisms. An analysis of the cases by means of the typology allows for: (1), an in-depth examination of the contracts used; (2), establishing a link between the contracts and the larger supply chain contexts in which they are embedded.

1. INTRODUCTION

Much coordination of economic activity, like price setting or determination of quality specifications, takes place in the context of contracts between supply chain actors (Goldberg and Erickson, 1987). However, few studies examine the relation between the mechanisms used to coordinate these activities and contracts in sufficient detail (Crocker and Masten, 1991). For example, in a lot of studies on this subject, only generic contracts are examined (e.g., verbal arrangements, formal contracts, equity-contracts), in which the use of underlying coordination mechanisms, such as fixed forward or spot price mechanisms, is not specified (see Raynaud, Sauvée and Valceschini, 2005; Ménard, 2004). As a result, frequently in such studies, it is unclear *what* exactly the contracts are supposed to coordinate (e.g., see Gellynck and Molnár, 2009). Furthermore, when coordination mechanisms *are* examined in a study, the focus is often on only one type of mechanism (e.g., use of

²⁸ The article on which this chapter is based has been submitted to “Supply Chain Management: An International Journal”.

Study Two: Examining contractual coordination mechanisms

forward price mechanisms), while the interactions with other types of coordination mechanisms (e.g., quality coordination through third-party certifying institutions) used within a contract (or required to support a transaction) are not specified (e.g., see Tomek and Peterson, 2001).

However, some aspects of a contract between parties may be coordinated by more market forms of coordination and other aspects by more hierarchical forms of coordination. For example, a supply chain actor may include in a formal contract the quality specifications of the products to be delivered by its suppliers, but leave the price of the products to be determined by the spot market. Therefore, when contracts are analyzed, it is necessary to examine which underlying mechanisms are used instead of studying only the generic contracts (see also Grandori, 1997a).

Studies which examine only generic contracts often fail to capture the complexity of problems which companies face in making contract related decisions. For this reason, scholars often prescribe ‘blunt’ contractual instruments (e.g., make, buy or hybrid) to situations which require a specific mix of coordination mechanisms (see Ménard, 2004; Barney and Lee, 2000; Williamson, 1991). To improve the practical relevance of research in this subject, more detailed conceptualizations are necessary which better capture what companies are actually doing. In the present study, an attempt is made to characterize the use of coordination mechanisms in supply chain contracts in more detail.

The objectives of the paper are twofold. First, the objective is to develop an integrated typology of coordination mechanisms used within supply chain contracts. ‘Integrated’ in this context means that a broad range of different types of contractual coordination mechanisms are jointly considered in the study. More specifically, four types of coordination mechanisms are examined: price, volume, quality and investment mechanisms. Second, the objective is to illustrate the value of the typology by characterizing the coordination mechanisms used in ‘real-life’ contracts. Contracts are analyzed from eight different supply chains.

The empirical part of the paper focuses on agri-food supply chains, more specifically pork supply chains. Pork supply chains are suitable for this type of research because of the variety of different types of contracts used, not only at different supply chain stages, but also across different types of supply chains. Three types of supply chains have been examined: collectively owned brands, proprietary owned brands and commodity supply chains. The diversity in supply chains studied allows for the examination of a wide variety of contracts, which is important for the typology’s applicability in different types of contexts.

The remainder of the paper is organized as follows. *Section two* presents the literature review of the study. Literature from institutional economics, contract theory, (corporate) finance and

organizational theory is used to develop a typology of four types of coordination mechanisms. *Section three* outlines the methodological approach taken to the study. A case study approach has been used to examine the eight supply chains. *Section four* gives an overview of the results of the study in terms of the contracts and coordination mechanisms used. *Section five* compares the results across the three types of supply chains. *Section six* concludes the paper and outlines areas for further study.

2. MODELING COORDINATION MECHANISMS WITHIN SUPPLY CHAIN CONTRACTS: TOWARDS AN INTEGRATED TYPOLOGY

Section 2.1 gives an overview of past and current contract typologies used by researchers, in order to shed light on why a new typology is required. The development of the typology is discussed in Section 2.2. The typology itself is presented in Section 2.3.

2.1. Supply chain contracts

Although not always clearly defined, the term ‘contract’ has various meanings, within economics and management literature (see Masten, 1999; Ménard, 1997; Klein, 1992; Cheung, 1983; Williamson, 1979; Macaulay, 1963). In its most narrow interpretation, a ‘contract’ refers strictly to those agreements which are implemented with the intention of creating legally enforceable rights and obligations for the parties involved in a transaction (Masten, 1999). In a more broad interpretation, a ‘contract’ refers to the agreements used, enforceable by legal or other means (e.g., by the threat of relationship termination), to govern transactions (Klein, 1992). The present study uses the broader interpretation of the term ‘contract’.

Table 3.1 (see below) gives an overview of several studies which use or present contract typologies. The table is adapted from Gellynck and Molnár (2009), who have undertaken a literature review of the contract typologies used within (mainly) agri-food studies. The table does not give an exhaustive overview of the different types of contract typologies used by (agri-food) researchers, but it does present some of the most widely used ones.

Study Two: Examining contractual coordination mechanisms

TABLE 3.1
Literature review of contract typologies

Author	Main variables/criteria (values, if specified, shown in brackets)	Typology							
Williamson (1991)	- Enforcement mechanism (price and competition, courts and arbitration, administrative control) - Incentive intensity (strong-weak) - Adaptation ability (strong-weak)	Market	Hybrid					Hierarchy	
Webster Jr. (1992)	- Length/frequency - Information required for transaction - Criteria for partner selection - Equity participation - Objective (adversarial, collaboration)	Transactions	Repeated transactions	Long-term relations	Partnerships	Strategic alliances	Network	Vertical integration	
Raynaud, Sauvée and Valceschini (2005)	- Duration (short, long) - Formality (verbal, written) - Enforcement mechanism (courts, reputation, hierarchy) - Equity participation (no, yes)	Spot market contract	Relational contract		Formal contract		Equity based contract		Vertical integration
Schulze, Spiller and Theuvsen (2007)	- Length/frequency - Number of suppliers/customers - Specifications (e.g., input control) - Enforcement (see Williamson) - Equity participation	Spot market	Long-term relationship	Marketing contract		Production contract		Contract farming	Vertical integration
Gellynck and Molnár (2009)	- Length (short, medium, long) - Formality (verbal, written) - Equity participation (no, minority) - Intensity of contract (low-high) - Partner restrictions (no, yes) - Resource sharing (no, yes)	Spot market	Non-contractual relationship	Contractual relationship		Relation-based alliance		Equity-based alliance	Vertical integration

(adapted from Gellynck and Molnár, 2009)

As is shown in Table 3.1, numerous variables are used to differentiate between contracts types in the examined studies, of which the most common are: length or frequency of transactions (which is used as a proxy for actors' commitment to future transactions), formality of contract (verbal or written; i.e., a proxy for the enforceability of the contract), equity participation (which is used as a proxy for – property rights based – control) and type of enforcement mechanism (price and competition, court, administrative control). These variables help, amongst others, to determine the level of autonomy actors have in entering into a transaction and making decisions regarding key aspects of the transactions.

All studies discussed in Table 3.1 consider markets and hierarchies as polar contract forms. In a market contract, the transaction parties are completely independent in their decision making. Thus, when a supplier does not meet the requirements, a buyer can switch to another supplier. In a hierarchical contract, this decision making autonomy is removed; i.e., in this case, the supplier (buyer) is not a separate actor, but is integrated into the buyer's (supplier's) company. In between these polar forms, various intermediate contract forms are distinguished (see also Ménard and Valceschini, 2005; Buvik, 2002; Heide and John, 1990). Whereas in the two polar contract forms property rights are aligned with decision rights, in the intermediate contract forms this is generally not the case (Sauvé, 2002). At least one of the transaction parties will recede, by means of the contract, some autonomy in its decisions making, either by fixing some aspects of the transaction in advance (e.g., prices) or by allocating some decision rights (but not property rights²⁹) to the counterparty to the transaction (e.g., with regard to the determination of the production process requirements used to make the exchanged good).

The variables presented in Table 3.1 are useful for characterizing how transactions are coordinated by market and hierarchy polar contract forms. For example, markets rely on the enforcement mechanism of 'price and competition' to coordinate transactions, while hierarchies rely on 'administrative control' to coordinate transactions. However, these variables are less useful for establishing how coordination takes place within the intermediate contract forms. For example, the extent to which an agreement is formalized does not explain how price is coordinated in the contract or whether prices are coordinated differently in verbal arrangements.

²⁹ With the exception of equity based contracts.

Furthermore, the typologies of contract forms shown in the table do not explain if and how various types of coordination mechanisms can be combined within the same contract.

Although for example Williamson's (1991) use of the term 'hybrid' suggests that such a combination should be possible in the view of the author, he at the same time perceives the various contract types as discrete alternatives; i.e., with their own distinct and (largely) incompatible characteristics (see also Ménard, 1997). Other authors, like Raynaud, Sauvé and Valceschini (2005) and Webster Jr. (1992), assume that coordination becomes more hierarchical (or market-like) as one shifts from one contract type to the next. However, this insufficiently takes into account the possibility that some aspects of a transaction may be coordinated by more market forms and other aspects by more hierarchical forms of coordination.

To give an example, even though an equity or other type of investment based contract exists between two actors – which is a contract form close to the pure 'hierarchy' type in the scheme of Raynaud, Sauvé and Valceschini (2005) – the actors may very well coordinate prices, volume and even quality by means of spot market arrangements. Is such a contract really a hierarchical type of contract? It is a relevant question, because the example given is not a hypothetical one. Farmers organized in a cooperative have an investment based contract³⁰; each producer is a minority owner of its customer. However, frequently, farmers are not required to market their products through the cooperative (no commitment exists for future transactions), no price arrangements are made (spot prices are paid) and commodity products are accepted (spot market specifications are used).

Other examples of ambiguity in the classification of contracts based on the typologies and variables shown in Table 3.1 could be given. However, the message should already be clear: these typologies may classify certain intermediate contract forms as more hierarchical (market-like), when in fact they largely rely on market (hierarchical) mechanisms to coordinate the transactions.

Why do the typologies seem to ignore the link between contracts and underlying coordination mechanisms? In part, this is because most of the authors (implicitly) take Williamson's (1991) view of contracts as discrete alternatives. From this perspective, different contract types fall under different forms of contract law, which strongly limits the different types of coordination

³⁰ Cooperatives have particular characteristics compared to equity based investment contracts, e.g., with regard to member voting rights and the transferability of members' stake in the cooperative (Chaddad and Cook, 2004).

mechanisms which can be used within a particular contract³¹ (Ménard, 1997). Subsequently, in this view, there is little to choose for transaction parties at coordination mechanisms level (and little need for researchers to study it); the choice of contract largely determines what types of coordination mechanisms can be used. However, this perspective only explains how contract level choices restrict transaction parties in the types of mechanisms they can use to resolve disputes and enforce compliance with contract provisions (e.g., arbitration, administrative control). It is unclear why contract level choices should affect transaction parties' use of other types of coordination mechanisms.

Another perspective, based on the work of Cheung (1983) and Alchian and Demsetz (1972) amongst others, assumes that there is a continuum of contracts. From this point of view, there are little structural differences between contract types, which, if true, should give transaction parties larger freedom in combining various coordination mechanisms within a single contract. However this approach is not without its problems. While the 'contracts as discrete' perspective tends to over-emphasize the importance of contract level choices at the expense of coordination mechanism level choices, the 'contract as continuum' perspective makes contract level choices seem trivial (see Cheung, 1983). However, this is plainly not always the case. For example, whether or not a transaction takes place within a vertically integrated company³², which can put an elaborated command structure in place and can use non-price based incentive systems, can greatly affect the types of coordination mechanisms available to the transaction parties (Gulati and Singh, 1998).

This paper attempts to take the middle ground between these two perspectives. While it is acknowledged that the choice of contract can restrict transaction parties in their choice of coordination mechanisms, it is assumed that these restrictions mainly apply to situations in which one of the two polar contract forms is chosen. The empirical part of the paper will show

³¹ As Williamson (1991) explains, a court will hear a dispute between two separate companies engaged in a transaction, but will refuse to hear disputes between two parts of an integrated company about the same issue. An internal authority is in place within the latter which offers dispute resolution procedures outside the courtroom (Gulati and Singh, 1998).

³² In particular, the debate between the two perspectives revolves around the issue of establishing company boundaries, which is difficult and futile according to Cheung (1983), while this is crucial according to Williamson (1991). However, both perspectives seem to focus on different types of companies. Williamson (1991) seems to have large, vertically integrated *corporations* in mind in his work, which functioning is arguably easier to contrast with market transactions. Cheung (1983; 1973) discusses mainly small *partnership-like* organizations consisting of two persons, in which case it is perhaps of less importance whether the partnership is considered to consist of one or two separate companies.

that even within these polar forms, actors have more freedom in combining various coordination mechanisms than is generally assumed within the literature.

2.2 Development of typology

The typology covers only contractual based coordination mechanisms, including: price, volume, quality and investment mechanisms (see Grandori, 1997a; for a discussion of non-contractual mechanisms). Key aspects of transactions which need to be coordinated within contracts include: prices, volumes, quality specifications, timing of product delivery, as well as investments (and associated return/risk sharing) (see Wilson and Dahl, 2009; Ponte and Gibbon, 2005; Bogetoft and Olesen, 2004; Hueth et al., 1999; Joskow, 1985). As price and volume mechanisms include aspects concerning the timing of product delivery, the paper covers these key aspects. Not included in the typology as a separate category are dispute resolution and enforcement mechanisms, which are considered as auxiliary mechanisms to facilitate the coordination of price, volume, quality and investments. Furthermore, as is explained above, the ability of transaction parties to use a particular enforcement mechanism within the transaction is largely determined by the contract type chosen.

2.2.1. Introduction

The typology has been developed in two steps: (1), determining variables (including values) by which coordination mechanisms can be distinguished; (2), differentiating between various types of coordination mechanisms based on these variables. Table 3.2 (see Section 2.3) gives an overview of the variables used in the study, while Table 3.3 (see Section 2.3) gives an overview of the types of coordination mechanisms distinguished in the study based on these variables. As is shown in Table 3.3, four categories of coordination mechanisms have been distinguished for each type of mechanism. The number of categories used is broad enough to make a valid differentiation between the mechanisms used within contracts, but small enough to be able to identify a manageable set of coordination mechanisms.

During the development of the typology, it has been assumed that the coordination mechanisms are used within the context of ‘incomplete’ contracts’, i.e., contracts with gaps and omissions (Williamson, 2008; Schmitz, 2001; Hart and Moore, 1999; Grossman and Hart, 1986). This incompleteness results from the incapacity of parties to a transaction to foresee all the contingencies and changes in the circumstances surrounding a transaction in advance (Brousseau and Fares, 2000) as well as the costs involved in setting-up and implementing contracts with extensive conditions (Klein, 1992; Williamson, 1991). This is an important

aspect of contracts to consider in the context of the typology, because it means that transaction parties may face a trade-off between implementing mechanisms which facilitate adaptation to changes (e.g., by including tolerance levels which allow for some deviation from contract conditions if market conditions change) and implementing mechanisms which prevent the transaction parties from using such changes as a pretext to exploit the counterparty to the transaction (e.g., mechanisms which prevent actors from renegotiating exchange conditions) (Masten, 1999; see also Mulherin, 1986; Masten and Crocker, 1985). Special attention has been paid to assure that the typology includes both types of mechanism and is sensitive to the difficulties actors have in balancing the use of these mechanisms. The empirical part of the paper will show some of the contractual solutions used by actors which facilitate adaptation, but which also prevent self-interested actors from exploiting the other party to the transaction.

2.2.2. Price coordination mechanism

As is shown in Table 3.2, three variables have been used to differentiate price coordination mechanisms in agri-food supply chains (based on Heyder, Theuvsen and Von Davier, 2010; Jang and Olson, 2010; Wilson and Dahl, 2009; Crocker and Masten, 1991; Goldberg and Erickson, 1987): *which actor sets the price*; *for what period (duration)*; and *based on what criteria*?

Prices can be *set by the following actors*: by centralized markets, by third-parties to the transaction, by the transaction parties (when a transaction takes place outside centralized markets) or within the company.

The *duration* of the price arrangement may vary³³. In a short-term arrangement, price is negotiated per transaction. When an agreement is reached about the price, it is valid for less than ten days³⁴. If a medium or long-term duration is used for the arrangement, the price is determined for multiple transactions covering an extended period of time (a minimum of 10 days) or a forward price is set for a single transaction (at least 10 days in advance). A price

³³ Contract duration is not necessarily a good predictor for relationship duration: short-term contracts can be renewed, while long-term contracts can be prematurely terminated (Zylbersztajn and Lazzarini, 2005).

³⁴ In currency markets, short-term prices (spot arrangements) are usually valid for a period of two days, while medium/long-term prices (forwards/futures) usually have a longer duration. Here, 10 days is taken as the cut-off point between short and medium/long-term price arrangements. In pork chain transactions, because of the complications involved in the delivery of physical (e.g., live animals) rather than monetary assets, the convention is that short-term prices have a slightly longer duration (usually a week). In the cases examined in this study, in medium/long-term arrangements, prices were usually fixed for a period of at least six months.

arrangement may also be made for an indefinite term (as when no termination period is specified).

Prices may be set according to *various criteria*, formulas or schemes. In the simplest case, only a base price is determined. This base price may be fixed or it may vary with market conditions. Prices paid may also include a bonus component (in the form of a premium or discount). The bonus component can also be fixed or variable. If it is fixed, the bonus is always paid (deducted) if certain product related criteria are met (e.g., fat percentage of the meat). Alternatively, the bonus is variable, in which case it usually depends on market conditions (i.e., no bonus when market prices are below a certain threshold).

As is shown in Table 3.3, four types of price coordination mechanisms have been distinguished based on these variables: '*spot price*', '*reference market price*', '*fixed forward price*' and '*internal price*'. In '*spot price*' arrangements, prices are fixed for the short term. Price is determined either in a centralized market or bilaterally amongst transaction parties. Base price and possible bonuses are fixed but, because of the short duration of the arrangement, always reflect market conditions. When a '*reference market price*' is used, the price of the transaction depends on the quoted price of a product traded on an agreed upon central market (which acts as a third-party price setter). For such transactions, the base price of the product is variable (depends on the reference market). Possible bonuses are usually fixed (i.e., a percentage above/below the quoted price) but can be variable. The duration of such arrangements is medium to long-term (otherwise spot prices would be used). In a '*fixed forward*' arrangement, a fixed base price is determined for a medium to long duration. Variable or fixed bonus mechanisms may also be included in the arrangement. The base price, as well as the premium, is determined either in a centralized market or bilaterally between the transaction parties³⁵. In '*internal price*' coordination, prices are determined within the company. Although a vertically integrated company may emulate market price mechanisms for intra-company transactions (it may want to promote competition between its various parts), its hierarchical structure means that these criteria can be changed.

³⁵ Standardized fixed price contracts which are traded in a centralized market are called 'future contracts', while customized off-market fixed-price contracts (used in bilateral transactions) are called 'forward contracts'. In this paper, only forward contracts are considered.

2.2.3. Volume coordination mechanism

Two variables have been used to differentiate volume coordination mechanisms (based on Wilson and Dahl, 2009; Bogetoft and Olesen, 2004; Goldberg and Erickson, 1987; Joskow, 1985): *what is the duration of the arrangement*; and *what are its volume specifications*?

With regard to *duration*, volume, like price, may be set for: (1), the short-term; i.e., negotiated per transaction (with volumes fixed for less than 10 days); (2), a medium to long-term period (with a minimum period of 10 days); or (3), the arrangement may be valid indefinitely.

With regard to *specifications*: (1), to be delivered amounts may not be specified in the arrangement; (2), actors may be allowed to deliver amounts within a (broadly) defined range; (3), the arrangement may force actors to deliver specific amounts (with penalties if the arrangement is not kept).

Four types of volume coordination mechanisms have been distinguished: '*spot volume*', '*fixed volume with deviations*', '*fixed volume*' and '*internal volume*'. In '*spot volume*' arrangements, amounts are fixed for the short-duration of the arrangement. In '*fixed volume with deviations*', a range amount is established for a medium to long-term duration. In such arrangements, minimum and maximum deviations are allowed from the agreed-upon amount. In '*fixed volume arrangements*', a fixed amount is agreed upon between the parties for either multiple transactions covering a medium to long-term period, or an amount is fixed for a single transaction in advance (at least 10 days). In '*internal volume*' coordination, no specific arrangement is in place, as an integrated company has (some) flexibility in managing its internal production. For example, when intra-company demand is low, the supply-part of an integrated entity may deliver to external customers.

2.2.4. Quality coordination mechanism

Two main quality coordination functions exist in the supply chain: *setting quality standards* and *monitoring compliance* with these standards (see Raynaud, Sauvée and Valceschini (2005); González-Díaz, Barcala and Arruñada 2003; Humphrey and Schmitz, 2001; Sporleder and Goldsmith, 2001). Based on these functions, the following variables are distinguished: *which actor sets standards*; and *which actor monitors compliance*.

Quality standards can be set by one of the transaction parties, an internal actor (in case of an integrated company) or by another actor not directly involved in the selling (purchasing) of

the exchanged goods. With regard to the latter, the standard setter is either a public actor (e.g., a regulator) or a private actor that facilitates the exchange as a third-party to the transaction (e.g., a certifying agency or a supply chain actor operating further downstream).

Like standard setting, *compliance monitoring* can be done by a transaction party, an internal actor or by an actor not directly involved in the exchange. This may be a different actor than the standard setter.

Four types of quality coordination mechanisms have been distinguished: '*spot market specifications*', '*third-party quality coordination*', '*counterparty quality coordination*', and '*internal quality coordination*'. When '*spot market specifications*' are used, transaction parties do not set any (additional) standards themselves, but rely for quality coordination on legislation set by public actors which are also responsible for monitoring compliance with these standards. '*Third-party quality coordination*' is used when both standard setting and compliance monitoring is outsourced to a third-party. '*Counterparty quality coordination*' applies to transactions in which standard setting is done by a transaction party, who either monitors compliance with these standards by itself or outsources the activity to a third-party. '*Internal quality coordination*' occurs when multiple supply chain stages are integrated into a company that sets and monitors compliance with standards for those stages.

2.2.5. Investment coordination mechanisms

A distinction is made in the study between two aspects of investment coordination: (1), **type of investment coordination mechanism** used; (2), **source of investment** (based on Williams, 2009; Turvey, 2006; Kaplan and Strömberg, 2003; Gow and Swinnen, 2001; Williamson 1988).

Two underlying variables are used to distinguish between **types of investment coordination mechanism**: *what are the monetary benefits and risks associated with the investment*; and *what are the non-monetary benefits and risks involved*.

With regard to *monetary benefits and risks*, a distinction is made between investments which promise a fixed return (e.g., a two percent semi-annual return) and investments in which the return depends on the extent to which the company (project) in which the investment is made is a success (failure). With the former, the risk is that the company in which the investment is made is not able to keep its promise. With the latter, the risk is that no returns are available after fixed return claimholders have been satisfied ((which are generally paid first).

Non-monetary benefits and risks are related to the control rights associated with the investment. Investors may have control rights over the company if it is in operation and expected to continue to operate as a business entity in the (foreseeable) future (i.e., if the company is regarded as ‘going-concern’). Likewise, investors may have control rights over (the assets of) the company if it is bankrupt, in bankruptcy process or likely to be in the foreseeable future (i.e., if the company is regarded as in ‘liquidation’).

Based on these variables, four types of investment mechanisms have been distinguished: ‘*no (external) investments required for transaction*’, ‘*debt instruments*’, ‘*hybrid instruments*’ and ‘*equity instruments*’. Holders of ‘*debt instrument*’ are promised a fixed return on their investments. Furthermore, they have the right to push the company in liquidation if this promise is not kept and they have control rights over the assets of the company when it is in liquidation. ‘*Equity*’ investors have the right to residual returns and they have control rights of the company when it is in operation. Hybrid instruments, like convertible debt³⁶, have characteristics of both debt and equity instruments, both with regard to monetary and non-monetary return. For example, they may promise a fixed return to the instrument holder, who also has the right to convert its investment into an equity instrument.

With regard to ‘**source of investment**’, four different types are distinguished: ‘*capital markets*’, ‘*third-party to the transaction*’, ‘*party to the transaction*’ and ‘*internal capital allocation*’. ‘*Capital markets*’ include both bond and equity markets. A ‘*third-party to the transaction*’ can be a financial intermediary or another actor not directly involved in the exchange, unlike when an investment is financed by a ‘*party to the transaction*’. ‘*Internal capital allocation*’ occurs when investments are financed by the company’s retained earnings.

2.3. Integrated typology of contractual coordination mechanisms

Table 3.2 summarizes the variables (and values) used for the development of the typology.

³⁶ Bonds which can be converted by the holder into a pre-determined number of shares.

TABLE 3.2
Variables used to distinguish coordination mechanisms

Type of mechanism	Variables	Values			
Price	Which actor sets the price?	<i>Centralized markets</i>	<i>Third-party (e.g., reference market)</i>	<i>Party(s) to the transaction</i>	<i>Intra-company (transaction in integrated company)</i>
	What is the duration of the arrangement?	<i>Short-term (price valid <10 days)</i>	<i>Medium/long-term (price valid ≥10 days)</i>		<i>Indefinitely (no termination date established)</i>
	Based on what criteria is price determined?	<i>Base price variable</i>		<i>Base price fixed</i>	
		<i>No bonus component</i>		<i>Variable bonus</i>	<i>Fixed bonus</i>
Volume	What is the duration of the arrangement?	<i>Short-term (volume valid <10 days)</i>	<i>Medium/long-term (volume valid ≥10 days)</i>		<i>Indefinitely (no termination date established)</i>
	What are the specifications of the arrangement?	<i>No amount specified</i>	<i>Range amount (base volume but with allowable deviations from this base)</i>		<i>Fixed amount</i>
Quality	Which actor sets the standard?	<i>Public actor(s)</i>	<i>Third-party (e.g., certifying agency)</i>	<i>Party(s) to the transaction</i>	<i>Intra-company (transaction in integrated company)</i>
	Which actor monitors compliance?	<i>Public actor(s)</i>	<i>Third-party (e.g., certifying agency)</i>	<i>Party(s) to the transaction</i>	<i>Intra-company (transaction in integrated company)</i>
Investment	What monetary benefits/risks are involved?	<i>Fixed return (if company/project is going-concern; i.e., expected to continue to operate)</i>		<i>Residual return/risk (after claims of fixed payment holders have been satisfied)</i>	
	What non-monetary benefits/risks are involved?	<i>Control if company/project is in liquidation (i.e., when expected to be discontinued)</i>		<i>Control if company/project is going-concern (i.e., when expected to continue to operate)</i>	
	What is the source of the investment?	<i>Capital markets</i>	<i>Third-party (e.g., bank)</i>	<i>Party to the transaction</i>	<i>Internal capital allocation</i>

Table 3.3 summarizes the coordination mechanisms which have been distinguished based on these variables.

TABLE 3.3
Integrated typology of contractual coordination mechanisms

	<----->			
	Market		Hierarchy	
Price	<u>Spot price</u> - Price setting: centralized market or party(s) to transaction - Duration: short-term - Criteria: base price and bonus fixed* (fluctuates with market conditions, but fixed for the short duration of the arrangement)	<u>Reference market price (+ premium/discount)</u> - Price setting: third-party (quoted price of reference market used) - Duration: medium/long-term - Criteria: base price variable (depends on market), bonus fixed or variable*	<u>Fixed forward price (+premium/discount)</u> - Price setting: centralized market or party(s) to transaction - Duration: medium/long-term - Criteria: base price fixed, bonus fixed or variable*	<u>Internal price</u> - Price setting: intra-company - Duration: indefinitely - Criteria: base and bonus variable* (criteria can be changed)
Volume	<u>Spot volume</u> - Duration: short-term - Specification: fixed amount (for the short duration of the arrangement)	<u>Fixed volume with min./max. deviations</u> - Duration: medium/long-term - Specification: range amount	<u>Fixed volume</u> - Duration: medium/long-term - Specification: fixed amount	<u>Internal volume</u> - Duration: indefinitely - Specification: no amount specified (depends on intra-company demands)
Quality	<u>Spot market specifications</u> - Standard setting: public actor - Monitoring: public actor	<u>Third-party quality coordination</u> - Standard setting: third-party (e.g., certifying agency) - Monitoring: third-party	<u>Counterparty quality coordination</u> - Standard setting: party(s) to transaction - Monitoring: either by third-party or party(s) to transaction	<u>Internal quality coordination</u> - Standard setting: intra-company - Monitoring: intra-company
Investment (source)	<u>Capital markets</u> Capital markets, like stock and bond markets, finance the investments	<u>Third-party</u> Investments are financed by an actor(s) which is not a party to the transaction (e.g., financial intermediary)	<u>Party to the transaction</u> Investments are financed by a party to the transaction; i.e., a supplier or buyer	<u>Internal capital allocation</u> No investments are made by external actors, only intra-company capital is used
Investment (type)	<u>No (external) investments required for transaction</u> Either there are no investments required, or they are financed within the company	<u>Debt</u> - Monetary return/risk: fixed (if going-concern **) - Non-monetary benefit/risk: control over company in liquidation***	<u>Hybrid</u> - Monetary return/risk: conditional - Non-monetary benefit/risk: control conditional	<u>Equity</u> - Monetary return/risk: residual - Non-monetary benefit/risks: control over company if going-concern**

* If a bonus component is included in the arrangement.

** If the company is expected to continue to operate.

*** If the company is bankrupt, in bankruptcy process, or likely to be in the foreseeable future.

In the empirical part of the paper, the value of the typology will be illustrated by characterizing pork supply chain transactions. Its value depends mainly on three characteristics. *First*, the extent to which the typology is ‘inclusive’, in the sense that it considers all main contracts and coordination mechanisms used within a particular supply chain context. *Second*, the extent to which the typology is applicable in various types of contexts. *Third*, the extent to which use of the typology can lead to new insights about contracting decisions and situations. For a discussion of this last point is referred to Section 6.

To address the first two issues, the study has grounded the typology in extant literature from a wide-range of disciplines (see above). The literature used includes both theoretical and empirical literature. The empirical literature used in the present study is based on studies conducted in various industries, both within and outside the agri-food sector. Furthermore, the respondents which provided information about the examined pork supply chain transactions were asked to mention whether other terms were included in the contract apart from those aspects which were specifically addressed in the interview topic list (see Section 3.3 and Appendix B). No such aspects were mentioned, which supports the notion that the typology is appropriate at least for the pork supply chains which have been examined³⁷.

Also, the objective during the typology's development has been to ensure that it is flexible enough so that it can be adopted, with some alterations, in a wide range of different types of (supply chain) contexts. How has this flexibility been achieved? By basing the typology on an extensive set of variables (see Table 3.2). Other researchers can use these variables to arrive at similar, but slightly different alterations of the typology presented in Table 3.3. For example, the variables used in the study allow for the examination of option-like features in contracts³⁸, even though the typology does not include a separate category for contracts with embedded options. The same applies to non-linear pricing mechanisms³⁹, which can be studied using the variables shown in Table 3.2, although they are not considered as a separate category in Table 3.3. Furthermore, the variables can be used to develop more fine-grained categories⁴⁰. In short, other researchers may wish to create additional categories in order to make the typology more suitable for the context which they examine or more in line with their research interests. Obviously, no typology and underlying variables can be universally applicable. The delineation of the study's empirical domain (see Section 3.1) and theoretical sampling of the cases (see section 3.2) signifies to what other types of contexts the typology may (not) be generalized.

³⁷ Although it could also indicate a certain weariness in the respondents during long-winded interviews.

³⁸ For example, a base price fixed, range volume amount contract (see Table 3.2) gives an option to the seller on whether it wants to market the deviations in its production from the agreed-upon base volume to the counterparty in the contract. When the market price is lower than the base price, it will sell the deviations to the counterparty. When the market price is higher than the base price, it will sell the deviations in the open market. Such a contract would be categorized as a fixed forward price/fixed volume with min./max. deviations contract in Table 3.3.

³⁹ An example of non-linear pricing is to give (certain) volume discount to suppliers (customers). Such a discount can be considered as a bonus component of the price used in the transaction (see Table 3.2).

⁴⁰ For example, a study may split-up the four categories of price mechanisms to examine in more detail the bonus components used in price arrangements.

3. RESEARCH DESIGN

A case study approach has been taken to examining the contracts used in pork supply chain transactions (see Section 6 in Chapter One). Such an approach was deemed most appropriate considering that the study attempted to obtain in-depth insights into the ‘real-life’ contracts used by actors, as well as the supply chain context in which the contracts are embedded.

3.1. Domain

In order to establish the generalisability of typology to other contexts, it is important to clearly delineate the (empirical) domain in which the research takes place (Gibbert, Ruigrok and Wicki, 2008). Mainly two characteristics of pork supply chains are important in this regard: (1), the sequential linkages between actors; (2), the ‘perishable’ nature of products.

With regard to the former, although the typology has not been developed specifically with sequential supply chains in mind, researchers should take into account that the typology has only been empirically examined within this particular context. In supply chains with other types of linkages between actors, like reciprocal (e.g., construction activities), other types of coordination mechanisms than those included within the typology may be used. Researchers that apply the typology to other contexts should be careful that they do not exclude aspects of contracts or coordination mechanisms which are common to the industry examined.

With regard to the latter, ‘perishability’ leads to storage constraints⁴¹, which increases the costs of non-contractual coordination mechanisms, like inventory buffers, and encourages the use of contractual coordination mechanisms, like forward contracts (Ziggers and Trienekens, 1999). Studies which examine other types of contexts should take into account what the importance is of non-contractual coordination mechanisms (Grandori, 1997a).

Furthermore, it should be mentioned that the typology has been developed specifically for the analysis of contracts governing transactions in which ‘real’ products are exchanged. The typology should not be used, without a more extensive examination of relevant literature, for the analysis of contracts governing the exchange of purely financial products or claims (e.g., interest rate options, credit default swaps etc.). Additionally, the study has focused on the (customized) contracts used to govern transactions between supply chain actors. Although aspects of the coordination of a transaction may be outsourced to a third-party, the study has not considered any side transactions which may exist between supply chain actors and third-

⁴¹ For example, the ‘inventory’ of producers consists of live animals which have to be maintained and fed.

parties (e.g., hedging through financial intermediaries). As a result of this, for example exchange traded contracts, like futures, have not been examined.

3.2. Selection of cases

Eight cases have been studied (see Table 3.4 below). Three different types of cases have been examined: commodity chains, collectively owned brands and proprietary owned brands. By selecting different cases, which are likely to have different contracts and coordination mechanisms, results could be contrasted across different contexts. Furthermore, by selecting multiple examples for each of these different types of cases, it was possible to compare results also within more similar contexts (Yin, 1994; Eisenhardt, 1989).

Commodity chains are those cases in which no brands are used to differentiate products in the consumer market. Three commodity cases have been examined: a Brazilian chain, a Danish chain and a Dutch chain. Collective brands are those cases in which the brand is jointly owned by various supply chain actors. Three collective brands cases have been examined: a PDO case (from Spain), a PGI⁴² case (from France), and a Regional brand case⁴³ (from Spain). Proprietary brands are those cases in which the brand is owned by one of the supply chain actors. Two Spanish proprietary brand cases have been examined: a processor owned brand and a retailer owned brand. The study has focused on the contracts used by the brand associations and brand members (collective brands), the integrated meat companies and their supply chain partners (commodity chains) and the brand owners and certified brand suppliers (proprietary brands) (see Table 3.4).

Branded cases have been selected mainly from Southern European countries, where branded pork products traditionally have a large market share. Commodity cases have been selected from some of the world's largest pork exporting countries. Pork, as an export product, is usually a commodity: carcasses and meat parts are distributed to foreign processors who need raw material to prepare meat products for their domestic markets. Also a case has been selected from a major pork production country from outside Europe to further improve the applicability of the typology in different types of contexts.

⁴² Product Designation of Origin (PDO) and Protected Geographical Indication (PGI) are brands which signal to consumers the region in which food products have been made. The brands are protected by EU regulation, which requires a clear link between final product characteristics and the location of the production system. Also, the EU requires collective ownership of the brands, usually through an association. Membership of the association should be made open to anyone who meets certain well-defined characteristics (Trienekens et al., 2008).

⁴³ Although not regulated by EU legislation, the brand is owned by an association with open-membership.

TABLE 3.4
Selected Cases

Type of brand	Case	Case characteristics		
		Background	Production and procurement	Distribution
Proprietary brand	Retailer owned brand (ES)	Brand is owned by a large supermarket company. [†] Fresh meat products, made from regular pigs, are sold under the brand.	Brand owner works with limited number of large and medium size suppliers within Spain (6-10 partners per stage).	Nationwide distribution of brand products through the proprietary supermarkets of the company.
	Processor owned brand (ES)	Brand is owned by a medium sized company. Dry-cured ham products, made from a special breed, are sold under the brand.	Brand owner works with limited number of suppliers of various sizes (1-4 main partners per stage).	Distribution of brand products in more than 100 supermarkets, butchers and small shops in Spain.
Collective Brand	PDO Brand (ES)	Brand is owned by a large association made-up of producers and processors. Dry-cured ham products, made from Iberian pigs, are sold under brand.	Production is tied to region specified in PDO application. Producers and processors of various sizes participate in the brand. Producers outnumber processors by around 30:1.	Nationwide distribution of brand products through a variety of outlets. Less than 10% export (mainly to other EU countries).
	PGI Brand (FR)	Brand is owned by a large association made-up of producers and processors. Dry-cured ham products, made from the regular pig, are sold under the brand.	Production is tied to region specified in PGI application. Producers and processors of all sizes participate in the brand. Producers outnumber processors by around 40:1.	Nationwide distribution of brand products through a variety of outlets. Less than 10% export.
	Regional Brand (ES)	Brand is owned by a medium size association made-up of producers, wholesalers, restaurants and butchers. Roasted suckling piglets are sold under the brand.	Brand ties production to specific region. Around 60% of the members are producers, 10% wholesalers and 30% retailers (either restaurants or butchers).	Mainly local distribution; i.e., brand products are marketed for more than 90% in the region in which they have been produced.
Commodity chain	Brazilian Case (BR)	Large meat company connects a few medium-to-large size pig producing companies with multiple (large) retail outlets.	Potentially statewide, but meat company (integrated slaughtering and processing) procures from small number of (mainly) large pig suppliers.	Various regions in Brazil served through multiple retailers. Export also important (e.g., Russia, Singapore, Hong Kong).**
	Danish Case (DK)	Large meat company connects many micro-sized pig producing companies with multiple (large) retail outlets.***	Nationwide procurement by meat company (integrated slaughtering and processing) of its pig inputs.****	Nationwide distribution through multiple retailers. Export oriented however (e.g., Germany, UK, Japan).**
	Dutch Case (NL)	Large meat company connects many micro-sized pig producing companies with multiple (large) retail outlets.***	Nationwide procurement by meat company (integrated slaughtering and processing) of its pig inputs.****	Nationwide distribution through multiple retailers. Export oriented however (e.g., Germany, Italy, UK).**

[†] The following criteria were used to determine the size of the organizations mentioned in the table (based on Gellynck and Molnár, 2009). Note that with regard to the brand associations, their size is determined based on the number of members they have and *not* the number of employees of the association. Micro: <10 employees (members); Small: < 50 employees (members); Medium: < 250 employees (members); Large: > 250 employees (members).

* The meat company had two main suppliers of pigs, next to fewer than 20 smaller suppliers. One of the two main suppliers had capacity for several ten thousands of finishing pig places.

** The focus in the study has been on the national operations of the meat companies operating in commodity chains.

*** The Dutch and Danish pork industry are quite similar in this regard: a limited number of large slaughterhouses procure pigs from thousands of micro sized pig producing companies. The latter are not only micro-sized in terms of the number of employees, but also in terms of their output relative to the slaughterhouses. For example, in The Netherlands, in 2005 16 slaughterhouses operated and around 8500 companies with finishing pig places. The mentioned slaughterhouses all processed a minimum of 100.000 pigs annually per company, while the average Dutch farm had a capacity of 640 finishing pig places (PVE, 2005).

**** The focus of the study has been on the procurement of pigs produced under the (national) large scale quality management system of the country (IKB for The Dutch case and QSG for the Danish case).

3.3. Methods

Data was generated for the cases primarily through semi-structured interviews with supply chain companies about their contracts (see Appendix B) and open interviews with (brand) associations to provide background information about the cases⁴⁴. A total of 38 interviews were held, 33 of which with representatives of the different supply chain companies and 5 with representatives of the various associations. With regard to the supply chain companies, the study obtained insights into 33 of their contracts, covering the main transactions in each of the cases (see previous section). With regard to the associations, the brands all provided the requested information. The interviews were more or less evenly distributed across the various cases⁴⁵: 15 interviews were held in the commodity chain cases (6 in the BR case, 5 in the NL case and 4 in the DK case), 14 interviews in the collective brand cases (5 in the PDO case, 5 in the PGI case and 4 in the Regional case) and 9 interviews in the proprietary brand cases (5 in the Processor case and 4 in the Retailer case).

Besides the semi-structured interviews, insights about the cases were also obtained means of site-visits, use of secondary data sources and open interviews with industry experts. The site-visits were used to identify operating procedures in the cases (e.g., how compliance with quality standards is achieved). Secondary data and expert sources were used to triangulate data obtained through other sources (e.g., what types of contracts are commonly used in the supply chain).

⁴⁴ The interviews with the associations and other brand owners focused on the history of the brand, the distribution channels for the brand, the types of quality standards and compliance mechanisms they use, and the conditions they set for actor to participate in the brand. Aspects of Appendix B were also used however; to confirm or dispel data gathered through the company interviews.

⁴⁵ Note that a different number of companies operate in the various cases because of the presence of vertically integrated entities. Furthermore, note that the interview numbers do not include instances in which multiple respondents within the same company were consulted (except for companies covering multiple supply chain stages) and are therefore a conservative reflection of the total number of interviews held.

3.4. Operationalisation and analysis

To gather data about contracts (Sections A and D in Appendix B), the interviews focused on: the length or frequency of transactions (a proxy for actors' commitment to future transactions; see Gellynck and Molnár, 2009), the formality of contracts (verbal or written; see Raynaud, Sauvé and Valceschini, 2005), financial participation (which is used as a proxy for control; see Milgrom and Roberts, 1992), and the main type of enforcement mechanism available to the transaction parties (e.g., price and competition, court, or authority; see Williamson, 1991). Obtained data was organized based on the categorization presented in Table 3.5.

TABLE 3.5
Coding rules for contracts

Contract type	Coding rule
<i>Spot market contract</i>	A contract (invoice) for instant exchange of goods or services. No commitment exists for future transactions.
<i>Verbal agreement</i>	Exchanges not formalized into written, legally enforceable contracts. A verbal commitment exists for future transactions. Performance or behavioral standards are unlikely to be specified, but if so, they are not formalized.
<i>Formal contract</i>	Legally enforceable, written contracts are used to govern the transaction. A written commitment exists for future transactions. Performance and behavioral standards are likely to be specified in the contract.
<i>Investment based contract</i>	A contract in which a supply chain actor has made a minority investment (equity, hybrid or debt) in (a project of) one of its suppliers/buyers. A minority investment means, for example, that an actor owns stock, but less than 50% of one of its suppliers/buyers.
<i>Vertical integration</i>	A supply chain actor owns more than 50% of the stock, and has the accompanying shareholder voting rights, of (one of) its suppliers/buyers.

(adapted from Raynaud, Sauvé and Valceschini, 2005)

To gather data about the underlying coordination mechanisms used (Sections A and D in Appendix B), the study focused on generating data about the price (e.g., scheme for ex-ante price agreement), volume (e.g., use of minimum volume requirements), quality (e.g., requirements of production practices, type of monitoring organization) and investment coordination mechanisms (e.g., credit provisions) used in the transactions. Obtained data was organized based on the categorization presented in Table 3.3 (Section 2.3). The following rules or decisions were used in the coding process.

First, with regard to quality coordination mechanism, agri-food supply chain actors frequently participate in multiple quality standards. This means that they are also confronted with multiple standard setters and monitoring institutions. In those instances, the standard most difficult to comply with (in the perception of the supply chain actors) has been considered for the purpose of the analysis presented in Sections 4-5.

Second, in a number of instances, multiple sources and mechanisms were used to finance an investment. In those instances, the study has included the various sources and mechanisms in the analysis. Other researchers may want to focus on the extent to which the different types of sources and mechanisms have been used, rather than the fact that they have been used.

Third, because the focus of the study is on how actors use investment mechanisms to govern a transaction – and not on actors’ access to financing or their capital structure – secondary investment sources and mechanisms were not considered. For example, consider a scenario in which a company vertically integrates with its suppliers, but finances its purchase of the supplier’s equity by means of a bank loan. Under the established coding rule, the investment source would be the ‘party to the transaction’ (i.e., the company, and not the bank) and the investment mechanism ‘equity’ (i.e., not the loan). In this example, it should be clear that equity is the mechanism used to establish control over the transaction and that the company who is integrating is the one who is doing this. Related to this, the study has focused only on investments made to support a specific transaction; i.e., investments made to support the general operations of the companies have not been considered.

Fourth, almost all transactions involved delayed payment; i.e., actors did not have to pay invoices immediately, but were allowed to pay within a certain period, usually 30-40 days. This type of late payment was not considered as a loan (i.e., not counted as use of debt)⁴⁶.

4. DESCRIPTIVE RESULTS

Table 3.6 gives an overview of the various types of coordination mechanisms used within supply chain contracts.

⁴⁶ Note that, as a result of this coding rule, as well as the previous rule, the study likely understates the use of ‘debt’ within the examined pork supply chain transactions (see Sections 4-5).

TABLE 3.6
Contracts and underlying coordination mechanisms[‡]

		TYPE OF CONTRACT				
TYPE OF COORDINATION MECHANISM		Vertical integration (in 6 transactions)	Investment contract (in 3 transactions)	Formal contract (in 12 transactions)	Verbal agreement (in 6 transactions)	Spot market contract (in 6 transactions)
Price	<i>Internal</i>	4/6	-	-	-	-
	<i>Fixed forward</i>	2/6	1/3	3/12	1/6	-
	<i>Reference market</i>	-	-	4/12	3/6	2/6
	<i>Spot price</i>	-	2/3	5/12	2/6	4/6
Volume	<i>Internal</i>	6/6	-	-	-	-
	<i>Fixed volume</i>	-	1/3	3/12	1/6	-
	<i>Fixed volume + dev.</i>	-	1/3	3/12	2/6	-
	<i>Spot volume</i>	-	1/3	6/12	3/6	6/6
Quality	<i>Internal</i>	4/6	-	-	-	-
	<i>Counterparty</i>	-	1/3	6/12	-	1/6
	<i>Third-party</i>	2/6	1/3	5/12	4/6	4/6
	<i>Spot spec.</i>	-	1/3	1/12	2/6	1/6
Investment (type)*	<i>Equity</i>	6/7	1/4	-	-	-
	<i>Hybrid</i>	1/7	2/4	2/13	4/6	3/6
	<i>Debt</i>	-	1/4	1/13	-	-
	<i>No (ext.) investment</i>	-	-	10/13	2/6	3/6
Investment (source)*	<i>Internal</i>	-	-	5/13	-	-
	<i>Party to transaction</i>	4/7	4/4	-	-	-
	<i>Third-party</i>	3/7	-	3/13	4/6	3/6
	<i>Capital markets</i>	-	-	-	-	-
	<i>No investment</i>	-	-	5/13	2/6	3/6

*In some transactions, multiple investment types and sources were used. As a result, the number of investment types and sources used within the contracts does not sum up to the total number of transactions in which the contracts have been used. [‡] The bold marked numbers in the table represent the most frequently used type of coordination mechanisms within each of the contract types.

The most frequently used are formal contracts (12x). Together with vertical integration and investment contracts, they account for almost two-thirds of the total number of contracts used (21 out of 33 contracts). This suggests that, when only the results at contract level are analyzed, the examined transactions seem quite hierarchically coordinated. However, when also the coordination mechanisms underlying these contracts are examined, a more complete picture emerges of how transactions are coordinated. As is shown in Table 3.6, actors have a lot of freedom in combining various sets of coordination mechanisms within a single type of

contract. Even within the two polar contract forms, spot market contracts and vertical integration, some differentiation can be made when the underlying coordination mechanisms are examined.

With regard to the spot market contracts, which were classified as such when parties to the transaction were not committed to subsequent future transactions, some differences were found in the types of price, quality and investment coordination mechanisms used. For example, in two contracts, price was coordinated by means of a reference market, rather than a spot price mechanism. In various spot market contracts, quality was coordinated by a third-party certifying institution. This happened amongst others in transactions in several of the collective brand cases. Although participants in these cases have to comply with standards above spot market specifications, the large number of actors participating in the brand makes it possible that actors switch back and forth between suppliers and customers without committing themselves to further transactions with any specific actor.

With regard to vertical integration, which was classified as such when one actor had more than 50% equity ownership of another supply chain stage, some differences have been identified in the types of price and quality coordination mechanisms used. With regard to prices⁴⁷, some of the vertically integrated companies were limited, by statute, in influencing the prices paid for intra-company transactions. With regard to quality, some of the vertically integrated companies which participated in the branded cases gave, by means of contractual arrangements, a third-party a key role in coordinating quality for intra-company transactions (e.g., by monitoring compliance with quality standards).

The three types of intermediate contract forms (verbal arrangement, formal contracts and investment contract) distinguished in the study show, unsurprisingly, much more diversity with regard to the types of underlying coordination mechanism used. Verbal arrangements frequently rely on third-party actors, like associations, for coordinating aspects of the transaction. In some transactions, this third-party actor only coordinates quality, in other instances the third-party may also coordinate investments and even prices. Formal contracts show the most diversity with regard to the types of underlying coordination mechanisms used.

⁴⁷ For example, one of the companies, an integrated slaughterhouse-processor, has two major shareholder blocks: a farmers' cooperative and an IOF (investor owned firm). The cooperative wants high carcass prices 'paid' by the processor to the slaughterhouse, because it increases the prices the farmers receive for their pigs. The IOF wants low prices, because it increases the total profits of the company, as the company will have lower input costs. A fixed price agreement between the two parts of the companies limits the ability of the two blocks of shareholders to influence prices for their own benefit.

In some formal contracts, prices and volumes are completely fixed. In other formal contracts, frequently between retailers and meat companies, only agreements about quality are included in the contract (e.g., a requirement for a specific quality certificate) while prices and volume are determined by market conditions. Investment contracts may involve minority equity investments in supply chain partners, like when a feed producer contracts external farmers to take care of its pigs or hybrid investments through a pooled investment vehicle, like a cooperative. In an investment contract, the investor is a party to the transaction, and detailed agreements are made about how risk and returns of the investments are divided amongst the parties. As is also alluded to in Section 2, this does not necessarily mean that a specific agreement is made about prices or volumes for future transactions, as some investment contracts use spot price and volume mechanisms.

5. DISCUSSION OF RESULTS ACROSS SUPPLY CHAIN TYPES

Table 3.7 (shown below) gives an overview of the differences in the arrangements used in the three types of supply chains. As is shown in the table, formal contracts and vertical integration are the dominant type of contracts used in proprietary brands and commodity chains, while spot market contracts and verbal agreements are the dominant types of contracts used in collective brands. The results show that transactions which look hierarchically coordinated when examined at contract level, may be more market-like coordinated when the underlying coordination mechanisms are examined (and vice versa). This is particular true for commodity chains, which embed market types of coordination mechanisms within the hierarchical contracts they employ, and for actors operating in the collective brand chains, which can use market types of contracts between them because some coordination functions are outsourced to a third-party central to all other actors in the supply chain.

TABLE 3.7
Contracts and underlying coordination mechanisms

Category	Specific type selected	TYPE OF BRAND			Total (33 transactions across 8 cases)
		Proprietary brands (10 transactions across 2 cases)	Collective brands (11 transactions across 3 cases)	Commodity chains (12 transactions across 3 cases)	
Contract	<i>Vertical integration</i>	3/10	-	3/12	6/33
	<i>Investment contract</i>	1/10	-	2/12	3/33
	<i>Formal contract</i>	6/10	2/11	4/12	12/33
	<i>Verbal agreement</i>	-	4/11	2/12	6/33
	<i>Spot market contract</i>	-	5/11	1/12	6/33
Price	<i>Internal</i>	3/10	-	1/12	4/33
	<i>Fixed forward</i>	4/10	1/11	2/12	7/33
	<i>Reference market</i>	2/10	6/11	1/12	9/33
	<i>Spot price</i>	1/10	4/11	8/12	13/33
Volume	<i>Internal</i>	3/10	-	3/12	6/33
	<i>Fixed volume</i>	3/10	1/11	1/12	5/33
	<i>Fixed volume + dev.</i>	3/10	2/11	1/12	6/33
	<i>Spot volume</i>	1/10	8/11	7/12	16/33
Quality	<i>Internal</i>	1/10	-	3/12	4/33
	<i>Counterparty</i>	6/10	1/11	1/12	8/33
	<i>Third-party</i>	3/10	9/11	4/12	16/33
	<i>Spot spec.</i>	-	1/11	4/12	5/33
Investment (type)*	<i>Equity</i>	4/13	-	3/12	7/36
	<i>Hybrid</i>	1/13	9/11	2/12	12/36
	<i>Debt</i>	2/13	-	-	2/36
	<i>No (ext.) investment</i>	6/13	2/11	7/12	15/36
Investment (source)*	<i>Internal</i>	5/13	-	-	5/36
	<i>Party to transaction</i>	4/13	-	4/12	8/36
	<i>Third-party</i>	3/13	9/11	1/12	13/36
	<i>Capital markets</i>	-	-	-	-
	<i>No investment</i>	1/13	2/11	7/12	10/36

* In some transactions, multiple investment types and sources were used. As a result, the number of investment types and sources used within the contracts does not sum up to the total number of transactions in which the contracts have been used. † The bold marked numbers in the table represent the most frequently used type of contract or coordination mechanisms within each of the brand types.

5.1. General structure

In the commodity chains, hierarchical types of contracts are used in order to formalize exchanges, and are generally not used to commit oneself to future transactions to another party. In the (rare) instances that such commitments are made, the conditions of the exchange,

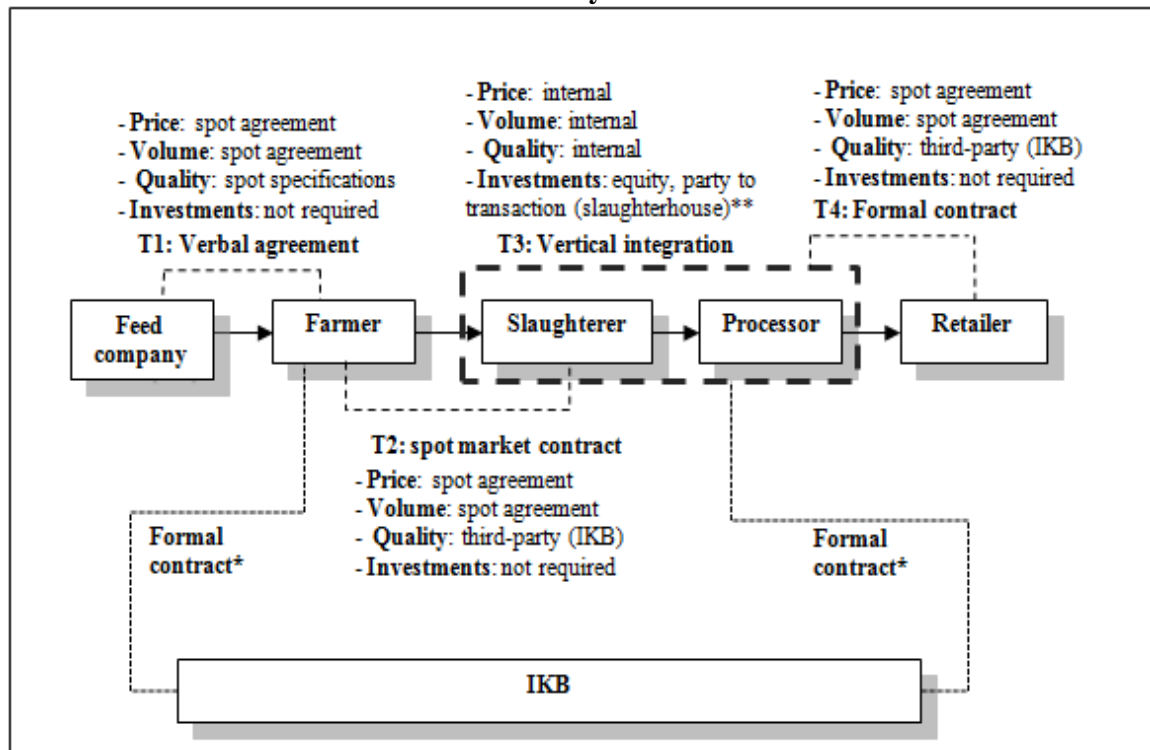
particularly with regard to price and volume are left open, as largely spot price and volume coordination mechanisms are used. The exception is quality coordination, which is frequently conducted by third-parties, rather than left to spot market specifications. These third-parties are often (vertically organized⁴⁸) associations which represent the interests of (most of) the supply chain actors⁴⁹. The associations set (voluntary) quality standards which are adopted by a large amount of actors. Because of their large adoption, which allows actors to switch between suppliers (buyers), the standards facilitate market-like transactions between the actors. Figure 3.1 shows the analysis of the contracts and coordination mechanisms used within the Dutch case, as an example of how coordination is achieved within commodity supply chains⁵⁰.

⁴⁸ A vertically organized association refers to those associations which have members from various supply chain stages (e.g., producers and meat companies are member). A horizontally organized association refers to those associations which have members only from a single supply chain stage (e.g., only producers are member).

⁴⁹ Or certifying institutions contracted by these associations.

⁵⁰ Note that actors can participate in various supply chains at the same time (Camps, 2005). For example, the meat company examined in the Brazilian case also markets parts of its production as branded goods in the domestic market. Whenever applicable, the study focuses only on the participation of the actors in one of their supply chains (in this case, the participation of the meat company in the commodity supply chain). Therefore, the figures represented in this section are a simplification; i.e., in reality multiple supply chains overlap.

FIGURE 3.1
Example of the analysis of contracts and coordination mechanisms used within commodity chains



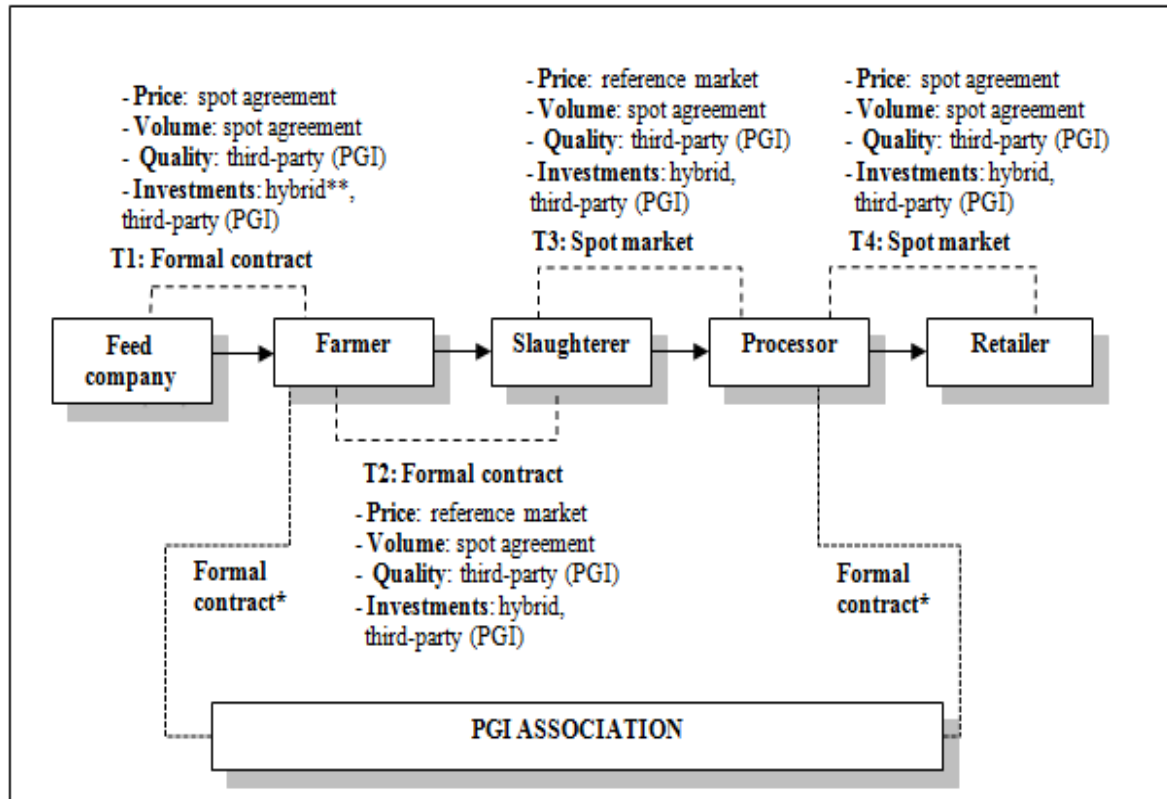
(T= transaction; T1= feed producer-farmer; T2= farmer-slaughterhouse; T3= slaughterhouse-processor; T4= processor-retailer)

* IKB is a quality management system covering multiple stages in the Dutch supply chain (see Section 5.2 in Chapter Two). Participation in the system is voluntary, but widespread. Actors participating have to sign a contract which includes the following elements: (a) compliance with standards; (b) participation in scheme for one year.

** Processing and slaughterhouse stage are part of an integrated meat company.

In the collective brand chains, third-parties have an even more active role. Besides quality, also investments and even price setting responsibilities may be outsourced to the associations which own the brands. These associations finance investments in brand development and quality coordination, by levying fees on transactions conducted amongst the actors participating in the brand. Price setting is done, not by actually determining price levels, but by selecting reference markets for transactions conducted amongst actors participating in the brand. Figure 3.2 shows the analysis of the contracts and coordination mechanisms used within the PGI case, as an example of how coordination is achieved within collective brands.

FIGURE 3.2
Example of the analysis of contracts and coordination mechanisms used within collective brands



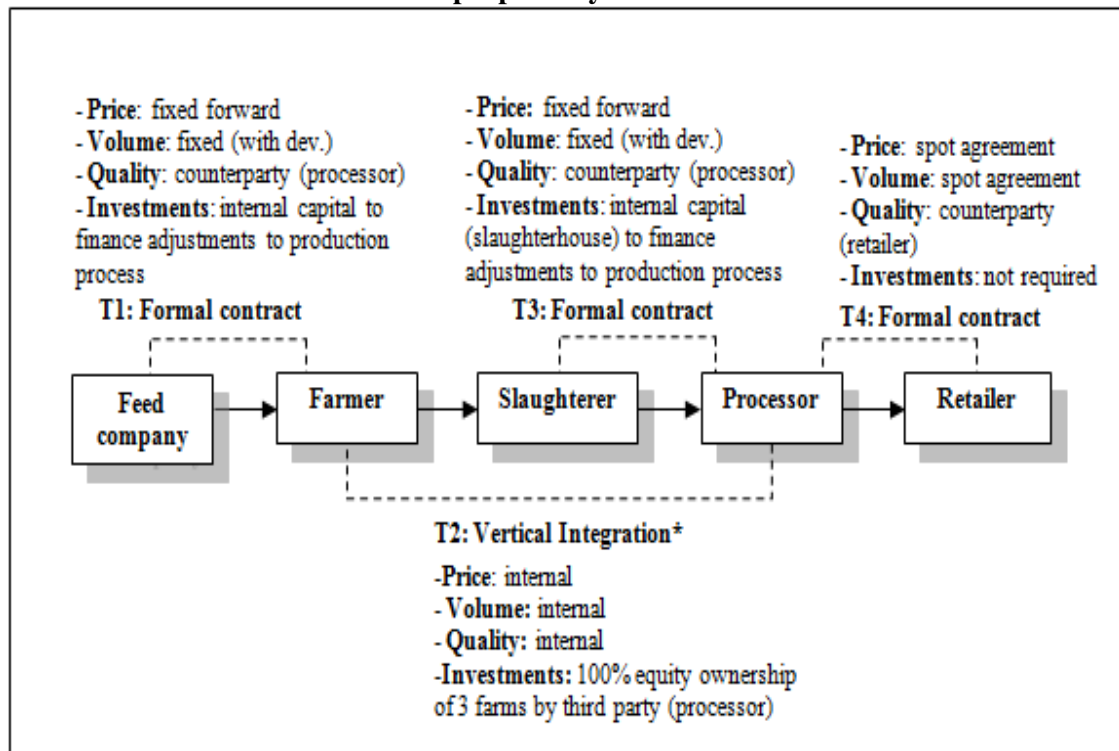
(T= transaction; T1= feed producer-farmer; T2= farmer-slaughterhouse; T3= slaughterhouse-processor; T4= processor-retailer)

* The formal contract between the PGI association and the supply chain actors that are members of the association (producers and processors) include the following elements: (a) compliance with standards; (b) determination of premium above reference market price (i.e., the financial incentive to participate); (c) participation in scheme; (d) levy on transactions to support investments in brand development.

** Note that associations combine characteristics of both equity and debt; i.e., they are hybrid mechanisms (see Section 2.2.5 and Section 5.5).

While both the commodity supply chains and the collective branded cases are characterized by an external administrative organization which undertakes some key coordination functions (i.e., the associations), in the proprietary brands these coordination functions are undertaken by the supply chain actor who is the brand owner. This brand owner enters into hierarchical types of contracts with most other supply chain actors. Unlike the previous types of supply chains, the proprietary branded chains largely do employ hierarchical types of coordination mechanisms (e.g., fixed forward prices and volumes, counterparty quality coordination) within the largely hierarchical types of contracts that they use. Figure 3.3 shows the analysis of the contracts and coordination mechanisms used within the Processor brand case, as an example of how coordination is achieved within proprietary brands.

FIGURE 3.3
Example of the analysis of contracts and coordination mechanisms used within proprietary brands



(T= transaction; T1= feed producer-farmer/processor; T2= farms integrated into processor; T3= slaughterhouse-processor; T4= processor-retailer)

* Besides the company owned farms, the processor also sources pigs from 4 other main suppliers. The Processor has fixed price and volume contracts with these suppliers and coordinates their feed inputs.

5.2. Use of price coordination mechanisms

In both the proprietary brand and collective brand cases, the actors use mainly ex-ante price arrangements, like fixed forward prices or reference market prices (see Table 3.7). This contrasts with commodity chains, where spot prices are the main coordination mechanisms used (in 8 out of 12 transactions). In the proprietary brands, prices were completely fixed in most transactions (7 out of 10 transactions), either by means of fixed forward prices, or by internal price coordination. In collective brand cases, mainly reference market prices were used (in 6 out of 11 transactions).

The use of ex-ante price arrangements within the branded supply chains limits the scope for counterparties to renegotiate exchange conditions, at least with regard to prices. Preventing such renegotiation by counterparties is particularly important in branded supply chains because

of the limited number of (potential) trading partners at each stage of the supply chain; i.e., it is more difficult to switch to another buyer (supplier) (Zylbersztajn and Farina, 1999).

Furthermore, the high use of reference market prices in the collective brands suggests that there is also a need to manage price uncertainty in these cases. The use of these mechanisms limits the scope for counterparties to renegotiate conditions like in fixed forward contracts, but, unlike fixed forward contracts, prevents the contract price from moving out of line with spot market prices. Fixing prices (in a uncertain price environment) can be risky, as spot market prices may move out of line with the agreed upon forward price when products are finally delivered.

5.3. Use of volume coordination mechanisms

As is shown in Table 3.7, proprietary brands use mainly fixed volume contracts or internal mechanisms (in case of vertical integration) to coordinate volume in the supply chain (in 6 out of 10 transactions). These ex-ante volume arrangements, like their price coordination counterparts, limit the scope of actors to renegotiate transaction volumes. In the commodity chains, where it is easier to find suppliers (buyers) than in the branded cases, mainly spot volume mechanisms are used (in 7 out of 12 transactions). In collective brands, like commodity chains, mainly spot volume arrangements are used (in 8 out of 11 transactions). Actors operating in collective brands have already put mechanisms in place which limit the scope for counterparties to renegotiate prices (see Section 5.2) and apparently do not require similar mechanisms with regard to volumes.

5.4. Use of quality coordination mechanisms

As is shown in Table 3.7, quality in proprietary brands is coordinated mainly by counterparties (in 6 out of 10 transactions). In collective brands, quality coordination is largely outsourced to third-parties; i.e. the associations which hold the brand property rights (in 9 out of 11 transactions). Commodity chains use a combination of third-parties (both certifying institutions and associations; in 4 out of 12 transactions) and spot market specifications (in 4 out of 12 transactions) to coordinate quality.

Branded supply chains require more hierarchical quality coordination mechanisms when compared to commodity chains, because they set additional requirements or standards for the supply chain actors to help differentiate the products sold under the brand. Compliance with these standards needs to be monitored. Furthermore, proprietary brands may need to be more

actively involved in the coordination of quality (i.e., by means of counterparty monitoring) when compared to the collective brands (which rely on third-party monitoring). This is because their standards are generally more unique to help differentiate their products. Collective brands have more accessible standards in order to keep and expand membership of the association.

In cases where standards are unique to a specific transaction or sets of transactions, outsourcing the quality coordination function to a third-party certifying institution may not be economical. This is because the third-party can 'use' the competences it needs to acquire for monitoring compliance with these standards only for a limited number of transactions (i.e., only for those transactions within the branded chain). In the collective brands, outsourcing the quality coordination function to a third-party may be more economical when compared to the proprietary brands. Not only do multiple actors operate in the supply chain for which third-party certifying agents could use their acquired monitoring capabilities, the certifiers could also use these capabilities to monitor transactions outside the branded supply chain because the standards are less differentiated.

5.5. Use of investment coordination mechanisms

Across both the proprietary brand and commodity cases, most transactions did not require external investments. In the proprietary brand cases, this is because most of such investments were financed with internal capital (in 5 out of 6 transactions for which no external capital was required). In the commodity cases, this is because most transactions did not require investments at all (7 out of 12 transactions). For those transactions for which external investments were required, both the proprietary brand and commodity chain actors used mainly equity mechanisms. Proprietary brands used equity in 4 transactions and commodity chains in 3 transactions. Equity mechanisms were mainly used when a company vertically integrated with its supplier or customer (i.e., the when the investment source was a party to the transaction). In the collective brand cases, most transactions required external investments (in 9 out of 11 transactions). These investments were made through the associations which owned the brand (i.e., through a third-party source). Associations, as is explained below, can be regarded as a hybrid investment mechanism.

What are the particular characteristics of the investment mechanisms used in the proprietary brand and commodity brand cases? The main difference between the proprietary brands and the collective brands is the distribution of brand ownership (or property) rights, which is

tightly held in the former, and widely distributed in the latter. Associations, which combine characteristics of both equity and debt mechanisms, may be a particularly suitable mechanism to govern collective brands. Like equity mechanisms, they give the members control over the brand and brand organization while it is still in operation. Like debt mechanisms, they remove the availability of free cash flows available to the management of the associations. This is because revenues flow directly through the brand participants, which sell their products themselves. Furthermore, unlike equity mechanisms, which are used in the proprietary brands, association guarantees the continuation of the brand as a collective entity, by preventing concentration of ownership and control.

6. DISCUSSION AND CONCLUSION

The paper has aimed to develop a comprehensive and detailed typology for studying supply chain contracts. This has been achieved by modeling the coordination mechanisms used within supply chain contracts. The typology integrates four types of coordination mechanisms: price, volume, quality and investments. The value of the typology has been illustrated by characterizing transactions in three types of pork supply chains: proprietary brands, collective brands and commodity chains. Eight supply chains were examined from five major pork producing countries (Brazil, Denmark, France, Spain and The Netherlands).

6.1. Towards an in-depth examination of contracts

The results show the importance of looking at contracts in a more detailed level: transactions which look hierarchical when examined at contract level are largely conducted in a market-like manner when the underlying coordination mechanisms are examined (and vice-versa). For example, some hierarchical types of contracts are used in order to formalize exchanges, and not to commit the actors to future transactions. In these contracts, the conditions of the exchange, particularly with regard to price and volume are left open, as largely spot price and volume coordination mechanisms are used. Amongst others retailers use such contracts with meat companies, which only specify some quality requirements, to create a list of preferred suppliers. From this list, the product category or purchase managers of the individual supermarket stores can select their own specific supplier, depending on local needs.

The reason why some contracts look more hierarchical when examined at coordination mechanisms level (and vice-versa), is that companies have more freedom in combining various types of coordination mechanisms within a single type of contract than is generally

assumed within the literature. For example, within some formal contracts, prices and volumes may be completely fixed while in other formal contracts, prices and volumes are completely determined by market conditions. Investment contracts may involve minority equity investments in supply chain partners or hybrid investments through a pooled investment vehicle, like a horizontally organized cooperative or a vertically organized association. Although one would expect extensive conditions in investment contracts, this was often not the case in the examined transactions where key aspects, like prices or volumes, were not agreed upon in the contract. In a vertically integrated company, prices between two parts of the integrated company may be fixed rather than decided by an internal authority. The large variety within different types of contracts can only be fully understood when the underlying coordination mechanisms are examined.

Furthermore, by examining contracts in more detail, it was possible to identify some of the ingenious contractual solutions used by supply chain actors. For example, the use of reference market price contracts in proprietary brands allows transaction parties to implement mechanisms which facilitate adaptation to changing circumstances, but also prevent one of the parties from exploiting this flexibility. This is because the price in such contracts depends on the quoted price of a product traded on an agreed upon central market. This limits the scope for counterparties to renegotiate conditions, by removing their ability to influence the contract price, but also prevents the contract price from moving out of line with spot market prices.

Additionally, the use of the typology sheds light on some of the unintended consequences or adverse implications of contracts. For example, in one of the cases, an investment based contract is in place between the cooperative slaughterhouse and its pig producer members. The objective of the contract is to assure that the slaughterhouse receives a steady supply of pigs. By entering into the contract, the producers promise to deliver a minimum percentage of their output to the slaughterhouse. However, the contract covers only the production of finishing pigs (i.e., those pigs ready to be slaughtered). As a result, producers which produce both piglets and finishing pigs may choose to sell their piglets to traders which are not tied to the slaughterhouse, rather than fattening the piglets themselves⁵¹. This happens when the producers are dissatisfied with the prices offered by the slaughterhouse. Thus, the contract gives the slaughterhouse some flexibility in raising prices when it already has sufficient pig inputs and demand for its pig meat is low (as its members will deliver their pigs to other

⁵¹ Subsequently, the traders market the piglets to finishing farms which are not tied to the slaughterhouse.

actors). However, it also means the slaughterhouse may be outbidded by competing slaughterhouses when demand for pig meat (and thus pig inputs) is high. In other words, the contracts may fail to assure a steady supply of pigs, particularly since a significant part of the members of the cooperative produce both piglets and finishing pigs.

6.2. Linking contracts and coordination mechanisms to their supply chain context

Besides facilitating a more in-depth examination of contracts, the developed typology also allows for a better linking of contracts with the supply chain contexts in which they are embedded. This is important because this context is frequently ignored by contracting studies, which often only examine bilateral transactions (Wever et al., 2012). The typology helps researchers in addressing this issue, by allowing for a more fine-grained examination of the role of third-parties to the transaction. For example, is the third-party an actor external to the supply chain (e.g., a certifying institution) or is it another (lead) supply chain actor? Does the third-party coordinate quality (e.g., an association) or does it facilitate investments (e.g., a bank)? How active is the third-party; i.e., does it only coordinate quality (e.g., a second-tier customer) or is it also active in setting prices and quality (e.g., an association)? What supply chain stages are covered by its activities? In helping researchers answering these types of questions, the typology can thus be used to study triadic relationships (and larger structures) next to dyadic relationships (see also Choi and Wu, 2009).

The empirical results give an indication of the importance of studying triads. Companies, particularly in collective brands and commodity supply chains, outsource quality, price and even some investment coordination functions to third-parties. These third parties allow supply chain actors to focus on their core competences rather than on controlling other supply chain stages. For example, in one of the collective brand cases, the vertically organized association which holds the property rights of the brand acts as a third-party to each transaction:

- The association coordinates prices, not by setting a fixed price, but by stipulating that the supply chain actors use reference market price mechanisms in their contracts.
- The association sets and monitors compliance with quality standards. This standardizes quality across the supply chain and allows for actors to easily switch back and forth between suppliers without worrying about the quality of the products they procure.
- The association functions as an investment vehicle by pooling the costs and risks of making investments in brand development. This reduces the size of the investments required by each individual actor, and reduces barriers to entry for actors wanting to participate in a supply chain producing differentiated products.

6.3. Theoretical implications and areas for further research

Further studies should focus on examining the conditions under which coordination mechanisms, and combinations of coordination mechanisms, are used within contracts. For example, under what type of conditions should fixed price contracts be used in combination with third-party quality coordination? Preferably, such a study would be conducted in a different setting (e.g., the telecommunications industry). As is explained in Section 3, researchers that apply the typology to other contexts should be careful that they do not exclude aspects of contracts or coordination mechanisms which are common to the particular context under study.

Additionally, studies could use the typology to specify existing contract theory. For example, Transaction Cost Economics (TCE) – which is the most frequently used theory across numerous disciplines to examine contracting decisions – provides a perspective on the conditions which affect the usage of contracts. However, TCE prescribes generic contractual solutions (e.g., make, buy or hybrid) to managers and provides only limited guidance on the conditions which affect the use of coordination mechanisms underlying these contracts. The typology developed in this paper can add value: by relating the various conditions (e.g., asset specificity) which affect contracting decisions within the TCE framework also to the use of the coordination mechanisms (e.g., fixed price coordination mechanisms) underlying the contracts.

For example, within the TCE framework, asset specificity and uncertainty are two important drivers of contracting decisions (see Section 2.2 in Chapter 2). However, few studies (see Grover and Malhotra, 1997) have linked these conditions to, for example, the use of specific price coordination mechanisms. This is important, as the use of certain price mechanisms (and other types of mechanisms) may be more beneficial under some conditions. From a TCE perspective, the results of the study suggest that supply chain actors use price coordination mechanisms to manage their exposure to both asset specificity and price uncertainty risks. On the one hand, actors use ex-ante price arrangements as a safeguard against the opportunistic behavior associated with the specific investments they have made to support their participation in a brand. That could be an explanation for the higher use of such arrangements in branded chains when compared to commodity chains, where such investments are not required. On the other hand, the use of reference market prices in collective brands suggests that there is also a need to manage price uncertainty in some of the branded chains.

Furthermore, the typology could be used to combine different theoretical frameworks. Relatively recently, researchers have started to link various contracting theories. In particular, researchers have often attempted to combine TCE and the Resource Based View (RBV) (see McIvor, 2009; Leiblein, 2003; Barney and Lee 2000). While TCE offers a perspective mainly on how actors can use contracts to minimize the risk of exploitation by the counterparty to the transaction, RBV argues that contracts should (also) be used to manage and develop a company's portfolio of unique resources or capabilities. In brief, core competences should be brought inside the company, while no-core competences can be outsourced.

Studies could use the typology to establish additional linkages between the two frameworks. For example, the frameworks can be combined to explain under what conditions outsourcing quality coordination to a third-party coordinator is likely to be beneficial. From a TCE perspective, the level of performance measurement difficulties (see Section 2.2 in Chapter 2) in supply chain transactions is likely to affect quality coordination mechanism choices. Branded supply chains set higher requirements for actors to help differentiate the products marketed under the brand, which should lead to more performance measurement difficulties when compared to non-branded supply chains. To reduce these difficulties, additional monitoring mechanisms are required. This could be a (TCE based) explanation for the additional quality coordination mechanisms used in the branded cases compared to the commodity chains

Furthermore, from a RBV perspective, quality coordination of 'unique' standards may be more difficult to outsource to a third-party than coordination of more generic standards. The development of such standards, as well as the monitoring of compliance with the standards, may require 'tacit' knowledge of certain operating procedures (see Barney and Lee, 2000); i.e., knowledge and skills, like the visual inspection of the color of dry-cured hams, which cannot easily be written down and thus cannot easily be transferred to a third-party. This could be a (RBV based) explanation for the more hierarchical quality coordination mechanisms (internal and counterparty) used in the proprietary brands when compared to the collective brands (third-party).

Finally, researchers should use the typology to examine interdependencies between contracting decisions at various stages in the supply chain. Frequently, contracting studies, including most of the TCE literature (see Geyskens, Steenkamp and Kumar, 2006; Grover and Malhotra, 2003; Rindfleisch and Heide, 1997), ignore such interdependencies. However,

Study Two: Examining contractual coordination mechanisms

contracting decisions downstream in the supply chain (e.g., use of variable price contracts), may affect what a suitable contracting decision is the upstream part of the supply chain (e.g., use of fixed price contract) and vice-versa. As is explained in the *next study* in more detail, studies which do not take such interdependencies in account are likely to understate the transaction risks to which supply chain actors are exposed. Subsequently, the recommendations of such studies on how to manage contract decision making situations are limited at best, and at worst, can increase the transaction risks to which the actors are exposed.

SUPPLY CHAIN-WIDE CONSEQUENCES OF TRANSACTION RISKS AND THEIR CONTRACTUAL SOLUTIONS: TOWARDS AN EXTENDED TRANSACTION COST ECONOMICS FRAMEWORK⁵²

Study Two (Chapter Three) has examined differences in contracting decisions across various types of supply chains. This has given some insight into the link between contracts and the larger supply chain context in which they are used. However, the conducted analysis has been largely descriptive in nature. Researchers who study contracting decisions often do so only in the context of bilateral transactions. As a result, a robust framework for examining such decisions in a wider supply chain context is lacking. Study Three aims to address this issue, by laying the foundations for such a framework. These foundations are grounded in TCE theory. The reasons for using TCE rather than another theory for analyzing contracting decisions have been outlined in Chapter One (Section 1.2).

The present study first provides justification for moving TCE's unit of analysis beyond the dyad. Subsequently, various models are constructed which examine: (1), how actors' usage of contracts to manage their exposure to supply (demand) side transaction risks can affect their exposure to demand (supply) side transaction risks; (2), how actors' risk exposure can also depend on transactions further upstream (downstream) in the supply chain in which they are not directly involved. The models show that when actors follow the recommendations from the traditional TCE framework regarding the use of contracts, it may increase rather than decrease their exposure to transaction risks. However, when actors take into account simultaneously both supply and demand side transactions when making their contract decisions, as is recommended in this study, a reduction in exposure to transaction risks is more likely. The study offers managers various strategies for taking a supply chain-wide approach to reduce transaction risk exposure.

Note that the present study focuses on a sub-set of the supply chain types examined in Study Two: i.e., on differentiated supply chains. As is explained in Section 1 of this chapter in more detail, interdependencies between contracting decisions are more likely to arise in differentiated supply chains.

⁵² The article on which this chapter is based has been published as "Wever, M., Wognum, P.M., Trienekens, J.H. and S.W.F. Omta. 'Supply Chain-Wide Consequences of Transaction Risks and their Contractual Solutions: Towards an Extended Transaction Cost Economics Framework', *Journal of Supply Chain Management*, January 2012, (48:1), pp. 73-91."

1. INTRODUCTION

Supply chain actors are exposed to risks in supply and demand side transactions. How supply chain actors can simultaneously manage their exposure to both supply and demand side risks is a topic which has been insufficiently examined, particularly within the transaction cost economics (TCE) literature (Sanchez 2003). TCE studies, both theoretical (e.g., Williamson 2008, 2002) and empirical (e.g., Grover and Malhotra, 2003; Rindfleisch and Heide, 1997), often only examine transaction risks in bilateral exchanges. These studies neglect the wider supply chain context in which these transactions take place (Zylbersztajn and Farina, 1999). Studies which fail to take into account this context may prescribe contractual solutions which seem optimal for reducing exposure to transaction risks in bilateral transactions. But, these solutions may be suboptimal for the supply chain as a whole (see Choi and Wu, 2009 and Agrell, Lindroth and Norrman, 2004 for some non-TCE related studies on this subject).

For example, in an agri-food supply chain, a processor may vertically integrate with its supplier to reduce exposure to performance measurement risks; i.e., as when the company has difficulties in assessing supplier performance. Vertical integration reduces performance measurement risks as the processor now makes its own supply of inputs. However, as is explained later in the paper in more detail, this might also leave the processor with a more fixed volume of inputs supplied⁵³. If the company has no agreement with its customer(s) in which demand for its products is also fixed, for example by means of a forward contract which stipulates the amount and price of future deliveries, it may be exposed to additional demand side transaction risks related to overproduction. This is because vertical integration upstream removes some of the freedom the company has in adjusting its production to changes in downstream demand.

The scenario described above, where a company should not view its supply and demand side contract use in isolation, is likely to become more common (Omta, Trienekens and Beers, 2001). This is because of the trend towards increased interdependencies within supply chains, amongst others to meet the demand of consumers for more high-quality products (Kaynak and Hartley, 2008). However, based on the current state of the TCE literature (see Geyskens, Steenkamp and Kumar, 2006) it is not possible to state under which conditions the benefits for

⁵³ For example, if the inputs are non-commodity products, it may be difficult to sell them in the open market. Also, because of fixed costs, it may be costly to stop producing at the supplier level. Thus, the processor may have to procure a minimum amount of inputs from its internal supplier, regardless of the demand for its products.

the company of vertical integration upstream outweigh the disadvantages of increased exposure to demand side volume uncertainty. To improve the practical relevance of research in this subject, a more supply chain-wide approach is necessary.

This paper aims to contribute to a shift within the TCE literature from a focus on bilateral transactions, to examining transactions within a supply chain context. More specifically, the objectives of the paper are threefold. First, the objective of the paper is to identify the main conditions under which supply and demand side transactions are interdependent. ‘Conditions’ refers to the attributes of the transaction (e.g., level of asset specificity), which are considered as the main drivers behind the contract decisions of organizations within the TCE framework (Joskow, 1987). Transactions are regarded as ‘interdependent’ when supply chain actors’ exposure to supply (demand) side transaction risks affects their ability to manage exposure to demand (supply) side transaction risks (Voß and Schneidereit, 2002). Second, the objective of the paper is to examine what the interdependence between transactions means for supply chain actors’ total exposure to transaction risks. Interdependencies may lead to negative ‘transaction externalities’, as when the use of a supply side contract not only affects the (supply side) risk exposure of the parties involved in the transaction, but its effects spill over into increased demand side transaction risk or increased risk elsewhere in the supply chain⁵⁴. This may increase actors’ ‘total exposure’ to transaction risks, which refers to the sum of supply and demand side transaction risks, as well as possible negative transaction externalities⁵⁵. Third, the objective of the paper is to explore the differences between the traditional TCE framework and a TCE framework with a supply chain-wide orientation, with regard to their analysis of contracts and risks. The difference between the two frameworks is

⁵⁴ More generally, an ‘externality’ can be regarded as a cost (benefit) incurred by an actor who is not a party to the transaction or economic activity causing the cost (benefit) (based on Scitovsky, 1954). In other words, a spill-over from activities undertaken in the context of a (bilateral) transaction to a third-party. Although formal definitions of ‘externality’ often consider just two parties (e.g., Buchanan and Stubblebine, 1962), actual examples of externality almost always consider (implicitly) at least three actors (Arrow, 1969; Coase, 1960). Note that the focus here is on spill-overs from one transaction to the next and that one actor can participate in both transactions (operating as both buyer and supplier). See Roberts and Key (2005) for an analysis of ‘horizontal’, industry wide externalities as opposed to the ‘vertical’ supply chain externalities examined here.

⁵⁵ Cheung (1970, p.56) has criticized the concept of ‘externality’, arguing that no meaningful distinction can be made between an externality and the type of economic activity underlying it: “*What, then, is an externality...Every economic action has effects.*” However, considering that not all economic action spills-over to affect a party not participating in a transaction, this distinction is not difficult in practice. For example, the ‘economic activity’ of a car trader is to market cars to consumer. An ‘externality’ arises when another actor(s) than the trader and consumer are affected by their transaction. For example, when the consumer become aware it has bought a ‘defect’ car and other traders (in ‘good’ quality cars) cannot (profitably) market their cars anymore because consumers have lost faith in this particular market (see Akerlof, 1970).

that the former does not explicitly consider the interdependence between supply and demand side transactions (because it unbundles the supply chain into separate transactions; Nickerson, Hamilton and Wada, 2001) while this is explicitly modeled within the latter.

The paper addresses this topic in the context of a supply chain with *sequential* linkages between actors which produce differentiated products; i.e., a non-commodity supply chain. In such a supply chain, interdependencies can arise between transactions, as the quality of the final product depends on practices in the preceding stages of the supply chain (Raynaud, Sauvée and Valceschini, 2005). Additionally, when *differentiation* takes place (vertically) across the supply chain, the number of potential trading partners at each stage is likely to be limited (Zylbersztajn and Farina, 1999). This can also increase interdependencies within the supply chain. Furthermore, the paper focuses on supply chains where *temporal factors* encourage the use of contractual solutions, like forward contracts, to reduce transaction risk exposure. For example, in agri-food supply chains, some products (e.g., vegetables) are perishable, which leads to storage constraints and increases the costs of using non-contractual solutions, like inventory buffers (Ziggers and Trienekens, 1999). Likewise, in the apparel industry, actors that keep large inventory buffers face the risk that their inventory becomes obsolete as consumer preferences (demands) change (Gereffi, Humphrey and Sturgeon, 2005). In these types of supply chains, besides costs related to under-production, there can also be high costs related to over-production, as actors have a low tolerance level for fluctuations in output levels (i.e., limited volume flexibility; Jack and Raturi, 2003; Koste and Malhotra, 1999). As is explained in the paper, actors which face such constraints, and which take part in differentiated supply chains, are vulnerable to risks related to transaction interdependence.

The remainder of the paper is organized as follows. In *Section 2*, the traditional TCE framework is discussed, and an overview of the TCE literature is given. In *Section 3*, five models are developed which: (a), provide justification for moving the TCE framework beyond the dyad; and (b), explain the implications of the shift towards an extended TCE framework for the (optimal) use of supply chain contracts. *Section 4* concludes the paper and discusses its implications for the TCE literature, supply chain management (SCM) literature and managers.

2. TRANSACTION COST ECONOMICS

2.1. Introduction to Transaction Costs Economics

In the context of SCM studies, TCE has often been used to examine organizations' outsourcing decisions: what activities should be kept in-house, and what activities should be conducted outside company boundaries (e.g., McIvor, 2009; Ellram, Tate and Billington, 2008). More generally, TCE examines the comparative advantage of alternative types of contracts for governing buyer-supplier transactions (Williamson, 2002). According to TCE, a transaction will occur either in the market (market contract) or within the organization (hierarchical contract or vertical integration) (Arnold, 2000; Williamson, 1985).

Market contracts rely on price and competition to coordinate transactions (Williamson, 1991). When a supplier does not meet the requirements, a buyer can switch to another supplier. Hierarchical contracts coordinate transactions by means of administrative control with associated monitoring rights and capabilities (Williamson, 1991). In this case, the supplier is not an autonomous actor, but is integrated into the buyer's company. Subsequent extensions of the TCE framework (e.g., Ménard and Valceschini, 2005; Buvik, 2002; Heide and John, 1990) also distinguish between various types of intermediate contract forms, like formal contracts or verbal agreements with preferred suppliers. Which type of contract is most suitable for governing a transaction depends on the characteristics or attributes of the transaction, which affect the relative costs of the contracts (Williamson, 2000).

In the TCE framework, transactions take place in a context where the actors are limited by their own bounded rationality and are subject to the strategic behavior of other actors (Williamson, 1988). Bounded rationality is the assumption that human behavior is intentionally rational, but constrained by the capacity to process and communicate information (Simon, 1957). Because of these constraints, actors cannot specify all the changes in the circumstances surrounding a transaction in advance (Williamson, 1991). Actors entering into a transaction run the risk that the circumstances change (e.g., demand for a product falls) after the parties have agreed upon exchange conditions (e.g., after a large order is placed). Furthermore, because of bounded rationality, complete contracts cannot be drafted, and complex contracts will include gaps and omissions (Williamson, 2008). These gaps offer the counterparty to the transaction an opportunity to engage in (self-interested) strategic behavior (Williamson, 2000). Strategic behavior refers to the attempts by actors to exploit the counterparty to the transaction, amongst others by renegotiating the conditions of the

exchange (i.e., opportunism) or by falsely claiming compliance with exchange conditions – i.e., shirking (Ghosh and John, 1999). Risks associated with strategic behavior are largest when contracts are inappropriately aligned with transaction attributes (Williamson, 2002).

According to TCE, transactions, which differ in their attributes, need to be aligned with specific contracts, which differ in their cost and aptitude, in an economically efficient manner (Williamson, 1985). Economic efficiency in this regard means that parties to a transaction should strive to minimize the costs of the transaction (Williamson, 2000), to the extent that value is maximized for both parties compared to the next best alternative for each party (Ghosh and John, 1999). Within the TCE framework, there are three attributes of transactions which are important in this regard: level of asset specificity (Williamson, 1988), level of performance measurement difficulty (Rindfleisch and Heide, 1997; Williamson, 1985; Barzel, 1982; Akerlof, 1970) and level of uncertainty (Williamson, 1991). The first two attributes affect the exposure of actors to risks associated with strategic behavior by counterparties. The third attribute affects the exposure of actors to risks associated with changes in transaction circumstances⁵⁶.

- *‘Level of asset specificity’* refers to the extent to which the investments an actor makes to support a transaction, ties the actor to the other party to the transaction. Assets are specific if their value decreases when they are used outside the transaction for which they were acquired. This exposes the actor making the investments to the risk of opportunistic behavior. This is the risk that the counterparty to the transaction will renegotiate terms once investments are made (Klein, Crawford and Alchian 1978).
- *‘Level of performance measurement difficulty’* refers to the extent to which the parties to a transaction can measure the benefits and costs the other party brings to the transaction. Performance measurement difficulties occur when one of the parties is better informed about the value of the exchanged goods or services. This exposes the uninformed party to the risk of shirking behavior. This is the risk that the counterparty to the transaction puts in insufficient effort (Ghosh and John 1999; Frazier 1999).
- *‘Level of uncertainty’* refers to unanticipated changes in the environment in which the transaction is embedded. These changes can expose the transaction parties to the risk of maladaptation; i.e., the risk of a failure to adapt to environmental changes (Gulati and Singh 1998). Williamson (1991) makes a distinction between changes for which

⁵⁶ The TCE framework used in this paper is representative of how TCE is frequently conceptualized in extant studies (Ghosh and John, 1999; Rindfleisch and Heide, 1997; Geyskens, Steenkamp and Kumar, 2006). Given the depth and breadth in TCE studies, some authors may use (slightly) different iterations of the framework. For example, some authors (Anderson and Schmittlein, 1984) also distinguish the ‘frequency’ by which actors transact with each other as a transaction attribute. However, studies are ambiguous about its effect on contract choice (Rindfleisch and Heide, 1997). This paper ‘controls’ for ‘frequency’ by studying only situations which involve recurring transactions.

autonomous adaptation of the transaction parties is sufficient (e.g., price uncertainty), and those which require a coordinated response (e.g., the adoption of new technologies).

When supply chain actors are exposed to transaction risks, they can employ various types of contracts in order to reduce their exposure to these risks. A contract is regarded as an efficient mechanism within the TCE framework if the direct costs of implementing it are lower than the opportunity costs of continued exposure to the transaction risk (or of implementing alternative contracts) (Masten, Meehan Jr. and Snyder 1991). These costs can occur before (as when potential suppliers are screened) and after implementation (as when performance of a contracted supplier has to be monitored) (Dyer 1997).

Market types of contracts have a relative cost advantage over hierarchical types of contracts when the transaction is characterized by low risk of strategic behavior (Williamson 1991). With market contracts, actors do not incur the set-up and administrative costs associated with hierarchical contracts (Arnold 2000). Hierarchical types of contracts have a relative cost advantage when the transaction is characterized by high risk of strategic behavior because they offer the actors more suitable mechanisms for managing these risks (Heide and John 1990). Hierarchical contracts can reduce risks associated with opportunistic behavior by implementing legally binding safeguards, which reduce the ability of counterparties to renegotiate conditions once specific investments are made (Williamson 1991). Furthermore, such contracts may reduce the risk of shirking behavior, by increasing the ability of actors to monitor the behavior and performance of counterparties (Williamson, 1985). When making their contract decisions, actors also need to take into account the environment in which the contract is embedded. For example, although the implementation of a hierarchical contract with extensive conditions may reduce the risk of opportunistic behavior, it may also increase the risk of maladaptation if actors operate in an environment with high levels of uncertainty (Artz and Brush, 2000).

2.2. Criticism of Transaction Cost Economics

Section 2.2 in Chapter One has explained that much criticism of TCE has focused on earlier studies and that recent TCE studies have started to address most of these points of criticism⁵⁷. However, some criticisms of TCE remain unaddressed.

⁵⁷ For example, with regard to a neglect of the institutional context in which transactions occur (see Oxley, 1999).

First, more TCE studies should examine the relation between different types of transaction risks (Geyskens, Steenkamp and Kumar, 2006). Supply chain actors may be exposed to multiple transaction risks at the same time (e.g., to both shirking behavior and maladaptation). This may impede actors in minimizing their transaction risk exposure, if conflicting contractual solutions are required to manage these risks (Barney and Lee, 2000).

Second, even though Williamson (2000) may explicitly conceptualize TCE as a dynamic framework, most studies examine the process of reducing exposure to transaction risks as a static process (Dyer, 1997). Studying the process as dynamic is necessary if the consequences of contractual choices are to be better understood (Nooteboom, 2004).

Third, the relation between contracts and transaction risks is often examined only in the context of bilateral exchanges (Sanchez, 2000). This is because the TCE framework unbundles the supply chain into dyads (Nickerson, Hamilton and Wada, 2001), and examines only the interdependencies which exist between the parties within each dyad (Williamson, 2008; 2002; 1991). Such an approach cannot examine the consequences of decisions made within each dyad for other supply chain transactions (Agrell, Lindroth and Norrman, 2004). For that, possible interdependencies between transactions need to be taken into account (Choi and Wu, 2009). Although there are a few studies on this subject, their contributions are limited because: (a), only two-stage supply chains (buyer-supplier relations) have been modeled (e.g., Roberts and Key, 2005); (b), a limited set of conditions under which interdependencies can occur have been studied (e.g., Sanchez, 2003); and (c), a small range of contracts to manage interdependencies have been examined (e.g., make or buy) (Barney and Lee, 2000).

This paper aims to examine transactions in a supply chain context, and therefore focuses mainly on the last of the three above mentioned criticisms. However, the paper also addresses the first two points because they are related to the issue of transaction interdependence. Transaction interdependence occurs when actors' exposure to supply (demand) side transaction risks affects their ability to manage exposure to demand (supply) side transaction risks. To examine under which conditions this interdependence is likely to arise, the relation between multiple transaction risks has to be taken into account. To study the consequences of this interdependence for actors' total transaction risk exposure, a dynamic conceptualization is required. In the next section, five models are developed about transaction interdependence within the context of a dynamic three-stage supply chain.

3. TRANSACTION COST ECONOMICS: TOWARDS A SUPPLY CHAIN-WIDE FRAMEWORK

3.1. Interdependency: A Myriad of Perspectives

Although TCE studies have focused largely on the interdependencies which arise within dyads, other theoretical perspectives have also examined interdependencies across dyads. For example, within social exchange theory scholars have examined how dyads are embedded within larger networks, which arise when multiple dyads are linked together (Emerson, 1976). Interdependencies occur when the behavior of actors making up a dyad, and the outcomes of their behavior, also depend on the behavior of other network actors (Molm, 1994).

Scholars from various fields, amongst others organizational sociology (Grandori and Soda, 1995; Granovetter, 1985), industrial marketing (Håkansson and Wootz, 1979; Ford, 1980) and communication science (e.g., Rogers and Kincaid, 1981) have explored the concept of interdependence in the context of economic exchanges or business networks. Several studies (Gulati and Singh, 1998; Kumar and van Dissel, 1996) have taken Thompson's (1967) conceptualization of various types of intra-organization task interdependencies and have applied it to examine interdependencies between organizations. Furthermore, researchers have used various interdependency related concepts from social network theory – e.g., the strength of actors' connections, the centrality of actors within networks – to examine issues like the diffusion of innovations (Granovetter, 1973), access to capital (Uzzi, 1999), interlocking directorates (Burt, 1980) and industrial districts (Lazerson and Lorenzoni, 1999).

In the SCM literature, the focus is beginning to expand to the path through a series of connected companies, rather than on stand-alone dyads (Borgatti and Li, 2009; Lambert and Cooper, 2000). Various interdependencies have been studied in supply chains which extend beyond the dyad, one of the most well-known example of which is the bullwhip effect – the increase in demand order variability for upstream stages due to decreasing insight into (final) demand information (Dooley et al., 2010; Lee, Padmanabhan and Whang, 1997).

Interdependencies have also been examined in the context of quality management practices, where collaboration is often necessary to assure final product quality (Kaynak and Hartley, 2008; Foster Jr., 2008).

The topics examined and insights generated which are mentioned above could not have been achieved without shifting the unit of analyses beyond the dyad. The present paper aims to contribute to such a shift within the TCE literature, by building on elements of the traditional TCE framework to develop a supply chain-wide TCE framework. In the traditional TCE framework, the unit of analysis is the 'transaction' and the focus is on the 'contract' used to govern the 'transaction' (Williamson, 1991). The extended TCE framework views the supply chain as a 'nexus of contracts' (Zylbersztajn and Farina, 1999) and takes the 'interdependence between transactions' as the unit of analysis.

Compared to social network and SCM studies, the paper has a more specific orientation on interdependencies related to the use of contracts. For example, social network studies focus mostly on how transactions are embedded in social relations (e.g., Galaskiewicz, 2011; Uzzi, 1996), and less on how transactions at various locations within networks affect each other through their contractual properties. SCM studies have examined the topic of 'contracts' mostly in the context of buyer-supplier relations, largely relying on the traditional TCE framework for guidance (Ellram, Tate and Billington, 2008; Cai and Yang, 2008).

3.2. Exposure to Multiple Transaction Risks

Exposure to multiple transaction risks occurs when a transaction has high levels of attributes of more than one type, e.g., high levels of asset specificity and high levels of performance measurement difficulty. Transaction attributes can be positively related, and therefore situations involving exposure to multiple transaction risks should not be uncommon. For example, asset specificity related risks arise amongst others when a company develops a brand, which may require specific investment by the brand owner in reputational capital; i.e., in promoting the brand and assuring the continuing reputation of the brand. Specific investments may also be required by suppliers of the brand owner, in order to be able to comply with additional quality requirements of the brand. Besides increasing asset specificity risks, the investments can also result in performance measurement difficulties as the brand owner may have difficulties in monitoring whether suppliers comply with requirements.

An actor may also be exposed to multiple transactions risks in separate transactions; e.g., to asset specificity related risks in its supply side transaction and volume uncertainty risks in its demand side transaction. Such situations can lead to the interdependency between transactions because they may require conflicting contractual solutions to reduce the different types of

transaction risk exposure. Table 4.1 gives an overview of the different combinations of transaction risks which are most likely to lead to interdependency.

TABLE 4.1
Exposure to Multiple Transaction Risks

	High Asset Specificity		Low Asset Specificity	
	<i>Performance Measurement Difficulty</i>		<i>Performance Measurement Difficulty</i>	
	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>
High volume uncertainty	1. ?	2. ?	3. ?	4. Market types of contracts
Low volume uncertainty	5. Hierarchical types of contracts	6. Hierarchical types of contracts	7. Hierarchical types of contracts	8. Market types of contracts

Note: the “?” in Boxes 1, 2, and 3 represents potential ambiguities in existing TCE theory.

The dark shaded areas in Table 4.1 give an overview of the instances in which a supply chain actor is exposed to multiple transaction risks. For example, in a transaction characterized by high levels of asset specificity and performance measurement difficulty (see Box 5 in Table 4.1), the supply chain actor would be exposed simultaneously to the risk of opportunism and the risk of shirking behavior. The question marks in Table 4.1 indicate situations in which the recommendations of TCE theory about what type of contracts are most efficient are ambiguous. In three out of four situations (see Box 1-3) in which supply chain actors are exposed to multiple transaction risks, it is unclear what type of contract is most efficient. All of these situations involve a combination of a high level of volume uncertainty and a high level of asset specificity or performance measurement difficulty. Volume uncertainty requires autonomous adaptation of the parties to the transaction, for which market types of contracts are more suitable (Williamson, 1991), while asset specificity and performance measurement related risks require the control mechanisms of hierarchical types of contracts (Williamson, 1991). Because these three situations require conflicting contractual solutions to reduce the different types of transaction risk exposure, they may lead to interdependency between transactions. The situations are discussed in the subsequent sections in more detail. Models 1-3 discuss a situation similar to Box 2 in Table 4.1, while Models 4-5 discuss situations similar to Box 1 and Box 3.

3.3. Managing Multiple Transaction Risks in the Context of Interdependent Transactions

Models 1-3 discuss a situation in which a supply chain actor is exposed to high levels of asset specificity and volume uncertainty. The situation is discussed in the context of two sequentially structured transactions: (1), between a supplier and focal actor; and (2), between the focal actor and customer. The models could apply amongst others to situations in which supply chain actors attempt to upgrade their production from commodity-oriented towards production for a differentiated or high-end market. These types of upgrades occur in a variety of industries⁵⁸ (e.g., apparel, footwear, horticulture, fruit, meat) (Gereffi, Humphrey and Sturgeon, 2005; Humphrey and Schmitz, 2002). Differentiation often requires specific investments by the supply chain actors wanting to participate in such markets. For example, a slaughterhouse which wishes to produce organic meat instead of regular meat needs to make adjustments to its slaughtering process (e.g., separate slaughter lines for organic animals need to be developed), but also needs to procure organically produced animals. Therefore, farmers wishing to market their animals to this slaughterhouse would need to invest in their stables to make them suitable for organic production (e.g., the animals would need to have more space).

As an example of multiple transaction risks in a two-stage supply chain:

- The relation between a supplier and focal actor is characterized by high levels of asset specificity. The supplier needs to adjust its production process, to be able to meet the specific quality requirements of the focal actor. However, to achieve that, the supplier needs to make significant investments in its production process, which will be adjusted in such a way that it is specialized in producing for the focal actor. The supplier can market its now differentiated products to other actors, but not without incurring a loss. To refer to the previous example, organic producers may market their organic animals in the regular market, but then they will not receive compensation for the extra costs they incurred in producing organic products.
- To limit the risk of opportunistic behavior by the focal actor, the supplier wants a long-term formal contract, in which the focal actor guarantees to purchase the total output of the supplier (with a min. and max. output) according to a fixed price. For example, if there is only one organic slaughterhouse in the proximity of the producer, it may be at risk of not getting a fair price from the slaughterhouse after it has made the investments in its stable, if no contract is in place between the two parties.
- Although this contract is necessary to assure a supply of products, the focal actor is at the same time exposed to demand side volume uncertainty. Demand can be both higher and

⁵⁸ Of the industries mentioned, examples from the meat industry will be used throughout the section to give more concrete illustrations to the models. For the sake of clarity, examples from a single industry will mainly be used. To address consumer food safety and animal welfare concerns, a growing number of actors in the meat industry attempt to differentiate their products. This can increase supply chain interdependencies and associated risks.

lower than expected, in part because of costs associated with keeping inventory. These costs include storage costs, but can also include costs associated with decay in the value of the products stored in case of perishable products.

- It is assumed that this demand side uncertainty cannot be solved by contractual design, because customers do not want to enter into a contract in which volume is included. The relation with the customer of the focal actor is considered exogenous to this model.

FIGURE 4.1
Interdependency between Supply Side Asset Specificity
and Demand Side Volume Uncertainty

		Exposure to Demand Side Volume Uncertainty	
		<i>High</i>	<i>Low</i>
Exposure to Supply Side Asset Specificity	<i>High</i>	1. ? S.....> X	2. FC S.....> X
	<i>Low</i>	3.	4.

(S= supplier; X= focal actor; FC= formal contract; dashed arrows indicate the flow of products between actors)

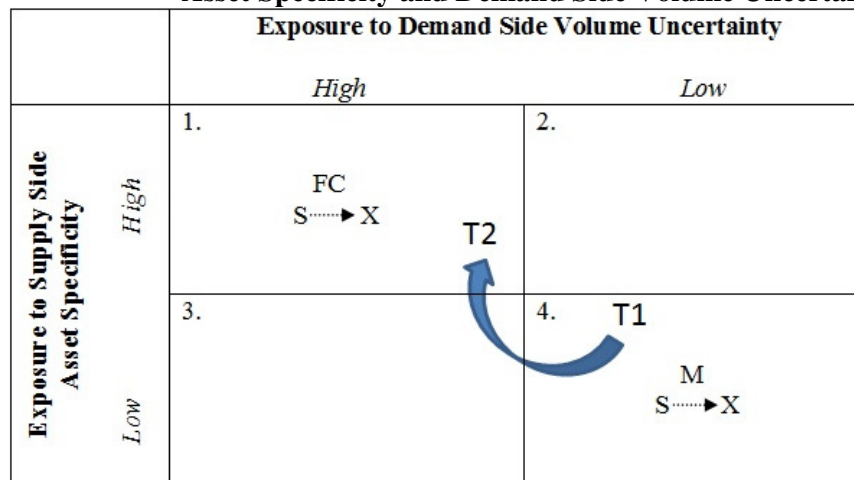
Model 1 (Figure 4.1) shows the relation between asset specificity and volume uncertainty:

- In box 1, a combination of high supply side asset specificity and high demand side volume uncertainty exists. To give its supplier an incentive to invest in quality improvements, the focal actor would need to implement the formal contract to show it has no opportunistic intentions.
- However, in a case of high demand uncertainty, it is not clear whether the direct costs of implementing the contract are lower than the opportunity costs of over- or under-production. This is because a fixed volume of inputs combined with a variable demand for the output of the company means the focal actor runs the risk of over- or under-production. Note that the focal actor is unlikely going to revolve this trade-off by contracting multiple suppliers or by vertically integrating into the supply stage of the chain. This may reduce the risk of under-production, but will increase the risk of over-production as the fixed volume of inputs supplied will be even larger.
- In box 2, a combination of high supply side asset specificity and low demand side uncertainty exists. In this situation, the focal actor can implement a formal contract with its supplier in which the volume is fixed, because the focal actor can predict demand for its products. In the absence of demand side risks, supply side decisions can be optimized.

3.4. Managing Transaction Interdependency in a Dynamic Context

Continuing with the example from above, this section explains how contract implementation may expose supply chain actors to other types of transaction risks. Model 2, displayed in Figure 4.2, once more shows the relation between supply side asset specificity and demand side volume uncertainty. A dynamic analysis is presented to demonstrate the consequences of contractual choices. The starting-point for the discussion is the same as is outlined above: the focal actor wants to give incentives to its supplier to make specific investments. However, it is assumed that the focal actor is, initially, not exposed to demand side volume uncertainty. This is because the focal actor has, before specific investments are made, a market relation with its supplier. This allows the actor to adjust the volume of its inputs in case the demand for its outputs changes.

FIGURE 4.2
Dynamic Analysis of Interdependency between Supply Side Asset Specificity and Demand Side Volume Uncertainty



(S= supplier; X= focal actor; M= market contract; FC= formal contract; dashed arrows indicate product flow)

The arrow in Model 2 (Figure 4.2) indicates the effect of contract usage on the transaction attributes:

- In box 4, the focal actor and its supplier are not exposed to any risks at Time 1 (T1). However, to protect the specific investments which the supplier needs to make, this actor wants a formal contract, in which the focal actor guarantees to purchase the total output of its production, according to a fixed price. The focal actor will enter into this contract, if the opportunity cost of a failure to invest in productive assets is lower than the opportunity cost of maladaptation.

- Assuming that this condition is met, the contract will be implemented. Subsequently, specific investments are made at T2. The arrow, which points from box 4 to box 1, shows how the implementation of the contract facilitates these investments.
- However, the arrow also shows that the use of the formal contract could increase the focal actor's exposure to demand side volume uncertainty. By implementing a contract with a fixed volume of inputs, the actor is arguably more exposed to demand side uncertainty than before the implementation of the contract. Such a contract removes the freedom the focal actor has in adjusting its production to changes in demand. For example, a slaughterhouse which has a spot market relation with its supplier(s), can choose to procure fewer animals if demand for meat falls. On the other hand, if it guarantees to its supplier(s) to purchase a fixed amount of their animals, it will be stuck with an excess supply of inputs when demand for meat falls.

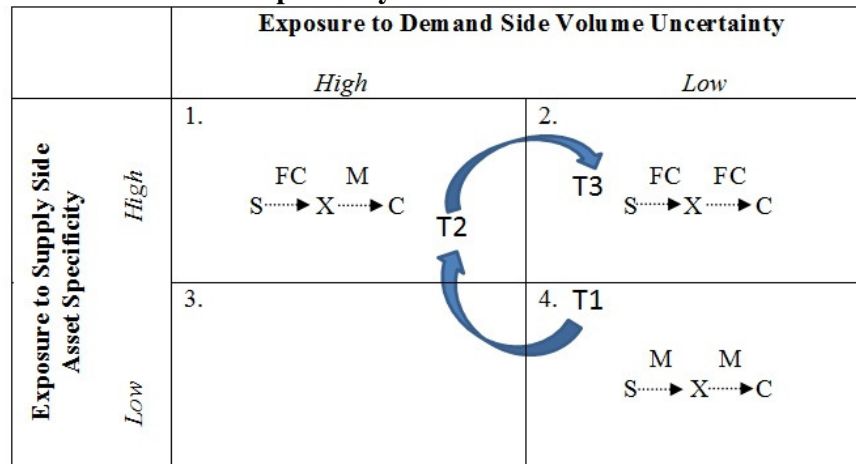
3.5. Managing Transaction Interdependency in a Three-Stage Supply Chain

Continuing with the example from above, this section includes the demand side transaction more explicitly in the analysis. This time, the focal actor can manipulate its relations with both its supplier and customer. Two types of transactions are examined: the supplier-focal actor transaction as well as the focal actor-customer transaction. Again, specific investments have to be made at the supply side of the focal actor and no initial exposure exists to high demand side volume uncertainty. Market relations exist for both examined transactions at T1.

Model 3 (Figure 4.3) visualizes the transactions between supplier-focal actor and focal actor-customer:

- At T2 in box 1, the focal actor has implemented a formal contract with its supplier, with the same fixed volume and price agreements as described in the previous examples. Although the use of this contract facilitates supply side specific investments, it could also increase the focal actor's exposure to demand side volume uncertainty.
- To reduce its exposure to demand side volume uncertainty, the focal actor could enter into a formal contract, with a fixed volume and price agreement with its customer. By implementing such arrangements with both suppliers and customers, it can facilitate supply side specific investments and reduce demand side volume uncertainty at the same time. This is shown at T3, in box 2. To refer to the previous example, the slaughterhouse would be relatively immune to changes in market demand if it has a fixed supply of animals combined with a guaranteed retail outlet for its meat.

FIGURE 4.3
Three-Stage Analysis of Interdependency between Supply Side
Asset Specificity and Demand Side Volume Uncertainty



(S= supplier; X= focal actor; C= customer; M= market contract; FC= formal contract; dashed arrows indicate product flow)

3.6. Managing Transaction Interdependency Resulting from Performance Measurement Difficulty

Participating in differentiated markets may require not only specific investments by supply chain actors, but can also lead to performance measurement difficulties as buyers (suppliers) cannot easily distinguish between differentiated and commodity inputs (outputs). For example, the slaughterhouse may not be able to easily identify the difference between organic and non-organically produced animals. Such issues can be of particular concern when a supply chain actor(s) produces both commodity and differentiated goods (e.g., as when the farmer produces both organic and non-organic animals). Models 4 and 5 describe interdependencies resulting from performance measurement difficulties.

The focal actor may face difficulties in establishing whether the supplier complies with its quality requirements because some attributes of the products delivered by the supplier may be difficult or costly to measure (Darby and Karni, 1973; Akerlof, 1970). To the extent that the focal actor is unable to monitor compliance, and the supplier incurs costs in achieving compliance, the supplier has an incentive to shirk and to not comply. For example, the slaughterhouse may have difficulties in monitoring whether certain welfare requirements are met during production, such as requirements that animals should not remain tied or boxed in a small space.

Compliance is not all or nothing. A supplier may include non-compliant products in a batch with a majority of compliant products (e.g., as when the farmer delivers a batch of organic animals which include non-organic animals). It may be too costly for the focal actor to inspect all of the delivered products, and so it examines only a random sample of products (i.e., sampling) (Barzel, 1982). Thus, if a batch of delivered products contains variability in product quality, this variability may be undetected by the focal actor (Jang and Olson, 2010).

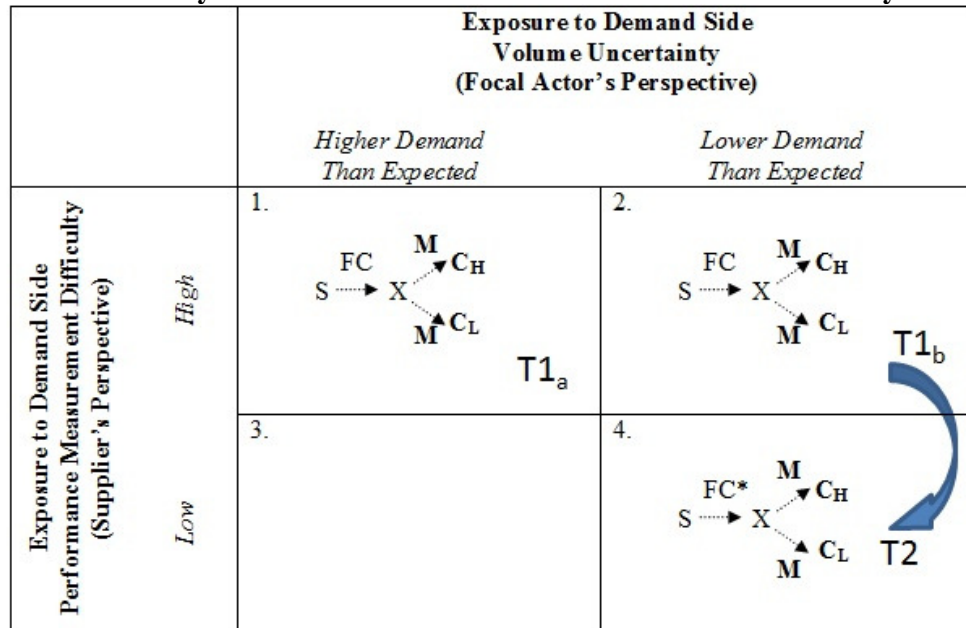
Apart from the supplier, the buyer can also have an incentive to shirk on the agreed upon quality requirements. The focal actor can shirk by falsely claiming some products do not meet the requirements, and pay a lower price for those products than agreed upon in the contract. For example, the slaughterhouse may claim that not all of the delivered animals meet the requirements it has set for organic production (e.g., the slaughterhouse may assert that residues of antibiotics were found in some animals), even if it uses all of the animals for organic meat production. The supplier may be particularly vulnerable to shirking when compliance monitoring takes place at sites of the focal actor. The supplier may lack the resources to evaluate the products at its own sites, or product quality can only be determined in latter supply chain stages (Hueth et al., 1999). For instance, meat quality can best be established after slaughter and is thus determined in the slaughterhouse rather than the farm.

Demand side volume uncertainty risks at the side of the focal actor may further amplify performance measurement difficulty risks for the supplier. This is shown in Model 4 (Figure 4.4) and explains as follows:

- The focal actor delivers products to customers in two markets: a high-end and a low-end market. Products intended for the high-end market can be delivered to customers in the low-end market, but not vice-versa (e.g., organic meat can be sold as regular meat, but not vice-versa). Products delivered by the supplier are used as inputs for making products for the high-end markets, if the inputs meet the requirement. If not, the inputs are used for products delivered to the low-end market.
- A formal contract is in place between the supplier and focal actor in which the latter guarantees to purchase a fixed amount of products of the former according to a fixed price. The contract price is higher than the low-end market price, but is only paid if products meet the requirements. Otherwise, the low-end market price is paid.
- Evaluation is done at the sites of the focal actor, by the focal actor, after delivery. The supplier can be present at the site where evaluation takes place, but can only monitor the focal actor by means of 'sampling'; i.e., it is too costly for the supplier to monitor the focal actor's evaluation of all products.

- The focal actor has market contracts with its customers, both in the high-end and low-end market. Demand in the high-end market is highly uncertain, and can be both higher and lower than the focal actor's expectations.

FIGURE 4.4
Interdependency between Supplier's Performance Measurement
Difficulty and Focal Actor's Demand Side Volume Uncertainty



(S= supplier; X= focal actor; C_L= customer low-end market; C_H= customer high-end market; M= market contract; FC= formal contract; FC*= formal contract with additional monitoring rights; dashed arrows indicate product flow)

- When demand is higher than expected, as is the case in Box 1 at T1_a in Model 4 (Figure 4.4), the focal actor has little reason to shirk. It does not have enough inputs to meet demand, and possibly needs to give incentives to the supplier for delivering additional inputs. Disapproving a large amount of the supplier's products is unlikely to achieve that.
- When demand is lower than expected, as is the case in Box 2 at T1_b, the focal actor has an incentive to shirk, as it will not want to pay the contract price for high-end inputs which it can only sell in the low-end market. The focal actor can shirk by claiming for example that only 70% of the inputs delivered by the supplier meet the requirements, while it uses 80% of the inputs for production to the high-end market.
- Note that the extent to which the focal actor can shirk is constrained by various factors, amongst others by the difference between the contract price and the low-end market price, as well as supplier monitoring costs. With a large difference between the contract price and the low-end market price, the supplier is likely to increase the frequency of 'sampling', because the relative costs of doing so have decreased. For example, if the price for regular animals drops and/or the price for organic animals increases, the

farmer has a stronger incentive to monitor whether the slaughterhouse correctly evaluates its animals as organic.

- Apart from increasing the frequency of monitoring when the supplier suspects excessive shirking takes place, it may also insist on additional monitoring rights in the contract. For example, the supplier may want the right to unannounced inspections at the focal actor's sites. Additional monitoring rights can reduce performance measurement difficulties, and thus reduce the opportunity for the focal actor to shirk, as is visualized by the arrow from T1_b in Box 2 to T2 in Box 4⁵⁹.

3.7. Employing Third-Parties to Manage Transaction Interdependency

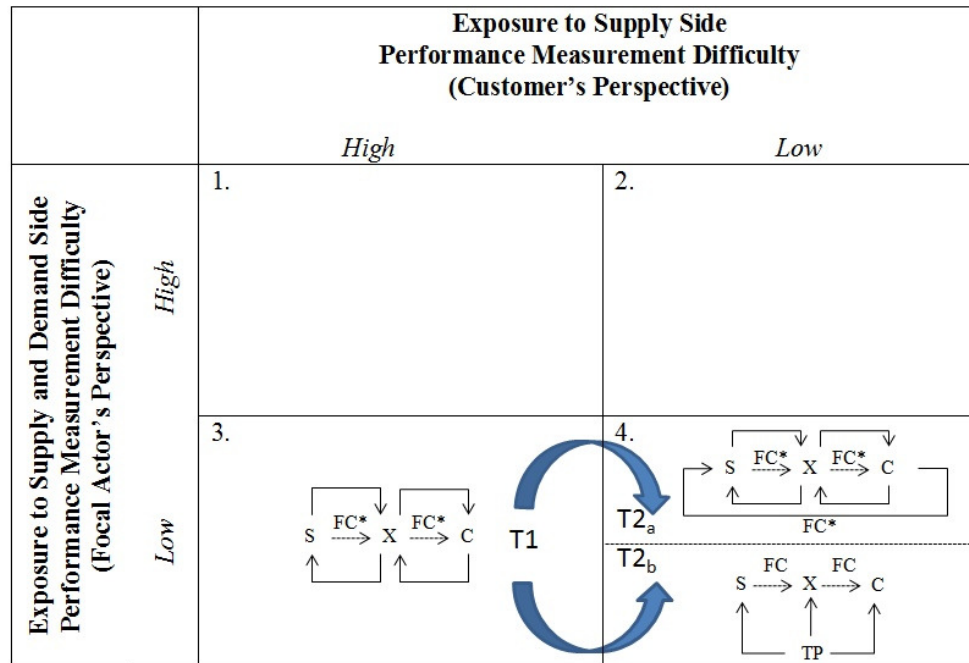
Besides the simultaneous manipulation of supply and demand side contracts, actors may also rely on third-party agencies to manage transaction interdependence. Third-parties are often used to reduce performance measurement difficulties. For example, in the financial sector, credit rating agencies monitor the creditworthiness of organizations (countries) and assign a rating which signifies the default risk associated with an organization's debt (White, 2009). In the agri-food sector, certifying institutions monitor the compliance of organizations with food safety requirements (Sporleder and Goldsmith, 2001). Although this topic has been examined within TCE studies, these studies focus on how third-parties affect buyer-supplier relations. However, the use of third-parties may have effects beyond the dyad (Wever et al., 2010).

Besides issues between the supplier and focal actor, performance measurement difficulties may also arise between the focal actor and its (high-end) customers. This may be particularly problematic for the customer, as it can be exposed not only to the risk that the focal actor shirks, but also that the supplier of the focal actor shirks (its second-tier supplier). This is because it may have to rely on the focal actor for the monitoring of the supplier (at least when no third-party agency is involved, as is explained below) (Fawcett and Magnan, 2002). To the extent that it is difficult or costly for the customer to monitor the focal actor, the latter may have no incentive to monitor its supplier. In the meat example, retail customers may be exposed not only to the risk that the slaughterhouse intentionally shirks by selling them non-organic meat as organic meat, but also that the slaughterhouse fails to effectively monitor the farmers, which may deliver non-organic animals as organic ones. The risk of shirking can be particularly high when both the farmer and slaughterhouse produce organic as well as non-organic products.

⁵⁹ The contract with additional monitoring rights will also be in place if demand is subsequently higher than expected. When shirking risk is reduced because of persistent changes in demand uncertainty, the supplier may choose to give up the additional monitoring rights. More likely, it will choose not to enforce those rights.

Model 5, displayed in Figure 4.5, shows two different strategies the customer may employ to resolve these difficulties.

FIGURE 4.5
Second-Tier Performance Measurement Difficulty and
the Role of Third-Parties



(S= supplier; X= focal actor; C= customer; FC= formal contract; FC*= formal contract with additional monitoring rights; TP= third-party monitoring agency; the angular arrows indicate the monitoring rights of the actors; dashed arrows indicate product flow)

- As is shown in box 3 of Model 5 (Figure 4.5), even when the actors have sufficient rights to monitor counterparties, performance measurement difficulties may persist at the customer's side. Compliance with some requirements, particularly production process requirements (e.g., whether or not animal welfare requirements are constantly met), can only be established by monitoring the behavior of the actor claiming compliance (Hueth et al. 1999). If such requirements apply, and the customer does not monitor the second-tier supplier itself, it has to rely on the focal actor.
- A closer monitoring of the focal actor by the customer could force the former to monitor its supplier more closely. If it does not, the customer may notice. However, the customer is unlikely to be able to evaluate the focal actor's monitoring activities when these activities take place at the sites of the second-tier supplier. For example, a retailer may be unable to monitor the slaughterhouse's audits of the locations of different producers, particularly if the retailer has a large number of second-tier suppliers. To the extent that the focal actor can profit from shirking by the second-tier supplier (see Model 4), it cannot be relied upon by the customer for monitoring on its behalf.

- Of course, the customer could decide to monitor (some of) its second-tier suppliers directly. As is shown in the upper side of Box 4 at T2_a, the focal actor would need additional monitoring rights for this. To obtain these rights, it may have to implement a direct contractual relation with its second-tier supplier.
- An alternative solution is for the customer (and other actors) to employ a third-party who monitors on its (their) behalf. As is shown at the lower side in Box 4 at T2_b, a third-party requires less monitoring rights, and thus potentially less monitoring activities to achieve compliance. To the extent that the actors can rely on the third-party for monitoring, they no longer need to monitor each other.

This example has shown the importance of monitoring by the customer (final actor) in the supply chain. If the customer has insufficient capability to monitor the other supply chain stages, then the other actors may have little incentive to perform or monitor their suppliers. A third-party agency may reduce such performance measurement difficulties, if the supply chain actors can rely on its judgment. Important aspects in this regard are the independence and competence of the third-party (Albersmeier et al., 2009; White, 2009).

3.8. Contrasting the Traditional and Supply Chain-Wide TCE Frameworks

Based on the developed models, various differences between the traditional TCE framework, which does not explicitly consider the interdependence between transactions, and a supply chain-wide TCE framework which explicitly models this, are discussed.

The *first model*, which considers a static two stage supply chain, shows that supply chain actors can be forced to make a trade-off between minimizing exposure to supply or demand side risks when transactions are interdependent. An analysis according to the traditional TCE framework would not identify this trade-off, as this interdependency is not recognized.

The *second model*, which considers a dynamic two stage supply chain, shows that the implementation of a contract to reduce exposure to a supply (demand) side transaction risk can have adverse consequences, by increasing exposure to demand (supply) side transaction risks. An analysis according to the traditional TCE framework would discount the increase in demand (supply) side risk which can occur when supply chain actors implement contracts in supply (demand) side transactions under conditions of transaction interdependency.

The *third model*, which considers a dynamic three stage supply chain, shows that supply chain actors can limit these negative ‘transaction externalities’⁶⁰, by manipulating both supply and demand side transactions simultaneously. An analysis according to the traditional TCE framework would recommend a different set of contracts than those recommended by the supply chain-wide framework. A contractual solution presented by the traditional TCE framework will not take into account externalities arising from transaction interdependency. Instead, the solution will be focused on optimizing the two sets of bilateral transactions.

The *fourth model* examines how the exposure of supply chain actors to transaction risks can depend on transactions in which they are not directly involved. The model shows that an actor’s exposure to the risk of shirking can depend on uncertainty in the volume demand of its second-tier customer. An analysis according to the traditional TCE framework would not take into account that an actor’s risk exposure can depend on how transactions further downstream (upstream) in the supply chain are managed.

The *fifth model* examines the role of third-parties in managing transaction interdependencies. The model shows that third-parties can facilitate in monitoring the performance of second-tier suppliers. An analysis according to the traditional TCE framework would provide a contractual solution which would require additional monitoring by the final actor in the supply chain. The traditional TCE framework would not be able to explain how insufficient monitoring by this actor can amplify transaction risks elsewhere in the supply chain; i.e., by reducing the incentives of the other actors to monitor each other.

⁶⁰ Only ‘transaction externalities’ in the context of the supply chain are considered in this paper; e.g., a spillover of supply (demand) side risks to the demand (supply) side transaction or elsewhere in the supply chain.

TABLE 4.2
Comparison between Traditional and Supply Chain-Wide TCE Framework

	Supply Chain-Wide TCE Analysis	Traditional TCE Analysis
<p>Model 1: <i>static two stage supply chain</i> involving the focal actor and its supplier.</p> <p><i>Situation:</i> the focal actor is exposed to <i>supply side asset specificity</i> and <i>demand side volume uncertainty</i>.</p>	<ul style="list-style-type: none"> - Interdependency exists under the examined conditions. This interdependency may force supply chain actors to choose between optimizing supply or demand side transactions. - In the situation modeled, the focal actor has to decide whether the opportunity cost of a failure to invest in supply side productive assets is lower than the opportunity cost of demand side maladaptation. 	<ul style="list-style-type: none"> - Trade-off between optimizing supply or demand side transactions does not arise as the interdependency between the two transactions is not recognized.
<p>Model 2: <i>dynamic two stage supply chain</i> involving the focal actor and its supplier.</p> <p><i>Situation:</i> similar to Model 1 at T1. At T2, the consequences of the focal actor's <i>supply side contract usage</i> for its exposure to transaction risk are also analyzed.</p>	<ul style="list-style-type: none"> - Manipulation of supply (demand) side transactions may have adverse consequences by increasing supply chain actors' exposure to risks in other transactions. - In the situation modeled, the focal actor's use of a fixed volume contract in its supply side transaction increases its exposure to volume uncertainty in its demand side transaction. 	<ul style="list-style-type: none"> - An analysis according to the traditional TCE framework would discount the risk that the focal actor takes in the situation, as it would consider only the role of the contract in reducing exposure to supply side transaction risk.
<p>Model 3: <i>dynamic three stage supply chain</i> involving the focal actor, its supplier and customer.</p> <p><i>Situation:</i> similar to Models 1 and 2 at T1. At T2 and T3, the consequences of the focal actor's <i>supply</i> and <i>demand side</i> contract usage for its exposure to transaction risk are also analyzed.</p>	<ul style="list-style-type: none"> - Supply chain actors can limit negative 'transaction externalities', by manipulating both supply and demand side relations simultaneously. - In the situation modeled, the focal actor has to implement fixed volume contracts in both supply and demand side transactions to balance supply and demand side exposure to volume uncertainty. 	<ul style="list-style-type: none"> - The traditional TCE framework would focus on reducing risk exposure for each transaction separately. - Such an analysis would recommend a different set of contracts: the fixed volume contract in the supply side transaction reduces the risk of opportunistic behavior, while the market contract in the demand side transaction reduces the risk of maladaptation.
<p>Model 4: <i>dynamic three stage supply chain</i> involving the supplier, focal actor and customer.</p> <p><i>Situation:</i> the supplier has <i>demand side performance measurement difficulties</i> while the focal actor is exposed to <i>demand side volume uncertainty</i>.</p>	<ul style="list-style-type: none"> - The risk exposure of actors can depend on transactions in which they are not involved. - In the situation modeled, the supplier's exposure to shirking risk depends on the focal actor-customer transaction. Demand side volume uncertainty for the focal actor increases the risk for the supplier that the focal actor will shirk on their agreement. 	<ul style="list-style-type: none"> - An analysis according to the traditional TCE framework would not take into account that the supplier's risk exposure can change, depending on how transactions further downstream (upstream) in the supply chain are managed.
<p>Model 5: <i>dynamic three stage supply chain</i> involving the supplier, focal actor and customer.</p> <p><i>Situation:</i> the customer is exposed to difficulties in <i>measuring the performance</i> of its <i>supplier</i> (the focal actor) and <i>second-tier supplier</i> (the supplier).</p>	<ul style="list-style-type: none"> - Insufficient monitoring by the final actor in the supply chain can amplify transaction risks. Third-parties may reduce risk exposure. - In the situation modeled, the customer relies on the focal actor to monitor the supplier. This means it is vulnerable to shirking by both actors. A third-party can reduce risk exposure for the customer and may also reduce the monitoring activities required to achieve this. 	<ul style="list-style-type: none"> - An analysis according to the traditional TCE framework would recommend contracts with additional monitoring rights for the customer, which would require it to also undertake more monitoring activities.

4. DISCUSSION AND CONCLUSION

This paper has contrasted the traditional TCE framework with a new supply chain-wide TCE framework by means of five theoretical models. The difference between the two is that the latter recognizes the interdependence between supply chain transactions, while this is not explicitly considered by the former. This topic has been examined in the context of sequential supply chains producing differentiated products. The paper has furthermore focused on supply chains where temporal factors encouraged the use of contracts to manage transaction risks.

4.1. Implications for Transaction Cost Economic Literature

In contrasting the two frameworks, this paper has made some important contributions to TCE theory.

First, it has modeled how contract choices in supply (demand) side transactions can affect actors' exposure to risks in other transactions; i.e., how transactions can be interdependent under some conditions. Model 1 has shown that exposure to multiple transaction risks can lead to transaction interdependency. This is because such situations can require conflicting contractual solutions to reduce exposure to the different types of risks.

Second, it has specified the main conditions under which the interdependence between transactions is expected to occur. An overview has been given of the different combinations of transaction risks which are most likely to lead to interdependency (see Table 4.1). Three detailed examples of transaction interdependency have been discussed: (1), supply side specific investments which amplify demand side risk of volume uncertainty (Models 1-3); (2), demand side risk of shirking which is amplified because of uncertain volume demand of second-tier customers (Model 4); and (3), supply side risk of shirking resulting from difficulties in monitoring the performance of second-tier suppliers (Model 5).

Third, it has shown that, as a result of these interdependencies, actors may be forced to choose between optimizing their supply or demand side transactions, which can result in negative transaction externalities. Model 2 has illustrated some of the limitations of a separate optimization of supply and demand side transactions. Formal contracts, with fixed prices and volumes, may minimize risks associated with opportunistic behavior by suppliers. But, if no similar contracts are put in place at an actor's demand side, than the rigidity of these contracts may expose it to maladaptation risks in transactions with customers. Model 4 and Model 5

have furthermore shown that negative transaction externalities may also result from transactions in which an actor is not directly involved.

Fourth, it has shown that supply chain actors may reduce the impact of these externalities by manipulating supply and demand side transactions simultaneously (Model 3) or by outsourcing some coordination functions (e.g., compliance monitoring) to a third-party (Model 5). Employing third parties may be the preferred option when externalities arise from transactions in which an actor is not directly involved (Model 4 and Model 5).

Fifth, it has highlighted some of the shortcomings of the traditional TCE framework:

- It discounts or fails to make explicit some transaction risks, as negative externalities arising from transaction interdependency are not recognized (Models 1-5);
- It is therefore not able to offer any solutions to deal with these risks (like the third-party in Model 5), but instead offers contractual solutions which minimize supply chain actors' exposure only to bilateral transaction risks (Models 1-2);
- If negative externalities are large, the bilateral solutions offered by the traditional TCE framework can increase actors' total exposure to transaction risks (Models 1-2), or can lead to a failure to implement alternative solutions which minimize risk exposure further than can be achieved by bilateral optimization (Models 3-5).

4.2. Implications for Supply Chain Management Literature

The SCM literature has shifted in the 1990s from a focus on logistics management to a broader perspective on the integration and management of business processes (Lambert and Cooper, 2000). Amongst others, this shift has resulted in a rich body of literature on a wide range of tools which practitioners may use to interface with their supply chain: (collaborative) inventory management systems (Barrat and Oke, 2007; Sahin and Robinson Jr., 2005), quality management systems (Kaynak and Hartley, 2008; Foster Jr., 2008), product tracking and other types of information systems (Cooper and Tracey, 2005; Kumar and van Dissel, 1996).

A potential limitation of the TCE framework in the context of SCM studies is its narrow focus on contracts as the main tool for supply chain management. This also applies to the present study which assumes amongst others that non-contractual solutions (e.g., inventory buffers) are costly. SCM studies could relax this assumption and examine how the use of other types of SCM tools affects the implications of the models presented in this study.

Despite its limitation(s), the traditional TCE framework has been used within SCM studies to examine a range of issues, including: channel integration (Frazier, 1999), outsourcing (Wallenburg, 2009; Ellram, Tate and Billington, 2008), global sourcing (Kamann and van Nieulande, 2010; Ettlie and Sethuraman, 2002), coordination mechanism choices (Xu and Beamon, 2006), and foreign entry mode choices (Chen, 2010). The extended TCE framework has potentially an even wider application within SCM studies, as researchers can use it to examine the role of contracts in managing interdependencies which extend beyond the dyad. For example, studies could examine how contracts can reduce upstream volume uncertainty risks resulting from downstream 'shortage gaming'; i.e., the 'over-ordering' by customers when supply of a product is expected to be rationed (Lee, Padmanabhan and Whang, 1997).

4.3. Managerial Implications

The study offers various strategies to managers for dealing with the risks which arise from transaction interdependence. Its main implication is that the use of contracts which impair the flexibility of the supply chain actors (e.g., fixed prices) or which lead to imbalances in the supply chain (e.g., contracts with asymmetric pay-offs) should be limited. Actors should consider outsourcing those aspects of supply chain coordination which are most exposed to opportunism and shirking, and which affects multiple stages, to a supply chain coordinator. This can be a passive entity, as when prices are set by a reference market, or an active third-party to each transaction, like monitoring agencies and associations. This is explained below.

First, actors should attempt to balance supply and demand side contracts to reduce imbalances in exposure to price or volume uncertainty. These imbalances, which can lead to maladaptation, are likely to arise when actors have made specific investments in only parts of the chain and have used contracts with fixed prices or volumes to reduce the risk of opportunistic behavior for those transactions (see Models 1-3). In these cases, supply chain actors might consider using contracts with 'reference market prices', where the contract price is based on the quoted price of a similar product exchanged in the open market. On the one hand, such contracts are a safeguard against opportunistic behavior, as they limit the ability of transaction parties to renegotiate prices. On the other hand, the use of reference market prices allows the contract price to move in line with current market prices, and thus reduces risks associated with maladaptation. Reference market price contracts are common in the financial sector (e.g., variable interest rate mortgages), but they could also be useful in other contexts.

Second, actors should consider sharing the costs of making investments in assets which are specific and are used across the supply chain (e.g., in measurement technology) or for which the benefits and risks of its use flow across company boundaries (e.g., in brand development). Sharing these costs, and some of the benefits, can reduce exposure to opportunistic and shirking behavior. For example, most supply chain actors stand to benefit if they spend fewer resources on monitoring each other (Models 4-5). They can achieve this by *jointly* contracting with a third-party monitoring agency. Unfortunately, it is more common for the actor receiving the certification to contract with the third-party, but this may compromise the independency of that entity (see White, 2009).

Third, (second-tier) suppliers can be given less of an incentive to act opportunistically or to shirk, by tying their profits to the performance of the final product in the supply chain. In some agri-food chains, this is achieved by jointly holding the property rights of the consumer brand under which products are marketed, by means of vertically organized associations (Ménard and Valceschini, 2005). The associations function as pooled investment vehicles, which reduce the size and specificity of the investments made by each individual actor.

4.4. Implications for Further Research

Further studies should also attempt to model transaction interdependence in different contexts. For example, studies could model supply chains with reciprocal linkages in the production process (e.g., construction activities) or where temporal factors are less important (e.g., non-perishable products). More importantly, studies should also attempt to examine this topic empirically. A case study approach can be used to compare the perspectives of multiple actors operating in the *same* supply chain. Such an approach should focus on comparing the contracts used within the supply chain and on identifying (perceived) interdependencies.

Alternatively, a more quantitative approach could compare ‘contract use’ *across* supply chains. For example, researchers could test the proposition that interdependency between transactions occurs. This could be examined by comparing the supply side contracts used by two different groups of actors: (1), actors exposed to both supply side asset specificity and demand side volume uncertainty; and (2), actors exposed *only* to supply side asset specificity. The assumptions of the supply chain-wide TCE framework would be supported when the two groups use different types of supply side contracts, as actors in the first group attempt to balance supply and demand side contracts. The traditional TCE framework’s assumptions

would be supported if both groups use the same type of supply side contract, as actors in the first group alter only demand side contracts to manage exposure to demand side risks.

Additionally, further research could also take contextual variables, like company size, into account. Such studies could paint a more complete picture of the transaction risk exposure of large actors, and under which conditions these risks are transferred to other actors in the supply chain through the interdependency of transactions. This should help counterparties of large actors, as well as policy makers, to better understand what risk is borne by these actors, and the extent to which they themselves are (indirectly) exposed to these risks. An inability of a large actor to carry risk can have systematic consequences, but these consequences will be amplified when there is a strong interdependency between transactions.

MANAGING TRANSACTION RISKS IN INTERDEPENDENT SUPPLY CHAINS: AN EXTENDED TRANSACTION COST ECONOMICS PERSPECTIVE⁶¹

Study Three has moved TCE's unit of analysis beyond the dyad. In doing so, an important contribution has been made towards the study of risk management in a supply chain context. Amongst others, Study Three has outlined various general strategies that actors can use to simultaneously manage their supply and demand side transaction risk exposure. Study Four builds on the previous study, by discussing several TCE based risk management strategies that actors can use in the supply chain. While Study Three has focused mainly on the strategies that actors can use to minimize or eliminate transaction risks in the supply chain, this study considers a broader range of strategies when risk minimization is not possible. Furthermore, compared to the previous study, the present study more explicitly considers risks resulting from non-sequential interdependencies in the supply chain.

1. INTRODUCTION

The 2007-2008 financial crisis has shown how risks can be transferred in the interdependent business networks, supply chains and economies which exist today. Insufficient monitoring by mortgage providers of the creditworthiness of borrowers in the American housing economy has contributed to the bankruptcy of banks and other financial institutions in Europe (see Van Hengel and Knot, 2011; Jacobs, 2009). Inadequate monitoring activities were undertaken because the mortgage providers had little incentive that the borrowers repaid their loans; they had (largely) repackaged and resold the rights to receive the loan repayments to other investors (see Den Butter, 2011; Haldane, 2008).

Besides crippling the world economy, the crisis has also drawn renewed attention to those economic and managerial disciplines, like institutional economics, which examine transaction risks resulting from conflicts of interests between transaction parties. In particular Transaction Cost Economics (TCE), which examines the different types of inter-organizational contract forms that can resolve such conflicts, has received additional interest.

However, many TCE studies focus mainly on transaction risks, as well as their resolutions, in individual transactions (see previous chapter). Such approaches ignore the consequences of a

⁶¹ The article on which this chapter is based has been submitted to "Journal on Chain and Network Science".

failure to adequately manage risk in a transaction for the wider business network or supply chain in which the transaction takes place.

The present study aims to address this issue by examining: (1), how risks arise within the supply chain as a result of interdependencies between the various transactions making up the supply chain; and (2), what types of TCE based risk management strategies actors can use to manage their exposure to these risks. Furthermore, the study explores whether the risk management strategies which are suitable to use when only an individual transaction is considered, are still appropriate when the larger supply chain context is taken into account.

Two aspects of the TCE framework should be mentioned at the outset of this study. *First*, TCE is based on the assumption that exposure to most transaction risks should be minimized (cost allowing). This is because the main risks which are analyzed within the TCE framework result from the strategic, self-interested behavior by one of the parties to the transaction and generally have little or no upside potential (unlike exposure to some risks⁶²). *Second*, although actors may use a wide variety of risks management strategies, TCE focuses almost exclusively on contractual based strategies.

The remainder of the study is outlined as follows. *Section 2* gives a TCE based overview of the different types of risks to which actors are exposed in bilateral transactions and what types of contracting strategies are suitable to manage these risks. *Section 3* shifts the focus beyond the dyad, by examining how different types of interdependencies can arise between transactions in the supply chain. The section discusses how such interdependencies can expose the actors to additional risks. *Section 4* discusses several TCE based contracting strategies which actors can employ for managing their transaction risk exposure under such circumstances. *Section 5* discusses the main findings of the study and outlines areas for further research.

⁶² For example, investing in shares of companies is risky, but has unlimited upside potential. Exposure to such risks can yield great benefits (unlike the main risks which are examined in the TCE framework, which have a large downside potential). In general, risk management should not be about the elimination of risks, as is it difficult or not impossible to manage a company without taking risks, but about determining an appropriate level of risk exposure (Chance, Grant and Marsland, 2007).

2. A TCE PERSPECTIVE ON RISK

‘Risk’ can be defined as the possibility of a harmful event (e.g., a cost or a loss) (see Hallikas et al., 2004; Chiles and McMackin, 1996). In this study, the focus is on ‘transaction risks’⁶³; i.e., possible harmful events resulting from the participation of an actor in transactions with other actors. The use of the term ‘possible’ indicates that there is uncertainty about the event. Uncertainty may exist about two different aspects of the event (see Hallikas et al., 2004). First, it may exist about the nature of the event (e.g., about the extent of the loss). Second, it may exist about the frequency by which the event occurs (e.g., how often does the loss occur).

Based on this conceptualization of risk, three generic (non-mutually exclusive) options which actors have to manage their risk exposure can be distinguished: (1), ‘get to know’ the odds; i.e., obtaining information to reduce uncertainty about the (expected) frequency or nature of the event (see Van der Vorst and Beulens, 2002; Baird and Thomas, 1985); (2), ‘manipulate’ the odds; i.e., affect the probability that an event occurs or affects the actor (see Neiger, Rotaru and Churilov, 2007; Heyder, Theuvsen and Von Davier, 2007); (3), minimize the impact when the event does occur (see Tomlin, 2006; Kleindorfer and Saad, 2005). As is explained below, TCE is mainly focused on the second of these three options. As a result, the study largely limits itself to examining the various strategies actors can take to (attempt to) change the probability that an event occurs; i.e., strategies to minimize, alter, transfer or share risk exposure (see Section 2.2 and Section 4).

The remainder of this section is organized as follows. Section 2.1 gives an introduction to Transaction Cost Economics (TCE) literature and a description of the situations in which risks arise within the TCE framework. Section 2.2 discusses several TCE based solutions for resolving these situations and reframes these solutions as risk management strategies (discussed in more detail in Section 4). Section 2.3 examines the relation between transaction risk and transaction cost within the TCE framework, and how this relation is expected to affect actors contracting choices.

2.1. Types of risk studied in the Transaction Cost Economic framework

The TCE framework offers a perspective on how transaction risks arise and what actors can do to manage their exposure to such risks by means of contracts. The main risks which are examined within the TCE framework are related to strategic behavior by a party to the

⁶³ Two broad categories of ‘risk’ can be distinguished: business and financial risk (Turvey, 2005). Business risk results from the operations of the company, while financial risk results from the employed capital structure (i.e., the level of debt). Transaction risks are a subset of ‘business risk’.

transaction (Williamson, 1988). Strategic behavior refers to the attempts made by actors to exploit their counterparty, amongst others by renegotiating the conditions of the exchange (i.e., the risk of opportunism; Joskow, 1987) or by falsely claiming compliance with exchange conditions (i.e., the risk of shirking; Ghosh and John, 1999). Strategic behavior is possible because contracts always include gaps and omissions (Williamson, 2008), which result from human constraints in information processing capabilities (Simon, 1957). Furthermore, because of these constraints, actors cannot specify all the changes in the circumstances surrounding a transaction in advance (Williamson, 1991). Actors entering into a transaction are exposed to the risk that they cannot adapt exchange conditions when circumstances change (i.e., the risk of maladaptation).

Risks associated with opportunism are largest when a transaction is characterized by high levels of asset specificity, which refers to the extent to which the investments an actor makes to support a transaction ties the actor to the other party to the transaction (Williamson, 1988). Assets are considered to be specific when their value decreases if they are used outside the transaction for which they were acquired (Klein, Crawford and Alchian, 1978). Risks associated with shirking are largest when a transaction is characterized by high levels of performance measurement difficulty, which refers to the extent to which the transaction parties can measure the benefits and costs the other party brings to the transaction (Frazier, 1999; Ghosh and John, 1999). Performance measurement difficulty occurs when one party is better informed about the value of the exchanged goods or services (Rindfleisch and Heide, 1997). Risks associated with maladaptation are largest when the transaction is characterized by high levels of uncertainty. Uncertainty refers here to unanticipated changes in the environment in which the transaction is embedded.

2.2. Contracts as risk management tools in the Transaction Cost Economic framework

This section discusses some of the main contracting strategies distinguished within the TCE framework⁶⁴ from a risk management perspective. Contracts are usually viewed in the TCE framework as a tool to reduce transaction costs (see Williamson, 1985). However, it is arguably more useful to view contracts as a tool to manage transaction risks. While contracts should be employed in such a way that transaction costs are minimized, their function is to help actors manage their transaction risk exposure. There are different ways in which contracts can facilitate in this regard.

⁶⁴ See, for example, Ménard (2004) for a more exhaustive discussion.

First, actors can use contracts to *minimize* or *reduce* their exposure to transaction risks. For example, the risk of opportunism may be reduced by implementing hierarchical types of contracts, with legally binding safeguards, which reduce the ability of counterparties to renegotiate conditions once specific investments are made (Williamson, 1991). Furthermore, such contracts may reduce the risk of shirking, by increasing actors' ability to monitor counterparty performance (Williamson, 1985).

Second, in the examples given in the previous paragraph, contracts are used to limit the prospects for counterparties to act opportunistically or to shirk. However, contracts can also be used to give counterparties an incentive not to act in such a way. One way to do this is to *share* exposure to a risk (and associated benefits) (Ménard, 2004; Chung, 1991). The key aspect of this strategy is to make transaction parties mutually dependent on each other, primarily by reducing any asymmetry which exists between the parties in terms of the specificity of the investments required to support the transaction (Cai and Yang, 2008). For example, when both parties to a transaction have made specific investments, both actors have committed themselves to the transaction and thus have a stake in its success⁶⁵. Subsequently, although both parties may have the chance to act opportunistically, they have an incentive not to act in this manner because they share the risk that the investments turns out to be unproductive as a result. For this reason, such contracting strategies are discussed within the context of the TCE framework as a form of 'exchange of hostages' (see Williamson, 1983) and such contracts as 'self-enforcing' (Klein, 2000). When transaction parties both have made the same level of commitment (investment) and have the same stake in a successful outcome, risk sharing in such circumstances lead to risk reduction (i.e., of opportunism in this case).

Third, besides risk reduction or risk sharing, contracts may also be used to *alter* the risk exposure of actors. For example, consider a contract with extensive conditions, which may be required to reduce the risk of opportunism or shirking (see above). Note that such a contract cannot specify all changes in the circumstances surrounding a transaction in advance (see Williamson, 1983; Klein, Crawford and Alchian, 1978). Subsequently, although the implementation of a contract with extensive conditions may reduce the risk of opportunism, it may also increase the risk of maladaptation if actors operate in a highly uncertain environment (Artz and Brush, 2000). If such a contract is nonetheless employed, the actors have altered their risk exposure; i.e., they have swapped exposure to asset specificity related

⁶⁵ When only one of the two transaction parties has made (more) specific investments there would be asymmetry in the specificity of the investments required to support the transaction.

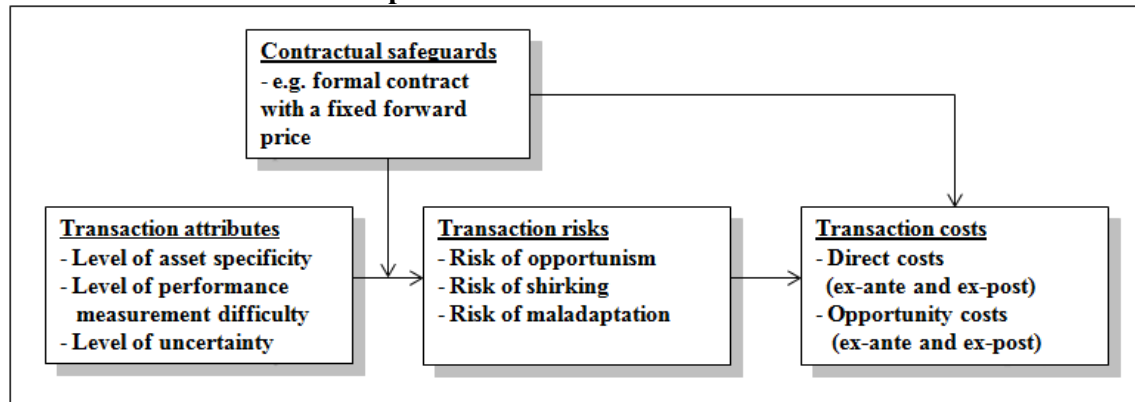
risks for exposure to uncertainty related risks. However, how actors should manage such situations, which involve exposure to multiple transactions risks, is not entirely clear from TCE literature (Geyskens, Steenkamp and Kumar, 2006). This is because when actors are exposed to multiple transaction risks at the same time, TCE gives conflicting contractual solutions to manage the different types of risk exposures (Barney and Lee, 2000). Under such circumstances, an actor may be forced to choose to which risk it wants to be exposed to.

Fourth, besides the above mentioned strategies, a frequently discussed contracting strategy outside TCE literature is the transfer of risk from one transaction party to the other (see Heyder, Theuvsen, and Von Davier, 2010; Jacobs, 2004). Within TCE literature, this strategy has received less attention, probably because most TCE studies consider actors to be risk neutral (Rindfleish and Heide, 1997). This means that transaction parties are considered to have the same level of risk preference (aversion) (Williamson, 1988) and, presumably, risk management competences. Subsequently, a key motive for transferring risk – a different level of risk preference amongst the transaction parties – is not taken into account within the TCE framework⁶⁶ (Chiles and McMackin, 1996). However, also within the TCE framework actors do have a motive to transfer or absorb risk in some situations; i.e., when multiple risks arise in a transaction. In such situations, absorbing the risk exposure of the counterparty to the transaction may reduce an actor's own exposure to another risk. For example, to refer the situation described in the previous paragraph, an actor may absorb the price uncertainty risk of its counterparty in order to encourage it to make specific investments (i.e., in order to reduce its own asset specificity related risks). This is further discussed in Section 4.

2.3. Transaction Cost Economics or Transaction Risk Economics?

Although it may seem obvious that actors should employ contracting strategies which minimize their transaction risk exposure, usage of different types of contracts also leads to different costs. This section discusses the relation between transaction risks and costs within the TCE framework. More specifically, the section addresses the question of whether transaction parties should minimize their transaction risk exposure or their transaction costs. To help address this question, Figure 5.1 visualizes the relation between TCE's key concepts.

⁶⁶ With different levels of risk aversion, a strong economic reason exists for the transfer of risk from one transaction party to another (see Chung, 1991). The TCE framework, which assumes risk neutrality, has difficulty addressing two questions: (1), why would a buyer (supplier) want to absorb the risk exposure of its supplier (buyer)?; and related to this, (2), why would a buyer (supplier) want to pay its supplier (buyer) to absorb a risk?

FIGURE 5.1**Relations between concepts within the Transaction Cost Economic framework**

The figure shows that the three attributes of the transaction lead to certain transaction risks. Appropriate use of contracts (see Section 2.2) can reduce the transaction risk exposure of actors and thus their transaction costs. However, the implementation of contracts is not without costs (Dyer, 1997). A contract is only regarded as an efficient mechanism within the TCE framework, if the costs of implementing it are lower than the costs of not implementing the contract (or of implementing alternative contracts; Masten, Meehan Jr. and Snyder, 1991). In other words, a contract is regarded as efficient when the costs of implementing it are lower than the costs of continued exposure to the risk.

To elaborate on this, transaction costs may arise in the form of direct or opportunity costs (Rindfleisch and Heide, 1997; Masten, Meehan Jr. and Snyder, 1991). Direct costs are the costs associated with implementing the contract and undertaking the transaction. For example, the costs incurred by actors in communicating and negotiating quality requirements with their suppliers. Communicating these requirements can reduce the risk of maladaptation by suppliers. Opportunity costs are, within the TCE framework, the costs resulting from the failure of an actor to adequately manage its exposure to transaction risks. For example, a failure by an actor to make investments in brand development, or to (timely) adapt to changing quality requirements, can reduce its profits. In the first example, costs associated with asset specificity related risks materialize; i.e., under-investments in productive assets⁶⁷. In the second example, costs associated with uncertainly related risks materialize; i.e., maladaptation.

⁶⁷ For example, because the risk of opportunistic behavior by potential brand suppliers has not been addressed, the company is unwilling to further invest in the brand.

Both types of costs may occur before (ex-ante), or after (ex-post) actors have agreed to enter into a transaction (Rindfleisch and Heide, 1997). For example, an actor may incur direct costs in: (1), seeking a suitable supplier (ex-ante costs); and (2), measuring the performance of this supplier (ex-post cost). Opportunity costs may result from: (1), the failure to identify suitable suppliers (e.g., ex-ante costs resulting from use of inadequate performance measurement technology); (2), productivity losses through effort adjustment of suppliers (e.g., ex-post costs resulting from a failure to reduce the risk of shirking). Tables 5.1A and 5.1B give an overview of the various types of costs distinguished within the TCE framework. As is explained above, rather than reducing either direct costs or opportunity costs resulting from a failure to minimize risk, actors should attempt to reduce both.

TABLE 5.1a
Types of direct costs within the TCE framework

Types of direct transaction costs	Sources of direct costs*		
	<i>Asset specificity related safeguards</i>	<i>Performance measurement difficulty related safeguards</i>	<i>Uncertainty related safeguards</i>
<i>Ex-ante costs</i>	1. <u>Costs of crafting and implementing (contractual) safeguards</u> for specific investments (e.g., investments in brand names).	3. <u>Screening and selection costs</u> (e.g., producer's evaluation of carcass pricing programs)	5. <u>Coordination costs</u> (e.g., costs of communication new quality requirements)
<i>Ex-post costs</i>	2. <u>Cost of enforcing compliance</u> with agreed upon exchange conditions (e.g., legal costs).	4. <u>Measurement costs</u> (e.g. slaughterhouse's measurement of pork quality)	6. <u>Coordination costs</u> (e.g., costs of changing price labels in supermarkets)

TABLE 5.1b
Types of opportunity costs within the TCE framework

Types of opportunity costs	Sources of opportunity costs*		
	<i>Asset specificity related risks</i>	<i>Performance measurement difficulty related risks</i>	<i>Uncertainty related risks</i>
<i>Ex-ante costs</i>	7. Failure to invest in <u>productive assets</u> (e.g., under investments in measurement technologies)	9. Failure to identify <u>suitable partners</u> (e.g., producer does not obtain the best available price)	11. <u>Maladaptation</u> (e.g., failure to adapt to changing quality requirements)
<i>Ex-post costs</i>	8. <u>Opportunistic behavior</u> (e.g., slaughterhouse changes exchange conditions once the producer has made specific investments in genetics)	10. <u>Productivity losses through effort adjustment</u> (e.g., producers of high quality pork will shift to low quality production if their efforts are not identified and rewarded)	12. <u>Maladaptation</u> (e.g., over-production)

(adapted from Rindfleisch and Heide, 1997)

* Note that most (empirical) TCE studies focus on the attributes of the transaction (e.g., asset specificity, which is a precondition for opportunism to arise) rather than the actual risks (e.g., opportunism). One reason for this

could be that respondents (e.g., companies participating in interviews) are more comfortable talking about whether or not they have had to make specific investments, than whether their customer (supplier) has cheated on them.

3. RISK IN A SUPPLY CHAIN CONTEXT

The previous section has discussed the management of transaction risks by means of contracts. A TCE lens was used to frame this discussion. However, TCE has been developed and used mainly to examine the management of transaction risks within the context of dyadic relations. Therefore, TCE based risk management solutions insufficiently take into account ‘interdependencies’ which exists between contracting decisions at various stages in the supply chain. As is explained in the previous chapter, the risks to which actors are exposed may depend on the various transactions in which they participate as well as on transactions in the supply chain in which they do not participate. As a result of these interdependencies, contracting decisions at one stage in the supply chain may have negative transaction ‘externalities’; e.g., the effect of a contract implemented in a company’s supply side could spill over into increased demand side risk for the company, or increased risk elsewhere in the supply chain (Wever et al., 2012; see Agrell et al., 2004; and Carlton, 1979 for some non-TCE studies on this subject).

The present section, as well Section 4, attempts to address this issue by examining the management of transaction risks in a supply chain context. While this section focuses on how different types of interdependencies in the supply chain can affect the risk exposure of actors, Section 4 focuses on the strategies which actors can use to manage their exposure to these risks.

3.1. Interdependencies

A supply chain (or networks) is made up of two or more dyads which are linked together⁶⁸. ‘Interdependencies’ occur when the behavior of the actors making up the dyad, and the outcomes of their behavior, depend also on the behavior of the (some of the) other actors within the supply chain (see Molm, 1994). Interdependencies may be distinguished based on the ‘type’ (see Thompson, 1967) and the ‘channel’ (see Borgatti and Li, 2009) through which the linkage between the actors is established.

With regard to ‘type’, numerous studies (e.g., Grandori, 2005; Gulati and Singh, 1998; Kumar and Van Dissel, 1996) have taken Thompson’s (1967) and Van de Ven, Delbecq and Koenig

⁶⁸ As is explained in Section 6 in Chapter One, a supply chain is considered to consist of three or more actors.

Jr. (1976) conceptualization of various types of intra-firm task interdependencies – independent tasks, sequential work flows or reciprocal workflows⁶⁹ – and applied it to examine interdependencies between organizations:

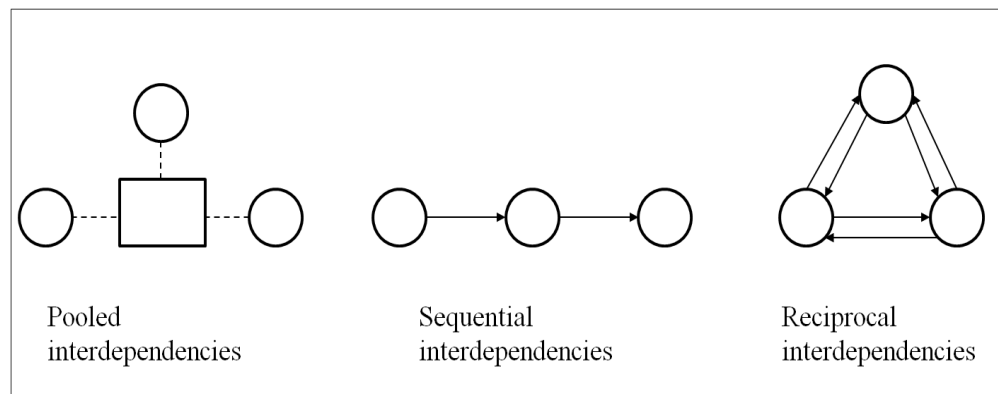
- ‘Independent tasks’ are also called pooled interdependencies (Thompson, 1967). This type of interdependency refers to situations in which actors can operate more or less completely autonomous from each other and are only (loosely) linked because they use the same pool of resources. For example, all pig producers use the same type of feed inputs. Therefore, they are all affected when demand for pig feed increases (i.e., increased input costs).
- ‘Sequential interdependency’ refers to instances in which actors are more directly linked. Serial linkages exist between the actors in this form of interdependency: the output of actor A forms the input of actor B, who’s outputs forms the input for actor C (Grandori, 1997b). For example, a pig producer delivers pigs to a slaughterhouse who delivers meat parts to a processor. Note that there are serial linkages between the actors; i.e., the processor cannot receive the meat parts before the pigs are slaughtered.
- ‘Reciprocal interdependency’ refers to instances in which the input of one actor forms the output of other actors and vice-versa (Lazzarini, Chaddad and Cook, 2001). This type of interdependencies are common in, for example, the automotive industry during product development, where the companies who develop the different parts of the car depend on each other’s input and output.

Figure 5.2 illustrates the difference between the various types of interdependencies⁷⁰.

⁶⁹ Van de Ven, Delbecq and Koenig Jr. (1976) also distinguish a fourth type of interdependency ‘multi-interdependent workflows’. However, according to Lazzarini, Chaddad and Cook (2001), ‘multi-interdependent work flows’ may be regarded as a special case of reciprocal interdependencies.

⁷⁰ Note that most authors apply Thomson’s (1967) conceptualization in the context of only two actors. When three or more actors are considered, the three types of interdependency are not (completely) mutually exclusive. In particular, reciprocal linkages can exist within each of the two dyads which make up the sequentially interdependent supply chain visualized in Figure 5.2. Considering that most if not all transactions involve some form of reciprocity, such a case would be regarded as a sequentially interdependent supply chain in this study. To put it differently, the study considers a supply chain as reciprocally interdependent only when all actors have a direct link with each other.

FIGURE 5.2
Interdependency types



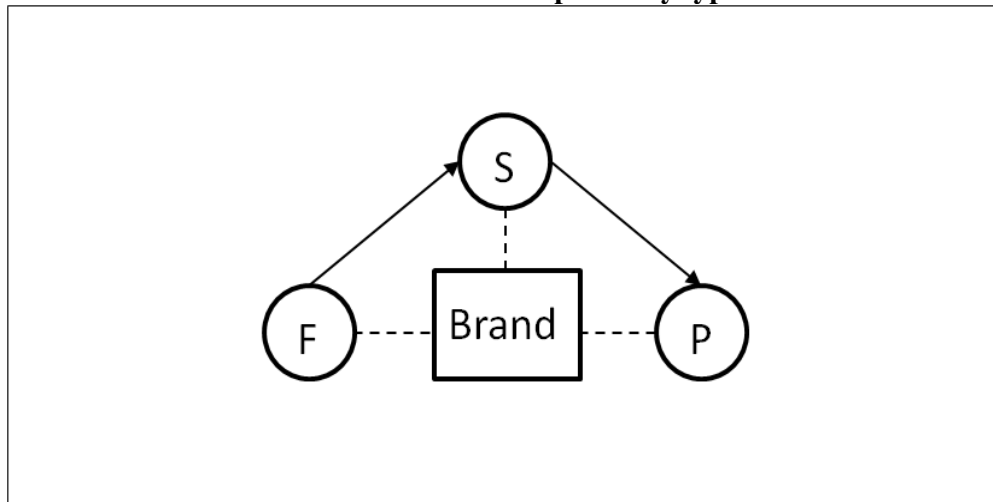
(adapted from Lazzarini, Chaddad and Cook, 2001)

The circles represent actors (e.g., companies). The square represents a shared resource. The dotted lines and arrows represent different channels for interdependencies (e.g., the arrows may represent product flows).

With regard to ‘channel’, actors may be interdependent through various interfaces (see Borgatti and Li, 2009). For example, actors may obtain credit from the same bank (Uzzi, 1999). Furthermore, actors may have interlinked board members (Burt, 1980). More closely related to the topic of this thesis, actors may be linked through their participation in the same quality management system (Wever et al., 2010) or the brand under which they produce (Raynaud, Sauvée and Valceschini, 2005). The present study focuses mainly on interdependencies which exist or arise between actors as a result from the transactions which they undertake. The study does take other ‘channels’ of interdependency into account (e.g., the participation of actors in brands), if they affect the transaction risks to which the actors are exposed.

Note that multiple interdependencies types can co-exist when actors are linked through more than one channel. For example, sequential interdependency may exist between supply chain actors as a result of the transactions between them. However, also pooled interdependency may exist because of their participation in a collective brand. This is illustrated in Figure 5.3.

FIGURE 5.3
Co-existence of interdependency types



The circles represent different companies (in this case: F = pig production company; S = slaughterhouse; P = processor). The square represents a shared resource, in this case: a collective brand with associated reputational capital. The dotted lines represent the brand membership of the actors. The arrows represent product flows.

3.2 Interdependencies and risk spill-overs

The channel through which actors are interdependent affects the type of interdependencies which exists between the actors and vice-versa. For example, with pooled interdependencies, actors are less likely to be linked through the transactions between them and more likely through some other channel, like a shared input market (see Grandori, 1997b). Related to this, as is explained below, the type and channel through which actors are linked shape the manner in which they are affected by risk spill-overs (i.e., externalities) from decisions or actions taken at other locations in the supply chain. Furthermore, they affect the extent to which an (individual) actor can manage its exposure to such risks.

Although pooled interdependencies may seem like the least intensive form of interdependency, damages to a shared pool of resources will affect all actors⁷¹ (see Akerlof, 1970). Furthermore, there may be little that any individual actor can do to prevent such harmful outcomes, as some form of collective action is likely to be required (Grandori, 1997b). From a TCE perspective, damages resulting from pooled interdependencies are usually related to performance measurement difficulties; i.e., difficulties in monitoring the behavior of the various actors using the resource⁷². This can lead to ‘misuse’ of the resource by some actors or insufficient contribution to maintain the resource (see Alchian and

⁷¹ This type of risk is also referred to as systemic risk (Jacobs, 2004).

⁷² Uncertainty can also be an issue, as high uncertainty can increase the likelihood that the resource is misused.

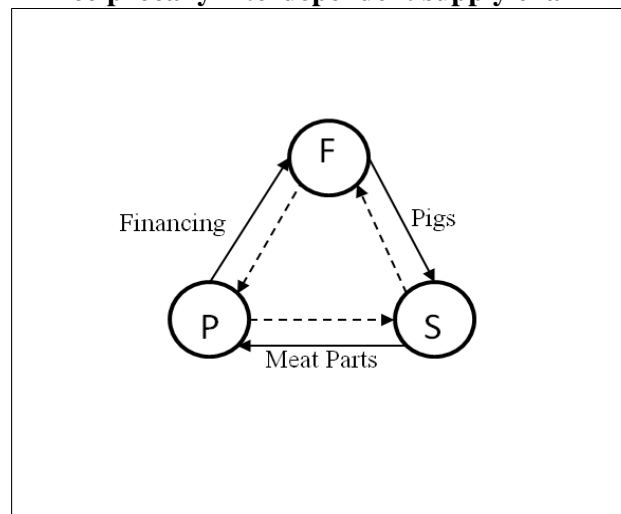
Demsetz, 1972). The main issue here is that actors can be affected by actors to which they seemingly have no linkages. Consider the agri-food market where decisions taken by an individual trader in fresh goods may affect the whole market. For example, when a small group of consumers become seriously ill after it has purchased unsafe products from this trader, also other traders (in safe products) may not be able to profitably market their products anymore because all consumers have lost faith in this particular market. To prevent such instances occurring, actors may need to set-up collective quality management systems which can measure the performance of traders and which can prevent 'bad' traders from access to the market.

Sequential interdependencies⁷³ are characterized mainly by direct linkages between the actors (Lazzarinni, Chaddad and Cook, 2001) although also indirect linkages exist (see Lambert and Cooper, 2000). An actor has direct linkages with its supplier and customer through the transactions with them. Indirect linkages exist with second-tier suppliers and second-tier customers. To manage its direct linkages, an actor should take into account how contracts used in its supply (demand) side transaction affect its risk exposure in its demand (supply) side transaction. To manage its indirect linkages, actors should take into account: (1), how its risk exposure is affected by activities further upstream (downstream) in the supply chain; (2), how it can use its supply (demand) side contracts to manage its exposure to these (indirect) risks; (3), how its own supply (demand) side contracting decision affect actors further upstream (downstream) in the supply chain. Note that, like with 'pooled' interdependencies, actors may be limited in what they can do to prevent harmful outcomes resulting from risk spill-overs. Actors are likely to have limited influence on contracting decisions with its own customers (suppliers) let alone on contracting decisions further downstream (upstream) in the supply chain (Wever et al., 2012). A well-known example of a risk spill-over resulting from sequential interdependencies between the actors is the 'bull-whip' effect – the increase in demand order variability for upstream stages due to decreasing insight into (final) demand information (Dooley et al., 2010; Lee, Padmanabhan and Whang, 1997). Within the TCE framework, spill-overs resulting from sequential interdependencies are related to the interaction between multiple transaction risks. This is further explained in Section 4.1.

⁷³ As is explained above, reciprocal linkages can exist within the two dyads which make up a supply chain with sequential interdependencies. Because most if not all transactions involve some form of reciprocity, the study considers actors to be reciprocally interdependent only when all three actors have a direct link with each other.

Reciprocal interdependencies can be seen as the most ‘intensive’ form of interdependency (see Van de Ven, Delbecq and Koenig Jr., 1976). This is because the actors are mutually reliant on each other (Lazzarinni, Chaddad and Cook, 2001). For this reason, all actors are likely to have an interest in preventing a harmful event⁷⁴ (Molm, 1994; Williamson, 1983). Therefore, the risk of strategic self-interested behavior by one of the transaction parties is likely to decrease when interdependencies become more reciprocal. At the same time, the risk of maladaptation may increase, because mutual adjustment is required when circumstances change (Gulati and Singh, 1998). Furthermore, when a harmful event occurs, its affects may be amplified (see Gulati, Lawrence and Puranam, 2005). To explain this, consider a situation similar to the Processor brand case discussed in Chapter Three (see Table 3.4 in Section 3.2), where the processor in the supply chain has integrated into the pig production stage of the supply chain. The processor provides financing to a large-scale pig production company (by means of an equity investment) and receives a variable compensation in return (cash dividends). The pig production company sells pigs to a slaughterhouse, which sells parts of the pigs in return to the processor. Figure 5.4 shows the interdependencies which exist in such a supply chain.

FIGURE 5.4
Example of amplification effects in a
reciprocally interdependent supply chain



The circles represent different companies (F = pig production company; S = slaughterhouse; P = processor). The dotted lines represent cash flows. The arrows represent input flows.

⁷⁴ This does not mean that actors have the same interest, as some actors may be more affected than others by a harmful outcome. Note therefore, that the study does not argue that there is no risk of strategic behavior by actors when reciprocal interdependencies are present. Rather, it is argued that the more reciprocal the interdependencies are, the less this risk is present. For a different view, see Gulati, Lawrence and Puranam (2005)

Consider the following scenario, in which a food safety issue arises at the pig production company. As a result, health inspectors may decide to close down the company. In a worst-case scenario, the processor has to write-down its substantial investment and goes bankrupt. The slaughterhouse will then lose both a supplier and a customer. The same scenario in a regular pork supply chain, where the actors are more sequentially interdependent, would mean that the slaughterhouse would just have to find an alternative supplier. Possibly, this would have no immediate consequences for the processing company.

At the same time, note that in the supply chain visualized in Figure 5.4, the various actors are likely to have a stronger incentive to prevent such a situation from occurring when compared to a supply chain with only sequential interdependencies between the actors. The processor has an additional incentive to prevent such a risk management failure at the pig production company because it has a direct financial exposure to it. The slaughterhouse has an additional incentive because it will lose both supplier and customer. The pig production company has an additional incentive because, even if it does not go bankrupt, it may lose both a supplier of capital and a customer of its pigs when food safety issues arise.

4. TCE BASED RISK MANAGEMENT STRATEGIES IN A SUPPLY CHAIN CONTEXT

This section places interdependencies and associated risk spill-overs more explicitly within the context of the TCE framework. In the section, the focus is mainly on supply chains with sequential interdependencies. An emphasis in the study on interdependencies related to transactions means that the study focuses more on sequential than pooled interdependencies. As is explained in Section 3.1, with pooled interdependencies, actors are less likely to be linked through transactions (Grandori, 1997b). Furthermore, the TCE studies which have expanded their focus beyond the dyad have focused on risks resulting from sequential rather than reciprocal interdependencies between the actors (e.g., see Wever et al., 2012). Reciprocal interdependencies have received less attention within these studies, possibly because strategic behavior by one of the actors is less of an issue when compared to the other types of interdependencies (see Section 3.2). TCE is best applicable to situations in which conflicts of interests arise between actors.

4.1 Trade-offs resulting from interdependencies

As is explained in the previous section, the risks to which actors are exposed depend on the various transactions in which they participate, as well as on transactions at stages in the

supply chain in which they do not participate. Actors may face trade-offs in minimizing their risk exposure because interdependencies can arise between decisions in the supply chain.

When are such trade-offs likely to arise?

Recently, some TCE studies have started to address this question, by modeling situations in which companies are faced with interdependencies between their supply and demand side transactions. For example, Sanchez (2003) has studied what types of assets (flexible or specific-use) a company should acquire or develop to manage supply side risks of opportunism under conditions of demand side uncertainty. Barney and Lee (2000) have examined make or buy decisions under conditions of supply side opportunism and demand side (technological) uncertainty. Wever et al. (2012) have presented an overview of various situations under which supply and demand side contracting decisions can be expected to be interdependent and have modeled several of these situations in more detail. The studies have in common that they all examine contract decision-making situations in which actors are exposed to multiple transaction risks in separate transactions. Table 5.2 gives an overview of the various situations that have been studied by these authors.

TABLE 5.2
Overview of decision-making situations studied involving exposure to multiple transaction risks in separate transactions

	High demand side uncertainty	
	<i>High demand side performance measurement difficulty</i>	<i>Low demand side performance measurement difficulty</i>
High supply side asset specificity	1. - Wever et al. (2012)	2. - Wever et al. (2011) - Sanchez (2003) - Barney and Lee (2000)
Low supply side asset specificity	3. - Wever et al. (2012)	

Why have these authors focused on situations involving exposure to multiple transaction risks? This is because conflicting solutions may be required to reduce exposure to the various types of risks. Subsequently, actors may face trade-offs in minimizing their risk exposure; i.e., actions which are taken to reduce risk in one transaction, increase risk in another transaction. Note that the existence of multiple transaction risks is a required but not sufficient condition for such a trade-off to arise. Actors also need to face barriers in manipulating their contracts.

4.2. Barriers to risk minimization

Chapter Four has discussed various types of contractual solutions which actors can implement in situations involving exposure to multiple transaction risks. What these solutions had in common is that they require actors to simultaneously manipulate various transactions in the supply chain. In such instances, trade-offs between reducing exposure to different (types of) transaction risks may still be largely avoided. For example, consider an actor involved in a situation similar to the one depicted in Box 2 in Table 5.2. The actor may implement a fixed price contracts in its supply side transaction to facilitate specific investments by its supplier. If the actor can also implement a fixed price contract in its demand side transaction, it may reduce exposure to both price uncertainty risks (see Box 7-8 in Table 5.1) and asset specificity related risks (see Box 11-12 in Table 5.1) (see also Model 3, Section 3.5 in Chapter Four).

However, as is discussed in Section 3.2, is not always possible for actors to manipulate contracts in multiple transactions. Barriers which actors face in manipulating their contracts include the costs of implementing the contract (Coase, 1988) and arguably most importantly, limited bargaining power (see Shervani, Frazier and Challagalla, 2007). An actor may have limited influence on the contract implemented with some of its counterparties. For example, the actor in the example given in the previous paragraph may not be able to implement a fixed price contract with its customer. In that case, the actor has to make a decision about whether or not it is still in its best interest to enter into a fixed price contract with its supplier. In particular, the actor has to address the following question: are the costs of a failure to facilitate the specific investments (see Box 7 in Table 5.1) greater than the costs of managing the increase in price uncertainty exposure (see Box 12 in Table 5.1) which results from the contract required to support those investments⁷⁵?

4.3. Risk altering

When an actor cannot minimize or eliminate its exposure to multiple risks, a logical next step is to attempt to minimize exposure to one of the risks, as is explained in Section 2.2. Under the conditions of interdependencies described in Table 5.2, this means that such a decision will affect the actor's risk exposure; i.e., it will be altered. An actor *alters* its risk exposure

⁷⁵ To rephrase the question perhaps more clearly: does the return the actor obtains from the specific investments made by the supplier outweigh the costs of managing the increase in price uncertainty which results from the contract required to support those investments?

when it swaps one type of risk for another. For example, an actor may invest in performance measurement equipment to reduce the risk of shirking by suppliers (see Box 10 in Table 5.1). However, if the required investments are asset specific, this may increase the risk of opportunism (see Box 8 in Table 5.1). Furthermore, in the context of the supply chain, an actor may swap one type of risk in its supply side transaction, for another type of risk in its demand side transaction. For example, investments in performance measurement equipment may reduce risk of shirking by suppliers, but may increase risk of opportunism by buyers. Box 5.1 gives an example of risk alteration which occurred in one of the cases discussed in Chapter Three.

BOX 5.1

Examples of risk altering in the pork supply chain

In the Retailer brand case (see Table 3.4, Section 3.2 in Chapter Three), the brand suppliers have had to make specific investments in their production process to be able to produce under the brand. To compensate the suppliers for their investments, the brand owner (the retailer) gives the suppliers a premium above a reference market price for their output under the brand. Furthermore, to reduce the risk of opportunism (Box 8 in Table 5.1) for the suppliers, the brand owner has implemented a contract which obliges the former to deliver and the latter to purchase a minimum amount of pig meat.

Although the minimum volume contract reduces the risk of opportunism for the suppliers it also increases their risk of ex-post maladaptation (Box 12 in Table 5.1) because it stimulates overproduction. Penalties are placed on underproduction, and as it is difficult to produce precise amounts (because of biological variation associated with animal production), actors regularly produce more than the minimum amount of products specified within the contract. When actors do overproduce, they may have to sell their overproduction outside Retailer channels, in which case they incur a loss as they do not receive the brand premium. Subsequently, the situation of the suppliers (e.g., the meat company) is similar to the situation described in Box 1-2 in Table 5.2, in which an actor was exposed to supply side asset specificity risks as well as demand side uncertainty related risks.

Under what conditions would actors want to alter their risk exposure; i.e., when would they want to switch exposure to one type of risk for exposure to another risk? Considering the importance attached to opportunism (see Williamson, 2000), the TCE framework strongly implies a hierarchy in the types of transaction risks to which exposure should be minimized. Reducing asset specificity related risks is then expected to have primacy amongst actors. However, as is explained in Section 2.3, this holds true only in situations in which a higher return on investments in specific assets offsets any costs incurred in managing increased exposure to other types of risk. More generally therefore, what matters from a TCE perspective is which risk is more costly to manage (Williamson, 1991). In the Retailer brand

case, the premium the actors receive for their output under the brand presumably compensates them for their overproduction which they cannot market under the brand. In other words the costs associated with a failure to invest in productive assets (Box 7 in Table 5.1) are likely to be higher than the costs associated with ex-post maladaptation (Box 12 in Table 5.1).

Note that the impact of a risk alteration strategy on an actor's transaction risk exposure cannot be fully understood without taking into account possible interdependencies which exist within the supply chain. When only a single buyer-supplier dyad is considered, examination of a risk alteration strategy may give the false impression that an actor has eliminated its exposure to a transaction risk. For example, consider a situation similar to the one described in Box 5.1, in which an actor swaps exposure to supply side risk of opportunism (Box 8 in Table 5.1) for exposure to demand side risk of maladaptation (Box 12 in Table 5.1). When only the transaction between the actor and its supplier is examined, it may look like the actor has eliminated its exposure to risks, while in fact the actor has only altered its risk exposure.

4.4. Risk transfer

As is explained in Chapter Four, actors may be exposed to multiple transaction risks in part because they have absorbed the risk exposure of other actors. In other words, actors have transferred risk to them. Risk is *transferred* in a supply chain when either the source or the holder of a risk has changed. An example of the former occurs when an actor swaps exposure to supply side price uncertainty for exposure to demand side price uncertainty (see Carlton, 1979). An example of the latter occurs when risk is transferred from actors operating upstream (downstream) in the supply chain, to actors operating downstream (upstream) in the supply chain (see Jacobs, 2004; Gray and Boehlje, 2004). Box 5.2 gives two examples of risk transfer which occurred in the cases discussed in Chapter Three.

BOX 5.2

Examples of risk transfer in the pork supply chain

In the Processor brand case (see Table 3.4, Section 3.2 in Chapter Three) the brand suppliers have transferred some of their exposure to price uncertainty to the brand owner, who has offered them fixed price contracts. The brand owner has absorbed the risk of its suppliers to ex-post maladaptation to falling prices (Box 11 in Table 5.1). The brand owner (the processor) cannot transfer this risk to the retailers, because they are not willing to enter into fixed price contracts.

A similar example occurs in the Retailer brand, discussed above in Box 5.2. In this case, the brand suppliers have transferred some of their exposure to volume uncertainty to the brand owner, who offers them fixed volume contracts. The brand owner has absorbed the risks of its suppliers to ex-post maladaptation to falling demand (Box 11 in Table 5.1). The retailer cannot transfer this risk to another actor further downstream in the supply chain, because it is the most downstream actor.

As is explained in Section 2.2, TCE studies generally assume actors are risk neutral (Chiles and McMackin, 1996; Williamson, 1988); i.e., they have the same level of risk aversion and risk management competences. Subsequently, the existence of differential risk preferences amongst transaction parties is not a plausible (or sufficient) explanation for the transfer of risk. Under the assumption of risk neutrality, the transfer of risk becomes mainly a useful strategy in situations when multiple transaction risks arise in the supply chain. In such situations absorbing the risk exposure of another actor may reduce an actor's own exposure to another type of risk.

In the examples discussed in Box 5.2, exposure to price and volume uncertainty risk is transferred downstream in the supply chain to the brand owners. In both instances, the reason for this was not necessarily because the brand owners were more capable in managing these risks, but because they had to give to their suppliers an incentive to produce under their brand. The fixed price or volume contracts help to reduce the risk of opportunistic behaviour for suppliers and thus facilitate the specific investments they need to make to participate in the brand.

However, note that the transfer of risk, like risk alteration, may reduce risk in an individual transaction, but not necessarily in the context of the supply chain. In the examples discussed in Box 5.2, price and volume uncertainty risks are largely eliminated in the supplier-brand owner transactions. However, the risk is still present in the supply chain; it is absorbed by the brand owners. They are still exposed to uncertainty risks in their own demand side

transactions (i.e., with retailers and consumers respectively). Subsequently, the brand owners operate in situations similar to those depicted in Box 1-2 of Table 5.2

4.5. Risk sharing

A risk is *shared* when it is held by two or more actors; i.e., when multiple actors are exposed to it (see Jacobs, 2004; Chung, 1991). Actors may share risk through a new or an additional channel – like a jointly controlled investment vehicle or an association – or through an already established channel, like when a contract between transaction parties is adjusted so that more than one actor is exposed to a risk. In particular the establishment of a new channel may have profound influences on the supply chain, by changing the types of interdependencies between the actors. When risk is shared by means of an additional channel like an association, actors in fact increase pooled interdependencies and reduce sequential interdependencies between them (see Box 5.3).

BOX 5.3

Example of risk sharing in the pork supply chain

An example of risk sharing by establishing a new channel through which actors are linked occurs in several of the collective brand cases discussed in Chapter Three. In these cases, products are marketed under a brand owned by a collective of actors. These brands can have hundreds or thousands of members and are vertically organized; i.e., actors from various stages in the supply chain can become members. All of the brands have members from at least two different stages (most often farming and processing).

How do the brands work in terms of interdependencies and risk management? The brands pool the investments required to support marketing activities and to monitor compliance with brand requirements; i.e., the brand is a pooled resource through which the actors are linked (see Figure 5.3). Through the brand, the actors share asset specificity related risks (Box 7-8 in Table 5.1) as well as performance measurement related risks (Box 8 -10 in Table 5.1). Why are these risk shared? Shirking by one of the actors may affect all actors if consumers lose faith in the brand.

As is explained in Section 3.2, arguably the main motive for risk sharing within the TCE framework is to align the interests between transaction parties (see Williamson, 1983). When individual dyads are considered, aligning interest between transaction parties can reduce the risk of strategic behavior by one of the counterparties (Ménard, 2004). In other words, risk sharing may mean risk reduction in such circumstances. However, this is not necessarily the case when triads or larger entities are considered, particularly in the context of exposure to multiple transaction risks.

When exposure to a risk is spread amongst multiple actors, no single actor may have a strong incentive to prevent a harmful outcome occurring. For example, in the collective brand cases discussed in Box 5.3, no single supply chain actor has made a large investments in reputational capital (i.e., exposure to asset specificity related risks is shared). Therefore, none of the supply chain actors has a strong incentive to ensure compliance with brand standards is achieved (i.e., to prevent shirking). Each actor has an incentive to reduce its own measurement costs (box 3 in Table 5.1) and to rely on other actors for monitoring activities to prevent effort adjustments by some of the brand participants (Box 10 in Table 5.1).

5. DISCUSSION AND FURTHER RESEARCH

This study has given some insight into the management of transaction risks in a supply chain context. Transaction Cost Economics (TCE) was used to frame this discussion. In the study, first an outline has been given of the different types of risks to which actors are exposed in bilateral transactions. TCE based contracting solutions (e.g., exchange of hostages) for resolving such situations were reframed as risk management strategies (e.g., risk sharing). Furthermore, the study has presented an overview of the different types of costs which actors incur in (failing to) managing their exposure to risks (see Table 5.1 in Section 2.3). From a TCE perspective, actors should attempt to reduce their exposure to transaction risks to the extent that the costs of implementing contracts are lower than the costs of continued exposure to the risks.

Subsequently, the study has drawn attention to some of the ‘hidden’ risks which result from interdependencies in the supply chain; i.e., from linkages between actors which extend beyond those which exist within individual, bilateral transactions. In particular, the study has discussed how different types of interdependencies – pooled, sequential and reciprocal – expose supply chain actors to different sources of risk and different limitations in managing their exposure to these risks.

Sources of risk include: shared pool of resources (e.g., collective brands, quality management systems etc.), actors further upstream (downstream) in the supply chain and mutual reliance on a third-party with which the parties transact.

Particularly with pooled and sequential interdependencies, actors are likely to face the strongest limitations or barriers to manage their risk exposure. With pooled interdependencies, arguably the main limitation which actors have is the lack of a direct linkage to the original

source of the risk (e.g., another actor who markets unsafe products under a collective brand) and the need for collective action to manage the risk (e.g., joint setting of quality standards by all industry actors). With sequential interdependencies, actors are likely to face bargaining power constraints in the extent to which they can manipulate both their supply and demand side transactions as well as transactions further upstream or downstream in the supply chain. With reciprocal interdependencies, the interests of actors in managing a risk are more likely to be aligned because of the mutual reliance of the actors on each other. However, for the same reason, the consequence of a failure to adequately manage a transaction risk may be amplified (see Figure 5.4 in Section 3.2).

Finally, the study has discussed various contracting strategies which actors can use to manage their transaction risk exposure in supply chains with mainly sequential interdependencies. In particular, the study has focused on situations in which the actors were exposed to multiple transaction risks in separate transactions. In such situations, actors are likely to face trade-offs in managing their transaction risk exposure because conflicting solutions may be required to resolve the different types of risks. The study has discussed three TCE based risk management strategies which actors can use under these conditions – risk transferring, risk altering and risk sharing – and has placed these strategies in a supply chain context.

Although these contracting strategies may seem to reduce risk when only an individual transaction is considered, they may lead to additional or different types of risks when the larger supply chain context is taken into account. For example, risk sharing in the context of an individual transaction may align interests between the two parties. However, in a non-bilateral context, exposure to a risk can be spread too ‘thin’ (i.e., amongst a too large number of actors) and no single actor may have a strong incentive to prevent a harmful outcome for the supply chain as a whole (see Section 4.5)

A limitation of the study is that it has not addressed the question of which actors are best positioned to manage the various risks in the supply chain. In part, this is because of the reliance of the study on the TCE framework, which assumes actors are risk neutral. Further TCE-based studies of supply chain risk management should attempt to take into account differences in the ‘risk appetite’ of the various actors. For example, a large actor may be more willing to accept exposure to a risk, because it is more capable of managing it.

Additionally, when studies based on the TCE framework start to expand their focus beyond the dyad, it becomes important to take the structure of the supply chain into account. This is

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because the structure of the supply chain (e.g., number of actors operating at each stage) is likely to be related to the outcome of (inadequate) risk management activities. For example, when one large actor is the intermediary between hundreds of suppliers and hundreds of customer, transferring risk exposure to this actor may not be desirable. Its central location within the supply chain may amplify the impact of a failure to adequately manage the risk.

DISCUSSION AND CONCLUSIONS

The final chapter discusses and concludes the main findings of the thesis. Section 1 outlines the answers to the research questions. Section 2 provides the general conclusion and discussion. Sections 3-4 discuss the theoretical and managerial implications of the thesis. Section 5 outlines areas for further research.

1. Conclusions Regarding the Research Questions

Agri-food supply chains are characterized by strong interdependencies between the different supply chain stages. Interdependency can lead to negative externalities (i.e., risk-spill-overs), as when a downstream (upstream) actor is exposed to transaction risks resulting from activities further upstream (downstream) in the supply chain. For example, a change in the formula used to calculate the price in a farmer-processor transaction (e.g., changes to bonuses or penalties), may reduce incentives for farmers to produce high quality products. This can increase the risks that low quality products are exchanged in the processor-retailer transaction.

The aim of the thesis has been to gain more insight in the challenges which companies face in managing interdependencies and associated transaction risks within the supply chain. More specifically, the aim has been to examine: (1), how risks arise within the supply chain as a result of interdependencies between the various transactions making up the supply chain; (2), what types of contracts are suitable for supply chain actors to implement in order to reduce or eliminate their exposure to these risks. The thesis has focused mainly on transaction risks which arise from conflicts of interest between the supply chain actors.

The thesis has addressed its subject from various angles, which have resulted in three main research questions. Answers to the research questions have been formulated by means of both a theoretical and an empirical approach. The theoretical approach was largely grounded within Transaction Cost Economic (TCE) literature. The empirical research was conducted in a specific sub-section of the agri-food sector: the pork meat industry. This was considered a suitable context for various reasons, amongst others because the management of interdependencies is of particular importance in the meat industry. Inadequate management of interdependencies and associated transaction risks can have not only economic consequences, but also public health consequences resulting from food quality problems. The thesis has examined the transactions between the actors operating in the pork supply chain.

Conclusions regarding the first research question

The first research question has focused on the relation between quality management systems (QMSs) and the contracts used between the supply chain actors participating in these QMSs. Although inter-company coordination of quality management is increasingly important for meeting end-customer demand, few researchers focus on the relation between QMSs and contracts. However, insufficient alignment between QMSs and contracts can result in high transaction costs, amongst others by leading to under-investments in quality improvements, quality cheating, and difficulties in adjusting quality standards within the supply chain.

To address this gap in research, the thesis has aimed to obtain insights into what types of contracts best match with the various types of quality management systems used by supply chain actors. In particular, the following research question has been addressed.

Research question 1: What is the relation between the participation of supply chain actors in different types of quality management systems and their contracting choices?

An answer to the research question has been formulated in three steps.

First, based on a literature review, classification schemes have been developed of both QMSs and contract types. QMSs have been distinguished based on their ownership (public or private), their vertical scope across the supply chain (company-to-company or chain-wide) and their horizontal scale of adoption at a particular supply chain stage (small or large)⁷⁶.

With regard to contracts, a distinction has been made between more market-based and more hierarchical types of contracts. In total, five different types of contracts were distinguished: spot market contracts, verbal agreements, formal contracts, equity based contracts and vertical integration⁷⁷.

Second, Transaction Cost Economic (TCE) theory has been used to relate the above mentioned aspects of QMSs to the contracts used by actors in their supply chain transactions. Based on TCE, three propositions were developed which formalize the relation between QMSs and contracts, as is shown in Table 6.1.

⁷⁶ See Table 2.1 in Chapter Two (Section 3.2) for an overview of the specific coding rules used in classifying QMSs.

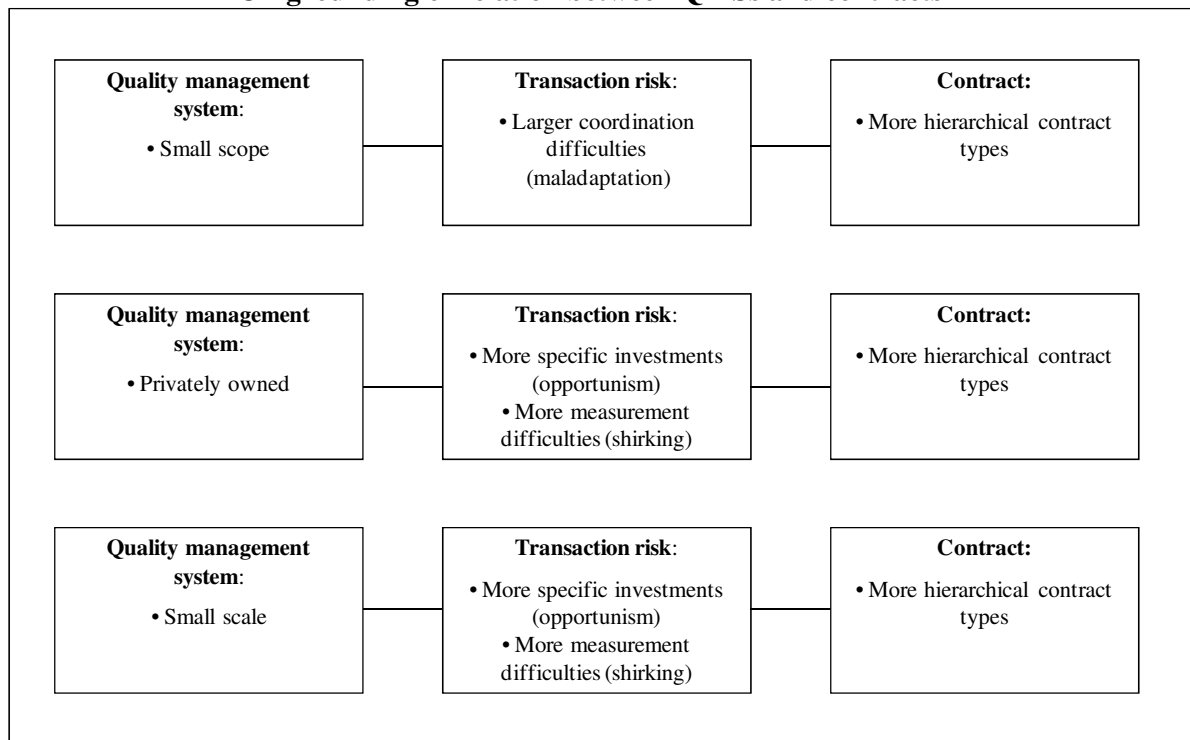
⁷⁷ See Table 2.2 in Chapter Two (Section 3.2) for an overview of the specific coding rules used in classifying contracts. Equity based contracts were not used in the cases discussed in Chapter Two.

TABLE 6.1
Propositions about relation QMSs and contracts

Propositions
<i>P1: Supply chains with company-to-company QMSs need, when compared to supply chains with supply chain-wide QMSs, more hierarchical types of contracts</i>
<i>P2A: Supply chains with private chain-wide QMSs need, when compared to supply chains with public supply chain-wide QMSs, more hierarchical types of contracts</i>
<i>P2B: Supply chains with private supply chain-wide QMSs that are adopted on a small scale need, when compared to supply chains with private supply chain-wide QMSs that are adopted on a larger scale, more hierarchical types of contracts</i>

According to TCE, different types of QMSs can be expected to affect the attributes of the transaction – level of asset specificity, level of performance measurement difficulty, level of uncertainty – in different ways. It is because of this reason that different types of QMSs need different types of contracts: unless parties to a transaction employ a contract which manages transaction risks resulting from the employed QMS, a loss of value will occur as supply chain actors may scale back investments and adapt less. Figure 6.1 shows the TCE logic in which the propositions are grounded.

FIGURE 6.1
TCE grounding of relation between QMSs and contracts



Third, case study research has been conducted in the pork industry to validate the propositions. In total seven cases have been examined in four different EU countries (Germany, Hungary, Spain and The Netherlands). Each case formed a pork supply chain from feed-producer to retailer. The examined cases are characteristic examples of the different types of supply chains which can be found in these countries. The results showed that four different types of systems can be distinguished for coordinating quality management in EU pork supply chains: one public baseline QMS, two types of private chain-wide QMSs and one public chain-wide QMS.

The patterns found between QMSs and contracts in the examined cases indicate that Transaction Cost Economic considerations are an important factor in explaining QMSs choices. As is shown in Figure 6.2, the four types of systems largely relate to the use of contracts as predicted by the propositions. In support of P1, supply chain actors participating in QMSs without a chain-wide scope (Box 3), used mainly hierarchical types of contracts. Furthermore, in support of P2A, more hierarchical types of contracts were used in (small scale) private chain-wide QMSs (Box 8) when compared to public chain-wide QMS (Box 6). Additionally, in support of P2B, more market types of contracts were used in large scale private QMSs (Box 4) when compared to small scale private QMSs (Box 8).

FIGURE 6.2
Empirical relation between quality management systems and contracts across cases

		<i>OWNERSHIP OF QUALITY MANAGEMENT SYSTEM</i>			
		<i>Public</i>		<i>Private</i>	
		<i>VERTICAL SCOPE OF SYSTEM</i>		<i>VERTICAL SCOPE OF SYSTEM</i>	
		<i>Company-to-company</i>	<i>Supply chain-wide</i>	<i>Company-to-company</i>	<i>Supply chain-wide</i>
<i>SCALE OF ADOPTION OF QUALITY MANAGEMENT SYSTEM</i>	<i>Large</i>	1.*	2.*	3.* Hierarchical contract types	4.* Market contract types
	<i>Small</i>	5.*	6.* Market contract types	7.*	8.* Hierarchical contract types

* Note that, for the purpose of validating the propositions, only the main QMS used in the examined cases were considered. Most of the cases had also other types of QMSs than the main type used. As these other types of QMSs were not used to examine the propositions, some of the boxes shown in the figure are empty.

Conclusions regarding the second research question

Besides the coordination of quality, which has been the focus of the first research question, it is also important to consider the role of contracts in coordinating other aspects of transactions. The second set of research questions has focused on the mechanisms which are used within contracts to coordinate prices, volume, quality and investments. The use of these mechanisms has been examined within five different types of contracts: (1), spot market contract; (2), verbal agreement; (3), formal contract; (4), investment based contract; and (5), vertical integration.

Furthermore, supply chain actors' use of coordination mechanisms has been compared across three different types of supply chains: (1), commodity supply chains; (2), collective brands; (3), proprietary brands. Commodity chains are those supply chains in which no brands are used to differentiate products in the consumer market. Collective brands are those supply chains in which the brand is jointly owned by multiple supply chain actors. Proprietary brands are those supply chains in which the brand is owned by one of the supply chain actors. The diversity of supply chains studied has allowed for the examination of a wide-variety of contracts and underlying coordination mechanisms.

The following research questions have been addressed.

Research question 2A: What types of coordination mechanisms are used within supply chain contracts (spot market contract, verbal agreement, formal contract, investment based contract, vertical integration)?

Research question 2B: What differences can be observed in the use of these mechanisms across various types of supply chains (commodity supply chains, proprietary brands and collective brands)?

An answer to the research questions has been formulated in three steps.

First, based on a review of extant literature (see Chapter 3) a typology has been developed of contractual coordination mechanisms. The typology has been developed by: (a), determining variables (including values) by which coordination mechanisms can be distinguished; and (b), differentiating between various types of coordination mechanisms based on these variables. Table 6.2 gives an overview of the variables used in the study. Table 6.3 gives an overview of the types of coordination mechanisms distinguished in the study based on these variables.

TABLE 6.2
Variables used to distinguish between coordination mechanisms

TYPE OF MECHANISM	VARIABLES	VALUES			
PRICE	Source	<i>Centralized markets</i>	<i>Third-party</i>	<i>Party(s) to the transaction</i>	<i>Intra-company</i>
	Duration	<i>Short-term</i>	<i>Medium/long-term</i>		<i>Indefinitely</i>
	Criteria	<i>Base price variable</i>		<i>Base price fixed</i>	
		<i>No bonus component</i>	<i>Variable bonus</i>	<i>Fixed bonus</i>	
VOLUME	Duration	<i>Short-term</i>	<i>Medium/long-term</i>		<i>Indefinitely</i>
	Specifications	<i>No volume specified</i>	<i>Range amount</i>		<i>Fixed amount</i>
QUALITY	Standard setting	<i>Public actor(s)</i>	<i>Third-party</i>	<i>Party(s) to the transaction</i>	<i>Intra-company</i>
	Monitoring	<i>Public actor(s)</i>	<i>Third-party</i>	<i>Party(s) to the transaction</i>	<i>Intra-company</i>
INVESTMENT	Source	<i>Capital markets</i>	<i>Third-party</i>	<i>Party(s) to the transaction</i>	<i>Internal capital allocation</i>
	Monetary benefits/risks	<i>Fixed return</i>		<i>Residual returns/risks</i>	
	Non-monetary benefits/risks	<i>Control if company/project is expected to be discontinued.</i>		<i>Control if company/project is expected to continue to operate.</i>	

TABLE 6.3
Integrated typology of contractual coordination mechanisms

	MARKET <-----> HIERARCHY			
PRICE	<i>Spot price</i>	<i>Reference market price</i>	<i>Fixed forward price</i>	<i>Internal price</i>
VOLUME	<i>Spot volume</i>	<i>Fixed volume with deviations</i>	<i>Fixed volume</i>	<i>Internal volume</i>
QUALITY	<i>Spot market specifications</i>	<i>Third-party quality coordination</i>	<i>Counterparty quality coordination</i>	<i>Internal quality coordination</i>
INVESTMENT (SOURCE)	<i>Capital markets</i>	<i>Third-party to transaction</i>	<i>Party to the transaction</i>	<i>Internal capital allocation</i>
INVESTMENT (TYPE)	<i>No (external) investments required for transaction</i>	<i>Debt</i>	<i>Hybrid</i>	<i>Equity</i>

Second, the typology has been used to characterize the coordination mechanisms used in the various types of pork supply chain contracts which have been distinguished in the conclusion of the thesis's first research question. Data from contracts in eight pork supply chains have been examined. The results showed the usefulness of looking at contracts at a more detailed level: companies have much more freedom in combining various types of coordination mechanisms within a single type of contract than is generally assumed within the literature (including Study One of this thesis). Even within the two polar contract forms – spot market contracts and vertical integration – some differentiation could be made when the underlying coordination mechanisms were examined (see Section 4 in Chapter Three).

The three types of intermediate contract forms distinguished – verbal arrangement, formal contracts and investment contract – unsurprisingly showed the most diversity with regard to the types of underlying coordination mechanism used. For example, within some formal contracts, prices and volumes were completely fixed while in other formal contracts, prices and volume were determined by spot market conditions. Investment based contracts sometimes involved (minority) equity investments in supply chain partners, but could also involve hybrid investments through a pooled investment vehicle. Although one would expect extensive conditions in investment based contracts, this was often not the case in the examined transactions, where key aspects, like prices or volumes, were regularly not agreed upon in the contract. Furthermore, although verbal arrangements frequently relied on third-party actors for coordinating aspects of the transaction, this third-party could have very different roles. In some transactions, the third-party only coordinated quality, in other instances the third-party also coordinated investments or even prices.

Third, the typology has been used to characterize the use of coordination mechanisms across the three different types of supply chains. With regard to their coordination of prices and volumes, the commodity supply chains used mainly spot mechanisms, while the branded supply chains used mainly ex-ante arrangements, like fixed price or reference market price contracts. Ex-ante arrangements prevent renegotiation by counterparties, which is particularly important in branded supply chains because of the limited number of potential trading partners. In the proprietary brands, prices and volumes were completely fixed in most transactions, while in collective brand cases more flexible arrangements were used, like reference market prices. The use of these mechanisms limits the scope for counterparties to renegotiate conditions like in fixed forward contracts, but, unlike fixed forward contracts, prevents the contract price from moving out of line with spot market prices.

With regard to the coordination of quality, the second research question focused on the standards and compliance monitoring activities undertaken within supply chains (i.e., aspects employed in all quality management systems⁷⁸) rather than the characteristics by which different types of quality management systems can be distinguished (i.e., ownership, scale and scope – see the conclusions for the first research question). The results showed that commodity chains use mainly spot specifications and third parties (certifying institutions) for quality coordination. In proprietary brands, quality was coordinated mainly by counterparties, while in collective brands quality coordination was largely outsourced to third-parties (the associations which own the brand). Branded supply chains require additional quality coordination mechanisms when compared to commodity chains, because they set additional requirements for the supply chain actors to help differentiate the products sold under the brand. Compliance with these standards needs to be monitored. Furthermore, proprietary brands may need to be more actively involved in the coordination of quality (i.e., by means of counterparty monitoring) when compared to the collective brands (which rely on third-party monitoring). This is because their standards are generally more unique or idiosyncratic in order to help differentiate their products. Collective brands have more accessible standards in order to keep and expand membership of the association.

With regard to the coordination of investments, across both the proprietary brand and commodity cases most transactions did not require external investments. In the proprietary brand cases, this is because most investments were financed with intra-firm capital. In the commodity cases, this is because most transactions did not require investments. For those transactions for which external investments were required, both the proprietary and commodity supply chains used mainly equity mechanisms. In the collective brand cases, most transactions required external investments. These investments were made through the associations which owned the brand, which can be regarded as a hybrid investment mechanism. Associations may be a particularly suitable mechanism to govern collective brands, because they guarantee the continuation of the brand as a collective entity. This is because associations prevent, unlike the equity mechanisms used within the proprietary brands, concentration of ownership and control.

⁷⁸ Also quality signals were considered: a distinction was made between supply chains in which quality was signaled to the end-consumer and those supply chains in which this was not the case.

Conclusions regarding the third research question

While the second set of research questions has considered both commodity and differentiated supply chains, the third set of research questions has focused mainly on differentiated supply chains. Differentiated supply chains are interesting to examine because they may limit the contractual options the supply chain actors have in managing their exposure to transaction risks. This is because differentiation can increase interdependency between an actor's supply and demand side transactions. Based on the present state of research into this subject, particularly within transaction cost economics (TCE) literature, it is impossible to evaluate how companies should manage interdependencies between their supply chain transactions.

To help bridge this gap in research, the following research questions have been addressed.

Research question 3A: What types of conditions lead to interdependencies in differentiated supply chains?

Research question 3B: What are the consequences of interdependencies for the transaction risk exposure of supply chain actors?

Research question 3C: What types of contractual options do supply chain actors have in managing the transaction risks arising from these interdependencies?

An answer to the research questions has been formulated based on a theoretical approach grounded in TCE.

With regard to research question 3A, the thesis has focused mainly on examining the conditions under which interdependencies arise through the various transactions in which actors participate⁷⁹. In particular, such 'transaction interdependencies' have been examined in the context of supply chains where the actors are sequentially linked; i.e., situations in which supply (demand) side contracting decisions by an actor affect its demand (supply) side risk exposure. Transaction interdependencies are likely to arise when supply chain actors are exposed to multiple transaction risks in separate transactions. Exposure to multiple transaction risks occurs when a transaction has high levels of attributes of more than one type. For example, exposure to both high levels of asset specificity and high levels of performance measurement difficulty. An actor may also be exposed to multiple transactions risks in separate transactions; e.g., to asset specificity related risks in its supply side transaction and

⁷⁹ The thesis has taken other channels by which actors were linked into account, if they were likely to affect their transaction risk exposure. Examples include (large scale) quality management systems (Study Two) and collective brands (Studies Two-Four).

volume uncertainty risks in its demand side transaction. Such situations can lead to interdependency between transactions because they may require conflicting contractual solutions to reduce the different types of transaction risk exposure. The dark shaded areas in Table 6.4 give an overview of the different combinations of transaction risks which are most likely to lead to interdependency.

TABLE 6.4
Overview of decision-making situations studied involving
exposure to multiple transaction risks in separate transactions

	<i>High demand side uncertainty</i>	
	High demand side performance measurement difficulty	Low demand side performance measurement difficulty
High supply side asset specificity	Box 1	Box 2
Low supply side asset specificity	Box 3	

To address research question 3B, the thesis has considered only briefly risks resulting from non-sequential types of interdependencies between the actors, like pooled⁸⁰ and reciprocal⁸¹ interdependencies. Similar to research question 3A, the thesis has focused primarily on risks in supply chain where the actors are (mainly) sequentially linked by means of the transactions which they undertake. Five simulations have been undertaken which model the consequences of such interdependencies for supply chain actors' risk exposure. Broadly, three different types of situations have been modeled. The first type of situation illustrated some of the limitations of a separate optimization of supply and demand side transactions. Formal contracts, with fixed prices and volumes, may encourage suppliers of a company to make specific investments, as they minimize risks associated with opportunistic behavior. But, if no similar contracts are put in place at a company's demand side, then the rigidity of these contracts may expose it to maladaptation risks in transactions with customers. Under those

⁸⁰ Amongst others, the thesis has discussed how pooled interdependencies can increase the exposure of actors to systemic risk. Damages to a shared pool of resources, like a collective brand, will affect all actors using these resources. From a TCE perspective, such damages are particularly likely when there are difficulties in monitoring or measuring the behavior (performance) of the various actors using the resource.

⁸¹ Reciprocal interdependencies can reduce the risk of strategic behavior by one of the transaction parties (as the actors are mutually dependent on each other), but increase the risk of maladaptation (because mutual adjustment is necessary when circumstances change). Furthermore, because of the mutual dependency between actors, the consequence of a failure to adequately manage a risk can be amplified.

circumstances, supply side specific investments by the company may increase its exposure to demand side price or volume uncertainty. The second and third type of situation showed that risks may result from transactions in which an actor is not directly involved. The second type of situation showed that demand side risk of shirking can be amplified because of uncertain volume demand of second-tier customers. The third type of situation showed that supply side risk of shirking can be amplified because of difficulties in monitoring the performance of second-tier suppliers.

The modeled situations have also helped to address Research question 3C, by showing how supply chain actors may reduce the impact of negative consequences resulting from interdependencies. Broadly, two different types of solutions were identified: (a), to simultaneously adjust both supply and demand side contracts to reduce imbalances in transaction risk exposure; (b), to outsource some coordination functions, like compliance monitoring, to a third-party to the transaction. Employing third parties is considered the preferred option when risks result from transactions in which an actor is not directly involved (see Section 4 for a more in-depth discussion of the contractual solutions identified in the thesis). Furthermore, the thesis has examined various contracting strategies which actors can employ when they cannot manipulate the various contracts in which they participate. In particular, three strategies were distinguished: risk altering, risk transferring and risk sharing. Rather than eliminating risk in the supply chain, these strategies shift it to other actors or expose them to other types of risk.

2. General Conclusion and Discussion

The risks to which supply chain actors are exposed depend on the various transactions in which they participate, as well as on transactions at stages in the supply chain in which they do not participate. Actors may face trade-offs in minimizing their risk exposure because interdependencies can arise between decisions in the supply chain; i.e., actions taken to reduce risk in one transaction, increase risk in another transaction. The focus in the thesis has been on the contracting decisions which actors make when faced with such transaction interdependencies and how these decisions transfer or alter the risk exposure of the actors in the supply chain.

At first, the decision which an actor should take in such a situation may seem clear: employ a solution which reduces these interdependencies. Subsequently, the need to make a trade-off between minimizing exposure to different (types of) risks will be avoided. This is the strategy

employed by actors operating in some commodity supply chains, where large scale, chain-wide quality management systems reduce transaction interdependencies⁸². Such systems, by standardizing quality, allow actors to transact with most other actors in an industry. This course of action is not taken in differentiated supply chains, where any specific investments required to produce under a brand will limit the number of potential trading partners at each stage. Contracting decisions at one stage of the supply chain are therefore more likely to affect actors operating at another stage; i.e., increased transactions interdependencies arise. Under these circumstances, why would actors choose to participate in differentiated supply chains? Because the return on investments in specific assets may off-set any costs incurred in managing increased interdependencies.

Then, in differentiated supply chains, transaction interdependencies are largely given and the focus of actors shifts towards managing the risks which arise as a result. The various types of (contractual) solutions which actors can implement in such situations are discussed in detail in Section 3. What these solutions have in common is that they require actors to simultaneously manipulate various transactions in the supply chain. For example, an actor adjusts both its supply and demand side contracts or adjusts contracts with both supplier and second-tier suppliers. In such instances, trade-offs between reducing exposure to different (types of) transaction risks may still be largely avoided. For example, an actor may implement a fixed price contract in its supply side transaction to facilitate specific investments by its supplier. If the actor can also implement a fixed price contracts in its demand side transaction, it may reduce exposure to both price uncertainty and asset specificity related risks. In practice, it is not always possible for actors to manipulate contracts in multiple transactions. An actor may have limited influence on the contract implemented with some of its counterparties, let alone on transactions in which the actor is not directly involved. For example, the actor in the previous example may not be able to implement a fixed price contract with its customer. In that case, the actor has to make a decision about whether or not it is still in its best interest to enter into a fixed price contract with its supplier. Does the return it obtains from the specific investments made by the supplier outweigh the costs of managing the imbalance in price uncertainty exposure which results from the contract required to support those investments⁸³?

⁸² Note that the actors who participate in such a quality management systems reduce the importance of linkages through one channel (the transaction) and increase the importance of linkages through another channel (the quality management system). Furthermore, note that actors have increased pooled interdependencies between them (by means of a new shared resource: the quality management system).

⁸³ The actor will pay a fixed price for its inputs and will receive a variable price for its outputs.

In situations where such trade-offs arise, a contract becomes more of a tool to alter, transfer or share risk in the supply chain rather than to reduce or eliminate it. An actor *alters* its risk exposure when it swaps one type of risk for another. For example, an actor may invest in performance measurement equipment to reduce the risk of shirking by suppliers. However, if the required investments are asset specific, this may increase the risk of opportunism (see Wever et al., 2012). Risk is *transferred* in the supply chain when either the source or the holder of the risk has changed. An example of the former occurs when an actor swaps exposure to supply side price uncertainty for exposure to demand side price uncertainty (see Carlton, 1979). An example of the latter occurs when risk is transferred from actors operating upstream (downstream) in the supply chain, to actors operating downstream (upstream) in the supply chain⁸⁴ (see Jacobs, 2004; Gray and Boehlje, 2004). A risk is *shared* when it is jointly held; i.e., when multiple actors are exposed to it (see Jacobs, 2004; Chung, 1991). Intentional risk sharing occurs, for example, when actors pool risks by means of jointly controlled investments vehicles, associations, collective brands or a combination of the three⁸⁵.

The thesis has not addressed directly the question of whether or not it is beneficial to alter, transfer or share exposure to transaction risks within the supply chain nor has the thesis addressed the related question of which supply chain actor is best positioned to manage (some of) these risks. Largely, this is because the TCE assumes actors to be to be risk neutral (Williamson, 1988). Subsequently, a key motive for transferring and absorbing risk – a different level of risk aversion amongst the transaction parties – is not taken into account within the TCE framework (Chiles and McMackin, 1996). However, some remarks can nonetheless be made.

First, TCE strongly implies a hierarchy in the *types* of transaction risks to which exposure should be minimized (see Williamson, 2000). Reducing asset specificity related risks (i.e., opportunism) generally should have primacy amongst actors⁸⁶, even if it increases price or volume uncertainty in (parts of) the supply chain. As is explained above, this holds true only in situations in which a higher return on investments in specific assets offsets any costs incurred in managing increased uncertainty. Reducing risks related to performance

⁸⁴ For example, a downstream actor which implements a fixed price contracts with upstream actors absorbs (part of) the price uncertainty risks of these actors.

⁸⁵ In the case of a collective brand, the actors not only pool risks related to investments in tangible assets (i.e., the collective financial capital the actors have contributed to support the brand) but also to investments in intangible assets (i.e., the collective reputational capital of the actors).

⁸⁶ Brand owners want to reduce the risk of opportunism because they want to facilitate specific investments by their suppliers. Suppliers will only make such investments, if the risk of opportunism by the brand owner is minimized.

measurement difficulties (i.e., shirking) will also be important in differentiated supply chains, at least for some actors⁸⁷, but becomes mainly an issue after specific investments (in reputational capital) are made and related risks are minimized.

Second, when a researcher or analyst attempts to determine *where* in the supply chain risk exposure should be held, it becomes important to consider the difference between transferring the management of a risk and transferring exposure to a risk. A failure to recognize the difference between the two may give the false impression that a supply chain actor has reduced its risk exposure. For example, when an actor outsources responsibility for monitoring its supplier to a third-party, as happened in a number of the studied cases, the actor has transferred the *management* of performance measurement difficulty risks, but has not altered its risk *exposure*. Unless another actor is more capable in managing a risk (e.g., a certifying institution), it is prudent if the actor managing the risk also has the most exposure to it. This is because it will have the strongest incentive to manage the risk adequately. In the best case scenario, the actor who holds exposure to a risk is also responsible for managing this risk and is capable of doing so. The studies have indicated that there are various reasons why this may not always be the case:

- Exposure to some risks may yield high returns. Therefore, actors with bargaining power may attempt to capture these returns by exposing themselves to the risk, even if other actors are better capable of managing it. For example, an actor wants to capture the return which flows to the brand owner who puts its reputational capital at risk, even if it has limited influence on the quality of products marketed under the brand⁸⁸;
- It can be costly for an individual risk holder to undertake risk management responsibilities or to obtain risk management competencies. In such cases, risk management responsibilities may be outsourced to a third party who can use the required competences in multiple transactions. For example, a brand owner outsources the responsibility of monitoring compliance with brand standards to a certifying institution⁸⁹;
- The actor most capable of managing exposure to a risk may not be able to assume risk management responsibilities because it will give malincentives to the other actors in

⁸⁷ When an actor's brand name is visible to the consumer, this actor has a strong incentive to assure that quality products are marketed to the consumer; i.e., it has an incentive to reduce shirking by suppliers. Note however, that the brand owner may still have an incentive to shirk vis-à-vis its suppliers (see Section 3.6., Chapter Four).

⁸⁸ For example, as is explained in Section 3.7 in Chapter Four, the last link in the supply chain (e.g., the retailer), is likely to be less capable than its supplier (e.g., the slaughterhouse) in monitoring the performance of its second-tier suppliers (e.g., farmers), who arguably have the most influence on product quality. Nonetheless, frequently product quality is guaranteed to the consumer by means of retailer brands.

⁸⁹ For example, in the Retailer brand case (see Section 3.2, Chapter Three), the retailer markets a portfolio of products under its own brand name. It may be difficult for the retailer to obtain competences in monitoring the suppliers of each of these different products. A specialized certifying institution can use the competences it obtains in monitoring supplier compliance also to service other retailers.

the supply chain. For example, a retailer who manages a portfolio of products may be the best positioned actor in the supply chain to absorb price uncertainty risks, as it is least affected by fluctuations in the price of any individual product. However, it may not want to absorb this risk (e.g., by fixing the price in the contract with its suppliers), because it reduces the incentive of its suppliers to reduce their costs⁹⁰.

Third, which actor is best positioned to manage a risk may also depend on the structure of the supply chain. This is because this structure can affect the impact of a failure to adequately manage a risk. For example, in a supply chain with a ‘hourglass’ like structure, as most agri-food supply chains are shaped, a single large actor may be the intermediary between hundreds of suppliers and hundreds of customers. Even though this actor may be the most capable of managing a certain risk (e.g., price uncertainty), transferring risk exposure and risk management responsibilities to this actor may not be desirable. Its central location within the supply chain may amplify the impact of a failure to manage the risk⁹¹.

3. Implications for Literature

The thesis has made contributions to the literature in three areas: (1), quality management systems; (2), inter-organizational forms, governance structures and contract types; (3), Transaction Cost Economics.

Quality management systems

Three main contributions have been made to research in this area.

First, the thesis has contributed to the development of the quality management system (QMS) concept. A QMS is considered to consist of three elements: quality signals, quality standards, and quality compliance monitoring mechanisms. Giving form and meaning to QMS, as well as its related underlying concepts like quality standards, is important because it has often been a poorly defined and inconsistently applied concept within the literature. A failure to clearly explain in a study what aspects of a QMS are considered may lead to imprecise or incomplete conclusions and recommendations. For example, Van Plaggenhoef (2007), while examining the benefits of self-regulation in agri-food supply chains, argues that supply chain companies should integrate their QMSs with their suppliers. However, at the same time, the author

⁹⁰ A situation similar to this example occurred in the Processor brand case (see Section 6.2, Chapter Three).

⁹¹ Imagine a large slaughterhouse with fixed price contracts with farmers and variable price contracts with retailers. In effect, the slaughterhouse has absorbed the price uncertainty risks of the farmers. However, if the slaughterhouse goes bankrupt because it fails to adequately manage this risk (e.g., demand side prices keep falling) hundreds of farmers who have delivered their products, but may not have received their payments yet, will be affected. This is not a far-fetched example, as in one of the commodity chain cases, a similar imbalance was identified (i.e., the slaughterhouse had a fixed volume contract with its suppliers and a variable volume contracts with its customers).

argues that the companies should less frequently and comprehensively monitor their suppliers. It is unclear then, whether compliance monitoring forms part of a QMS or whether companies should integrate only part of their QMS. Furthermore, Coronado (2010), while discussing the relation between ownership of quality standards and contract use by supply chain actors, does not explicitly distinguish between the various parts of a QMS. The author seems to consider monitoring mechanism as part of a quality standard, but this conceptualization fails to take into account that different actors can be responsible for standard setting and compliance monitoring. Although Humphrey and Schmitz (2001) distinguish between responsibility for standard setting and compliance monitoring in their study of supply chain governance, they do not discuss quality signals. However, the extent to which quality attributes, like origin, are signaled within the supply chain is an important aspect to consider in the context of governance decisions⁹². Finally, while Humphrey and Schmitz (2001) insufficiently take into account how quality management practices are signaled across the supply chain, Sporleder and Goldsmith (2001), insufficiently consider the role of standards and monitoring mechanisms in supporting quality signals.

Second, a classification scheme has been developed by which QMSs can be distinguished along three dimensions: ownership, scope and scale. Compared to some of the QMSs classification schemes used in previous studies (e.g., see Raynaud, Sauvé and Valceschini, 2005; González-Díaz, Barcala and Arruñada, 2003; Humphrey and Schmitz 2001), the present thesis distinguishes QMSs along more dimensions. This holds particularly true for studies which use such schemes to examine the relation between supply chain actors' participation in QMSs and their choice of contracts (Coronado, 2010; Raynaud, Sauvé and Valceschini, 2005; González-Díaz, Barcala and Arruñada, 2003). Often in such studies, only a distinction is made between public and private QMSs. However, private QMSs can be similar to public QMSs in a lot of aspects when other dimensions than ownership are considered. For example, private QMSs which are adopted on a large scale in an industry require, just like public QMSs, few (specific) investments by any individual supply chain actor. As is explained in Study Two, the extent to which participation in a QMS requires (specific) investments by supply chain actors affects the types of contracts which are suitable to support this participation. Therefore, studies which distinguish QMSs on just one dimension are likely to make incomplete conclusions on the relation between QMSs and contracts.

⁹² For example, self-regulation of (some) quality management practices by industry actors may work better when manufacturer names are visible on end-consumer labels than when only retailer names are visible. This is because in the former example, also the manufacturer has a reputational stake in the product's success.

Third, by developing various propositions, the thesis has formalized the relation between contracts and QMSs. Although previously examined (see Raynaud, Sauvée and Valceschini, 2005; González-Díaz, Barcala and Arruñada, 2003), the relation between QMSs and contracts has not been operationalized in testable propositions or hypothesis. The propositions developed in the present thesis, which are grounded in TCE theory, can facilitate researchers in understanding how the use of suitable contract forms can efficiently reduce conflicts of interests between supply chain actors operating in different types of QMSs. Considering the importance of both quality management systems and contracts for coordinating supply chain transactions in the context of the agri-food industry, insights into how they can best be combined are crucial.

Inter-organizational forms, contracts, governance structures

The main contribution the thesis has made to research in this area is the development of an integrated typology of contractual coordination mechanisms. This typology⁹³ has a number of advantages compared to previous typologies of inter-organizational forms, contracts or governance structures which are worth mentioning.

First, the typology presented in this thesis allows researchers to examine the contracts used by supply chain actors in more detail. Frequently, typologies used in studies distinguish only between generic contracts (e.g., verbal arrangements, formal contracts, equity-contracts) and do not specify the underlying coordination mechanisms (e.g., fixed forward or spot price mechanisms) which are used in these contracts (e.g., Gellynck and Molnár, 2009; Webster Jr., 1992; Williamson, 1991). As a result, in studies which use such typologies (see Table 3.1 in Section 2.1, Chapter Three), it is frequently unclear *what* exactly the contracts are supposed to coordinate. Furthermore, the studies mentioned above do not explain if and how various types of coordination mechanisms can be combined within the same contract. However, this is an important aspect to consider because some aspects of a transaction (e.g., prices) may be coordinated by more market forms and other aspects (e.g., quality) by more hierarchical forms of coordination. The typology developed in this thesis, which does take underlying coordination mechanisms into account, can help researchers address these shortcomings.

Second, compared to studies which do examine underlying coordination mechanisms (e.g., Mulherin, 1986; Masten and Crocker, 1985), the present study has considered a broader range

⁹³ Note that, as the typology has been developed based on theory from general management journals rather than specifically for the agri-food sector, it should be applicable (with minor modifications) also to other contexts.

of coordination mechanisms. In total, four different types of coordination mechanisms have been integrated in the typology: price, volume, quality and investments. Most studies focus on only one or two types of coordination mechanisms (e.g., only price and volume mechanisms; see Heyder, Theuvsen and Von Davier, 2010; Goldberg and Erickson, 1987). Such studies insufficiently consider how interaction between different types of coordination mechanisms (e.g., the role of third-party certifying institutions on the use of price coordination mechanism) affect contract choices by supply chain actors.

Third, the typology has been developed based on an extensive set of variables. Compared to previous typologies (e.g., Gellynck and Molnár, 2009), these variables arguably allow for a more reliable classification of the contract types used in empirically examined transactions; i.e., it is more likely that two different researchers will reach the same conclusion about what type of contract is used in the transaction. When only generic contracts are examined in a study, the distinction between the different contract types can seem somewhat arbitrary. For example, classifying a reoccurring transaction between two parties which contains only a (implicit) verbal commitment for future transactions can be difficult. Some researchers may consider such a transaction to be governed by a verbal agreement, others by a spot market contract. There is less room for debate when the underlying coordination mechanisms are examined; e.g., either a forward price agreement has been established or not.

Fourth, besides facilitating a more in-depth examination of contracts, the developed typology also allows for a better linking of contracts with the supply chain contexts in which they are embedded. This is important because this context is frequently ignored by contracting studies, which often only examine bilateral transactions (according to Wever et al., 2012; Voß and Schneidereit, 2002; Zylbersztajn and Farina, 1999). The typology helps researchers in addressing this issue, amongst others by allowing for a more fine-grained examination of the role of third-parties to the transaction. For example, is the third-party an external actor to the supply chain (e.g., a certifying institution) or is it another (lead) supply chain actor? And, does the third-party coordinate quality (e.g., an association) or does it also facilitate investments (e.g., a bank)? What supply chain stages are covered by the third-party's activities? In helping researchers answering these types of questions, the typology can thus be used to study triadic relationships (and larger structures) next to dyadic relationships. The importance of studying structures larger than dyads is discussed in the next section in more detail, where the contributions of the thesis to TCE literature are discussed.

Transaction Cost Economics

The thesis has made various contributions to TCE literature.

First, through the development of the typology of contractual coordination mechanisms, researchers can relate the conditions which affect contracting decisions within the TCE framework also to the use of the coordination mechanisms underlying these contracts. Most TCE studies examine only generic contracts in which the use of underlying coordination mechanisms are not specified. For example, within the TCE framework, asset specificity and uncertainty are regarded as two important drivers of contracting decisions. However, few studies (Grover and Malhotra 2003; Rindfleisch and Heide 1997) have linked these conditions to the use of price coordination mechanisms. But, this is important, as the use of fixed price mechanisms may be more beneficial under some than other conditions (see Section 5 for examples of propositions).

Second, the thesis has drawn (renewed) attention to the study of the trade-offs companies encounter in managing their exposure to multiple transaction risks. Although previous studies have examined this subject, few researchers take all three main TCE based transaction risks into account (e.g., see Geyskens, Steenkamp and Kumar, 2006). Especially performance measurement difficulties are often insufficiently taken into account in TCE studies (see Grover and Malhotra, 2003; Rindfleisch and Heide, 1997). Taking a holistic approach to examining the transaction risk exposure of supply chain actors can lead to a better understanding of their contracting choices and the barriers they may face to implementing suitable contractual solutions.

Third, and arguably its main implication, the thesis has contributed to a shift within TCE literature from a focus on bilateral transactions, to examining transactions within a supply chain context. Making this shift is important because contracting decisions within dyads can be affected by decisions elsewhere within the supply chain. This is shown in Study Three which has identified some of the limitation of the traditional, bilateral TCE framework and which has laid the groundwork for the development of a more supply chain-wide TCE approach. Furthermore, this is shown in Study Four, which has examined a broad range of TCE based contracting strategies which actors can use in a supply chain context.

4. Implications for Managers

The main implication of the thesis for practitioners is that they should take a more supply chain-wide approach to managing their contractual relations. As is explained in Section 1, two

generic types of strategies have been distinguished in the thesis: (a), to limit the use of contracts which impair the flexibility of the supply chain actors or which lead to imbalances in the supply chain (see Studies Three-Four); (b), to outsource some coordination functions, like price-setting or compliance monitoring, to a third-party to the transaction (see Studies One-Four). The first type of strategy applies mainly to differentiated supply chains, where increased interdependencies between supply chain transactions have to be managed. The latter type of strategy applies to both differentiated and commodity supply chains. Some specific examples of the strategies are given below, as well as the conditions under which they should be employed.

First, actors operating in differentiated supply chains should attempt to balance supply and demand side contracts to reduce imbalances in exposure to price or volume uncertainty. These imbalances, which can lead to maladaptation, are likely to arise when actors have made specific investments in only parts of the chain and have used contracts with fixed prices or volumes to reduce the risk of opportunistic behavior for those transactions⁹⁴. In these cases, an option for supply chain actors is to use contracts with 'reference market prices', where the contract price is based on the quoted price of a similar product exchanged in the open market. Such contracts are a safeguard against opportunistic behavior, as they limit the ability of transaction parties to renegotiate prices. But, the use of reference market prices also allows the contract price to move in line with current market prices, and thus reduces risks associated with maladaptation⁹⁵.

Second, related to the previous point, imbalances may also occur because actors are limited in their ability to manipulate both supply and demand side transactions. In those circumstances, partially adjusting the contract which the actor can manipulate, to the conditions of the contract which it cannot manipulate, can be a suitable strategy. For example, when a demand side market price contract cannot be altered, a company could implement also a more market like contract (e.g., a reference market price contract) with its suppliers.

Third, actors should consider sharing the costs of making investments in assets which are specific and are used across the supply chain (e.g., in brand development in differentiated

⁹⁴ Obtaining this type of risk exposure can be a deliberate choice by a company, as it attempts to capture a risk premium. But, it can also be an unintended consequence of participating in a differentiated supply chain where bargaining power constraints prevent a company from obtaining its optimal configuration of supply chain contracts.

⁹⁵ The price in a reference market price contract is based on the quoted price of products traded in an open market. Thus, the contract price will move in line with market prices.

chains) or for which the benefits and risks of its use flow across company boundaries (e.g., measurement technology which makes standardization possible in commodity chains). Sharing these costs, and some of the benefits, may be beneficial because actors can reduce their exposure to opportunism and shirking by (second-tier) suppliers (customers). To give an example, most supply chain actors stand to benefit if they spend fewer resources on monitoring each other. They can achieve this by jointly contracting with a third-party monitoring agency. Currently, it is more common for the actor receiving the certification to contract with the third-party, but this may compromise the independency of that entity.

Fourth, related to the previous point, when the quality of the final product in the supply chain depends strongly on practices in preceding stages, it may be particularly beneficial for (lead) actors to share the property rights of the brand under which the products are marketed. This can be done by means of vertically organized associations, through which the costs of making investments in brand development are pooled. Sharing these costs can reduce exposure to both opportunistic and shirking behavior, as actors operating at other stages in the supply chain have more of an incentive to contribute, since they have a stake in the brand's success. However, managers should be aware that, as is also explained in the next paragraph, sharing brand property rights may fail to incentivize actors when the rights are shared amongst a large number of actors at each stage⁹⁶. Although every actor will have some stake in the brand's success, no individual actor may have a large enough stake to make an effort to prevent a failure of the brand.

Fifth, when they face barriers to minimizing or eliminating risk in the supply chain (e.g., because of limited bargaining power), actors should consider implementing contracting strategies which alter, transfer or share risk amongst them. Risk altering is a suitable strategy when the costs of exposure to one type of risk (e.g., asset specificity) are clearly more costly than exposure to another type of risk (e.g., price uncertainty). Risk transfer is a suitable strategy when the actor absorbing the risk (e.g., of price uncertainty) can reduce its own exposure to another risk (e.g., risk of opportunism). Risk sharing may align interests between the actors, as is explained in the previous two paragraphs. However, managers should be aware of situations in which exposure to a risk is spread too 'thin'; i.e., amongst a too large number of actors. Under such circumstances no individual actor may have a strong incentive

⁹⁶ I.e., when brand property rights are not only shared 'vertically' alongside the various stages in the supply chain, but also 'horizontally'; i.e., amongst a large number of actors operating at each of the stages.

to prevent a harmful outcome (e.g., of damages to reputational capital in case of a collective brand).

Perhaps the main contribution of the thesis for managers is that it has made some previously ‘hidden’ transaction risks more explicit. Although managers may be constrained in fully implementing the strategies outlined above, a higher awareness of the interdependency between transactions, and the negative externalities which can result from this, should encourage collaboration between lead actors and (second-tier) suppliers.

5. Implications for Further Research

The implications of the thesis for further research are outlined in detail in each of the studies. This section outlines some general implications and summarizes the main implications of the studies.

First, researchers could attempt to examine the relation between a broader set of QMSs and contract choices. As is shown in Table 6.2, only four types of QMSs have been examined in Study Two. Although also some of the other QMSs shown in the table were used in the examined pork supply chains, these were not the main QMSs used in these cases and were thus insufficiently considered in the study. Other studies could examine cases where these ‘missing’ QMSs are the main type of QMS used. Furthermore, researchers could consider classifying QMSs based on a broader set of variables or categories. For example, the study distinguishes between small and large scale QMSs, but perhaps it would be useful to distinguish also a third category: ‘intermediate scale QMS’. Additionally, researchers could try to examine the relation between different types of end-consumer signals and the type of QMS used in the supply chain. For example, to what extent are the relations between supply chain actors affected when the use of a QMS is no longer signaled to the end-consumer?⁹⁷

Second, studies could use the typology of contractual coordination mechanisms developed in Study Two to further specify existing contract theory. For example, TCE provides a perspective on the conditions which affect the usage of contracts, but only limited guidance on the conditions which affect the use of the coordination mechanisms underlying these contracts. Researchers could use the typology to relate the various conditions (e.g., asset

⁹⁷ Study One stated that most retailers have stopped signaling the QMS used in the Dutch pork chain to consumers, to be able to source products from other countries (where the QMS is not used). This suggests that changes in QMS practices influence relations between actors and highlights the importance of more in-depth research into this area.

specificity) which affect contracting decisions within the TCE framework also to the use of these coordination mechanisms. Table 6.5 gives an example of the types of propositions which could be tested.

TABLE 6.5
Example of propositions related to the use of price coordination mechanisms

Propositions
<i>PA: With high levels of asset specificity, and low levels of price uncertainty, actors will use internal or fixed forward price mechanisms in their supply chain transactions</i>
<i>PB: With high levels of asset specificity, and high levels of price uncertainty, actors will use reference market price mechanisms in their supply chain transactions</i>
<i>PC: With low levels of asset specificity, actors will use spot price mechanisms in their supply chain transactions</i>

Third, related to the previous point, the typology can be used to combine different theoretical perspectives. For example, researchers have recently started to combine TCE and the Resource Based View (see McIvor, 2009; Leiblein, 2003; Barney and Lee 2000). Studies could use the typology to establish additional linkages between the two perspectives. For example, the perspectives can be combined to explain under what conditions outsourcing quality coordination to a third-party coordinator is expected to be beneficial. Table 6.6 gives an example of the types of propositions which could be tested.

TABLE 6.6
Example of propositions related to the use of quality coordination mechanisms

Propositions
<i>PA: With unique quality requirements, and high levels of performance measurement difficulty, actors will coordinate quality in supply chain transactions internally or by means of counterparty monitoring</i>
<i>P2: With generic quality requirements, and high levels of performance measurement difficulty, actors will coordinate quality in supply chain transactions by means of a third-party</i>
<i>P2: With low levels of performance measurement difficulty, actors will coordinate quality in supply chain transactions by means of spot market specifications</i>

Fourth, perhaps most importantly, researchers should focus on further developing the extended, supply chain-wide TCE framework presented in Studies Three-Four. For example, researchers could try to identify a broader range of conditions which lead to interdependency between supply chain contracting decisions. In particular, researchers could try to identify more situations in which actors' contracting decisions depend on transactions in which they are not directly involved. Furthermore, researchers could try to find (more) situations in which the interdependency between transactions has positive externalities; i.e., when a contract

implemented upstream in the supply chain reduces also the transaction risk exposure of downstream supply chain actors. Additionally, further research should develop more quantitative constructs of interdependency. Such studies could examine, by means of more quantitative approaches, whether managers' attempts at optimization of their contractual relations are more in accordance with the logic of the traditional or the supply chain-wide TCE approach. Two propositions in particular should be tested in further research (see Table 6.7).

TABLE 6.7
Examples of propositions for further testing of supply chain-wide TCE approach

Example of proposition	Example of test	Support of supply chain-wide TCE approach	Support of traditional TCE approach
<u>1. Interdependency between transactions:</u> <i>Actors' use of supply side contracts does not depend on their exposure to demand side transaction risks</i>	A comparison of the supply side contracts used by two different groups of actors: (1), exposed to both supply side asset specificity and demand side volume uncertainty; (2), exposed only to supply side asset specificity.	Rejection of proposition: the two groups use different type of supply side contracts, as actors in the first group attempt to balance supply and demand side contracts.	Failure to reject proposition: both groups use the same type of supply side contract, as actors in the first group alter only demand side contracts to manage demand side risks.
<u>2. Consequence of contractual strategy:</u> <i>Actors that attempt to minimize exposure to bilateral transaction risks are exposed to less total transaction risks (sum of supply and demand side risks) than actors that do not attempt this</i>	A follow-up to the research outlined above (assuming the first proposition is rejected). The first group is split into two sub-groups: (1), made up of actors which altered both supply and demand side contracts; (2), made up of actors that altered only demand side contracts. A time-series analysis should indicate whether there is a significant difference in risk exposure in the groups over time.	Rejection of proposition: the second group, which consists of those actors that are oriented towards minimizing exposure to bilateral transaction risks, is exposed to higher transaction risks than the other group.	Failure to reject proposition: the first group, which consists of actors that are oriented towards balancing supply and demand side contracts, is exposed to higher transaction risk than the other group.

Fifth, as is explained in Section Two, the thesis has not addressed directly the question of which supply chain actor should hold or manage transaction risk exposure. Further studies on this subject should take into account differences in risk management competences between the various supply chain actors and how these differences affect which actors should have risk management responsibilities. Related to this, such studies could also take the structure of the supply chain into account in determining which actor is best positioned to manage a risk. For example, an (large) actor with a central position in the supply chain may be most capable actor of managing a certain risk. However, any mistakes such an actor makes in managing the risk may have systematic consequences because of its strong links or interdependencies with the other actors in the supply chain or network.

Six, further research should examine to what extent the implications of the thesis are applicable also to other contexts than the pork industry. Because the theoretical approach taken to the thesis is not developed specifically for the pork industry, while the empirical results are based on this approach, its main implications should be applicable also to other contexts. However, this should be tested. For example, other studies could examine to what extent the typology of contractual coordination mechanisms developed in Study Two is useful for characterizing contractual relations also in other industries and sectors. Additionally, studies could examine to what extent some of the negative consequences of transaction interdependency mentioned in Study Three occur also in supply chains that have non-sequential linkages in the production process (e.g., construction activities), supply chains which produce non-perishable products (e.g., petroleum-based products) or service supply chains (e.g., the structuring and subsequent marketing of mortgages-backed securities in the financial services industry).

SUMMARY

Agri-food supply chains are characterized by strong interdependencies between the different stages. Interdependency may lead to negative externalities, as when a downstream actor is exposed to transaction risks resulting from activities further upstream in the supply chain. For example, a change in the formula used to calculate the price in a farmer-processor transaction, may reduce incentives for farmers to produce high quality products. This can increase the risks that low quality products are exchanged in the processor-retailer transaction.

The present thesis aims to gain more insight in the challenges which companies face in managing such interdependencies and associated transaction risks. More specifically, the thesis aims to examine: (1), how risks arise in the supply chain as a result of interdependencies between the various transactions making up the supply chain; and (2), what types of contracts are suitable for supply chain actors to implement in order to reduce or eliminate their exposure to these risks. The thesis focuses mainly on economic risks resulting from conflicts of interests between supply chain actors.

The thesis addresses its subject from various angles, which has resulted in three main research questions which are addressed in four different studies. Answers to the research questions have been formulated in the studies by means of both a theoretical and an empirical approach. The theoretical approach is grounded within Transaction Cost Economic (TCE) literature. The empirical setting for the study is the pork meat industry.

STUDY ONE: ALIGNMENT BETWEEN CHAIN QUALITY MANAGEMENT SYSTEMS AND CONTRACTS

The first study focuses on the relation between quality management systems (QMSs) and the contracts used between the supply chain actors participating in these QMSs. Although inter-company coordination of quality management is increasingly important for meeting end-customer demand, few researchers focus on the relation between QMSs and contracts. However, insufficient alignment between QMSs and contracts can result in high transaction costs, amongst others by leading to under-investments in quality improvements, quality cheating, and difficulties in adjusting quality standards within the supply chain. To address this gap in research, this study aims to obtain insight into what types of contracts best match with the various types of quality management systems used by supply chain actors. In particular, the following research question is addressed.

Research question 1: What is the relation between the participation of supply chain actors in different types of quality management systems and their contracting choices?

To answer the research question, first a conceptual analysis of the relation between QMSs and contracts is made, based on Transaction Cost Economic (TCE) theory. Three propositions are developed about the relation between various aspects of QMSs (ownership, vertical scope and horizontal scale of adoption) and use of different types of contracts by the supply chain actors. Case study results from seven pork supply chains in four different countries (Germany, Hungary, Spain and The Netherlands) show that four main types of systems can be distinguished for coordinating quality management in EU pork supply chains: one public baseline QMS, two private chain-wide QMSs and one public chain-wide QMS. The four types of systems largely relate to the use of contracts as predicted by the propositions: (1), actors participating in QMSs without a chain-wide scope use mainly hierarchical types of contracts; (2), more hierarchical types of contracts are used in private chain-wide QMSs when compared to public chain-wide QMS; (3), more market types of contracts are used in large scale private QMSs when compared to small scale private QMSs.

The patterns found between QMSs and contracts indicate that TCE considerations help to explain QMSs choices. This supports the view that alignment between QMSs and contracts is an important aspect to consider for the efficient coordination of quality management in (agri-food) supply chains.

STUDY TWO: EXAMINING CONTRACTUAL COORDINATION MECHANISMS IN DIFFERENTIATED AND COMMODITY CHAINS

Besides the coordination of quality, which is the focus of the first study, it is also important to consider the role of contracts in coordinating other aspects of transactions. The second set of research questions focuses on the mechanisms which are used within contracts to coordinate prices, volume, quality and investments. Furthermore, actors' use of coordination mechanisms is compared across three different types of supply chains: (1), commodity supply chains; (2), collective brands; (3), proprietary brands. The diversity of supply chains studied allows for the examination of a wide-variety of contracts and underlying coordination mechanisms.

The following research questions are addressed.

Research question 2A: What types of coordination mechanisms are used within supply chain contracts?

Research question 2B: What differences can be observed in the use of these mechanisms across various types of supply chains?

To answer the research questions, the study: (1), develops a comprehensive typology for studying supply chain contracts; (2), uses the typology to characterize transactions in eight supply chains from five major pork producing countries (Brazil, Denmark, France, Spain and The Netherlands). The results show the usefulness of looking at contracts in a more detailed level: transactions which look hierarchical when examined at contract level are largely conducted in a market-like manner when the underlying coordination mechanisms are examined. For example, some hierarchical types of contracts are used in order to formalize exchanges, and not to commit the actors to future transactions. Furthermore, the results show that companies have much more freedom in combining various types of coordination mechanisms within a single type of contract than is generally assumed within the literature.

With regard to the three types of supply chains, actors in commodity chains generally do not commit themselves to future transactions to another party. In the rare instances that such commitments are made, the conditions of the exchange, particularly with regard to price and volume are left open. The exception is quality coordination, which is frequently conducted by third-parties (i.e., associations or certifying institutions). In the collective brand chains, these third-parties have an even more active role. Besides quality, also investments and even price setting responsibilities are regularly outsourced to the associations which own the brands. While both the commodity supply chains and the collective branded cases are characterized by an external administrative organization which undertakes some key coordination functions (i.e., the associations), in the proprietary brands these coordination functions are undertaken by the supply chain actor who is the brand owner. The brand owners employ hierarchical types of coordination mechanisms (e.g., fixed forward prices and volumes, counterparty quality coordination) within the largely hierarchical types of contracts that they use.

STUDIES THREE-FOUR: INTERDEPENDENCIES, RISKS AND THEIR CONTRACTUAL SOLUTIONS IN DIFFERENTIATED CHAINS

While the second study considers both commodity and differentiated supply chains, the third and fourth study focus mainly on differentiated supply chains. Differentiated supply chains are interesting to examine because they may limit the contractual options actors have in managing their exposure to transaction risks. This is because differentiation can increase interdependency between an actor's supply and demand side transactions. Based on the

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present state of research into this subject, particularly within transaction cost economics (TCE) literature, it is impossible to evaluate how companies should manage interdependencies between their supply chain transactions. To help bridge this gap in research, the following research questions are addressed.

Research question 3A: What types of conditions lead to interdependencies in differentiated supply chains?

Research question 3B: What are the consequences of interdependencies for the transaction risk exposure of supply chain actors?

Research question 3C: What types of contractual options do supply chain actors have in managing the transaction risks arising from these interdependencies?

In addressing research question 3A, the thesis focuses mainly on examining the conditions under which interdependencies arise through the various transactions in which actors participate. Such transaction interdependencies are likely to arise when supply chain actors are exposed to multiple transaction risks in separate transactions. Exposure to multiple transaction risks occurs when a transaction has high levels of attributes of more than one type. An actor may also be exposed to multiple transactions risks in separate transactions; e.g., to asset specificity related risks in its supply side transaction and volume uncertainty risks in its demand side transaction. Such situations can lead to interdependency between transactions because they may require conflicting contractual solutions to reduce the different types of transaction risk exposure.

To address research question 3B, three types of situation are modeled which examine the consequences of transaction interdependencies for supply chain actors' risk exposure. The first type of situation illustrates some of the limitations of a separate optimization of supply and demand side transactions: demand side volume uncertainty can be amplified by the attempts of an actor to reduce its supply side risk of opportunism. The second and third type of situation show that risks may result from transactions in which an actor is not directly involved. The second type of situation shows that demand side risk of shirking can be amplified because of uncertain volume demand of second-tier customers. The third type of situation shows that supply side risk of shirking can be amplified because of difficulties in monitoring the performance of second-tier suppliers.

The modeled situations also help to address Research question 3C, by showing how actors may reduce the impact of negative consequences resulting from interdependencies. Broadly,

two different types of solutions are identified: (a), to simultaneously adjust both supply and demand side contracts; (b), to outsource some coordination functions to a third-party. Furthermore, the thesis identifies various contracting strategies which actors can employ when they cannot manipulate the various transactions in which they participate. Rather than eliminating risk in the supply chain, these strategies – risk altering, risk transferring and risk sharing – change the risk exposure or shift it to other stages.

DISCUSSION

The risks to which supply chain actors are exposed depend on the various transactions in which they participate, as well as on transactions at stages in the supply chain in which they do not participate. Actors face trade-offs in minimizing their risk exposure because interdependencies arise between decisions in the supply chain; i.e., actions taken to reduce risk in one transaction, increase risk in another transaction. The studies have examined the contracting decisions which actors make when faced with such interdependencies and how these decisions transfer or alter the risk exposure of the actors in the supply chain. Based on the studies, various implications for researchers and managers can be drawn. The most important of these implications are outlined below.

Two main theoretical contributions have been made in the thesis. *First*, the typology of contractual coordination mechanisms presented in Study Two. The typology has a number of advantages compared to previous typologies of contracts, most important of which is that it allows researchers to examine the contracts used by supply chain actors in more detail. This can help researchers to: (a), capture the complexity of problems which companies face in making contract related decisions; (b), prescribe a specific mix of coordination mechanisms to address these problems rather than ‘blunt’ generic contracts. *Second*, the thesis has contributed to a shift within TCE literature from a focus on bilateral transactions, to examining transactions within a supply chain context. The thesis has identified some of the limitation of the traditional, bilateral TCE framework and has laid the groundwork for the development of a more supply chain-wide TCE approach. This makes it possible for researchers to examine, for example, how conflicts of interests between actors upstream in a supply chain can affect the transaction risk exposure of actors operating downstream.

An important implication of the thesis for managers is that they should take a more supply chain-wide approach to managing their contractual relations. Various types of contracting strategies have been distinguished which actors can use to minimize, alter, transfer or share

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transaction risk exposure in the supply chain. However, arguably the main contribution of the thesis for managers is that it has made some previously ‘hidden’ transaction risks more explicit. Although managers may be constrained in fully implementing some of the contracting strategies discussed in the studies (e.g., because of limited bargaining power), a higher awareness of the interdependency between transactions, and the negative externalities which can result from this, should encourage collaboration between lead actors and (second-tier) suppliers (customers).

SAMENVATTING⁹⁸

Productieketens in de agrarische sector worden gekenmerkt door een sterke onderlinge afhankelijkheid tussen de bedrijven in de keten. Deze afhankelijkheid kan leiden tot negatieve externe effecten. Een voorbeeld hiervan is dat een bedrijf dat stroomafwaarts in de keten actief is kan worden blootgesteld aan transactierisico's die voortvloeien uit activiteiten van bedrijven die stroomopwaarts opereren. Dit proefschrift heeft als doel meer inzicht te verkrijgen in de uitdagingen waarmee bedrijven worden geconfronteerd bij het managen van dit soort afhankelijkheden. Meer specifiek is het doel van het proefschrift om inzicht te verkrijgen in: (1) hoe risico's ontstaan in de productieketen als gevolg van de afhankelijkheden tussen de bedrijven; (2) wat voor typen contracten de bedrijven dienen te gebruiken om hun blootstelling aan deze risico's te minimaliseren.

Het proefschrift bestaat uit vier studies. De theoretische benadering die in de studies wordt gebruikt is gebaseerd op "Transaction Cost Economic"(TCE)-literatuur. Verder wordt in het proefschrift gebruik gemaakt van onderzoek verricht in de varkensindustrie.

EERSTE STUDIE: AFSTEMMING TUSSEN

KWALITEITSMANAGEMENTSYSTEMEN EN CONTRACTVORMEN

De eerste studie richt zich op de relatie tussen de participatie van bedrijven in gezamenlijke kwaliteitsmanagementsystemen en de contracten die gebruikt worden door deze bedrijven om hun onderlinge transacties te structureren. Onvoldoende afstemming tussen een kwaliteitsmanagementsysteem en de geïmplementeerde contracten kan leiden tot hoge transactiekosten voor de bedrijven, onder andere door: (1) onderinvesteringen in kwaliteitsverbetering; (2) problemen bij het meten van de kwaliteit van geleverde producten; en (3) moeilijkheden bij het aanpassen van de kwaliteitsnormen binnen de productieketen.

Onderzoeksvraag 1: Wat is de relatie tussen de participatie van bedrijven in verschillende soorten kwaliteitsmanagementsystemen en hun keuze voor een bepaald type contractvorm?

Om de onderzoeksvraag te kunnen beantwoorden is eerst een conceptuele analyse gemaakt van de relatie tussen kwaliteitsmanagementsystemen en contracten. Drie stellingen zijn ontwikkeld over de relatie tussen verscheidene aspecten van kwaliteitsmanagementsystemen

⁹⁸ Summary of thesis in Dutch. Its Dutch title is: "Ketenregie, transactierisico's en contractuele oplossingen: Het managen van onderlinge afhankelijkheden in gedifferentieerde agrarische productieketens".

(eigendom, verticale dekking en horizontale adoptie) en het gebruik van verschillende soorten contractvormen door de bedrijven.

Vervolgens zijn zeven productieketens van varkensvlees in vier verschillende landen geanalyseerd (Duitsland, Hongarije, Spanje en Nederland). Vier typen kwaliteitsmanagementsystemen worden gebruikt in deze ketens: één type privaat systeem zonder ketenbrede dekking; twee typen private systemen met ketenbrede dekking en één type publiek systeem met ketenbrede dekking. Het contractgebruik van de bedrijven in de vier typen systemen is in overeenstemming met de proposities. Hiërarchische contractvormen worden gebruikt wanneer: (1) een kwaliteitsmanagementsysteem met ketenbrede dekking in de productieketen ontbreekt; of (2) participatie in een kwaliteitsmanagementsysteem specifieke investeringen vereist en deze investeringen niet kunnen worden verdeeld onder een groot aantal bedrijven.

TWEDE STUDIE: HET GEBRUIK VAN CONTRACTUELE COÖRDINATIE-MECHANISMEN IN VERSCHILLENDE TYPEN PRODUCTIEKETENS

De tweede studie richt zich op de mechanismen die worden gebruikt in contracten om prijzen, volume, kwaliteit en investeringen te coördineren. Er wordt een vergelijking gemaakt tussen het gebruik van deze mechanismen in drie verschillende typen productieketens: (1) ketens waarin producten worden verkocht zonder merknaam ('commodity' ketens); (2) ketens waarin gedifferentieerde producten worden verkocht onder een bedrijfsmerknaam ('proprietary brand' ketens); (3) ketens waarin gedifferentieerde producten worden verkocht onder een collectieve merknaam ('collectieve brand' ketens).

Onderzoeksvraag 2A: Wat voor soorten coördinatiemechanismen worden gebruikt in contracten?

Onderzoeksvraag 2B: Wat is het gebruik van deze mechanismen in verschillende typen productieketens?

Om de onderzoeksvragen te kunnen beantwoorden is er in de studie eerst een typologie ontwikkeld voor het bestuderen van coördinatiemechanismen binnen contracten. Vervolgens is deze typologie gebruikt om transacties te karakteriseren in acht productieketens uit vijf verschillende landen (Brazilië, Denemarken, Frankrijk, Spanje en Nederland). Al deze landen zijn belangrijke varkensvleesproducenten. De resultaten tonen aan dat bedrijven veel meer

vrijheid hebben in het combineren van verschillende soorten coördinatiemechanismen binnen een enkel type contract dan algemeen wordt aangenomen in de literatuur.

Met betrekking tot de drie soorten productieketens, bedrijven in ‘commodity’ ketens laten over het algemeen de voorwaarden van de transactie open. Dit heeft als gevolg dat er continu heronderhandeld wordt over de transactievoorwaarden. De uitzondering is de coördinatie van kwaliteit; bedrijven eisen vaak dat hun leveranciers over specifieke kwaliteitscertificaten beschikken. ‘Proprietary brand’ ketens worden gekenmerkt door overeenkomsten waarin, naast kwaliteit, ook met betrekking tot de andere voorwaarden voor een langere termijn (6-12 maanden) afspraken worden gemaakt. Het bedrijf dat de merkeigenaar is stelt deze voorwaarden vast. In ‘collective brand’ ketens speelt de vereniging (samenwerkingsverband) die het merk beheert een belangrijke rol bij het vaststellen van de transactievoorwaarden. De vereniging stelt minimale kwaliteitsvoorwaarden vast en int een heffing op de transacties waarin het merk gebruikt wordt. Met deze heffingen financiert de vereniging de investeringen die nodig zijn om het merk te promoten.

DERDE EN VIERDE STUDIE: ONDERLINGE AFHANKELIJKHEID, RISICO EN CONTRACTUELE OPLOSSINGEN IN GEDIFFERENTIEERDE KETENS

De focus in de derde en vierde studie is gericht op productieketens waarin gedifferentieerde producten gemaakt worden. In dit soort ketens is er sprake van een vergrote onderlinge afhankelijkheid tussen de bedrijven en een toename van de daaraan verbonden risico's. Op basis van de huidige stand van onderzoek naar dit onderwerp is er weinig inzicht in wat voor typen contracten de bedrijven dienen te implementeren in zulke situaties.

Onderzoeksvraag 3A: Welke omstandigheden leiden tot onderlinge afhankelijkheid tussen de bedrijven in gedifferentieerde productieketens?

Onderzoeksvraag 3B: Wat zijn de gevolgen van deze afhankelijkheid voor de blootstelling van de bedrijven aan transactierisico's?

Onderzoeksvraag 3C: Wat voor contractuele opties hebben de bedrijven om deze risico's te managen?

Bij het beantwoorden van onderzoeksvraag 3A was de focus in het proefschrift vooral op de afhankelijkheden die ontstaan tussen de verschillende transacties waaraan een bedrijf deelneemt. Er is sprake van afhankelijkheid wanneer het contract dat een bedrijf wil implementeren in de transactie met zijn leverancier (afnemer) beïnvloed wordt door het

contract dat het bedrijf implementeert met zijn afnemer (leverancier). Deze afhankelijkheid ontstaat wanneer de participatie van het bedrijf in de twee transacties tegenstrijdige eisen stelt aan zijn bedrijfsvoering, o.a., met betrekking tot de mate waarin het noodzakelijk is om de prestaties van de leverancier (afnemer) te meten en om flexibele productiecapaciteit aan te houden. Bijvoorbeeld, wanneer een bedrijf verticaal integreert met zijn leverancier om meetproblemen op te lossen kan een (ongewenst) gevolg hiervan zijn dat het bedrijf een vaste toelevering van inputs verkrijgt. Dit beperkt het bedrijf in de mate waarin het de productiecapaciteit kan aanpassen indien er een veranderde vraag is naar zijn outputs.

Om onderzoeksvraag 3B te beantwoorden zijn drie situaties gemodelleerd. De eerste situatie illustreert een aantal van de problemen die resulteren uit een afzonderlijke optimalisatie van transacties aan zowel de vraag- als aanbodzijde: onzekerheid in de transactie aan de vraagzijde kan worden versterkt door de pogingen van een bedrijf om het risico van opportunistisch gedrag in de transactie aan de aanbodzijde te verminderen. De tweede en derde situatie laten zien dat risico's ook kunnen voortvloeien uit transacties waarbij een bedrijf niet direct betrokken is. De tweede situatie toont aan dat meetproblemen in de transactie aan de vraagzijde versterkt kunnen worden door fluctuaties in de vraag van de 'klant van de klant'. De derde situatie toont aan dat onderprestatie in de transactie aan de aanbodzijde toeneemt naarmate er meer moeilijkheden zijn bij het meten van de prestaties van de 'leverancier van de leverancier'.

De gemodelleerde situaties zijn ook gebruikt om onderzoeksvraag 3C te beantwoorden. In grote lijnen zijn er twee verschillende soorten oplossingen te onderscheiden voor bedrijven om risico's in de keten te beperken of te elimineren: (a) het gelijktijdig aanpassen van de contracten aan de vraag- en aanbodzijde; (b) bepaalde coördinerende taken uit te besteden aan een derde, 'onafhankelijke' partij. Hiernaast zijn er in het proefschrift verschillende strategieën geïdentificeerd die bedrijven kunnen gebruiken wanneer het niet mogelijk is om de beide transacties waarin ze participeren te manipuleren. In plaats van het elimineren van risico's, leiden deze strategieën tot het delen of overdragen van risico's in de keten.

DISCUSSIE

De risico's waaraan bedrijven worden blootgesteld zijn afhankelijk van de verschillende transacties waaraan zij deelnemen, maar ook van transacties in de keten waaraan zij niet deelnemen. Bedrijven moeten keuzes maken met betrekking tot de risico's die ze willen elimineren indien er afhankelijkheden in de keten zijn: handelingen die ondernomen worden

om risico's in één transactie te verminderen, kunnen risico's in een andere transactie verhogen. In het proefschrift is onderzocht wat voor typen contracten bedrijven (moeten) implementeren in dat soort situaties. De vier studies die gepresenteerd zijn in het proefschrift hebben verscheiden consequenties voor onderzoekers en managers.

Twee belangrijke theoretische bijdragen zijn gemaakt in het proefschrift. Ten eerste stelt de typologie die gepresenteerd is in de tweede studie onderzoekers in staat om de contracten die door bedrijven worden gebruikt in meer detail te bestuderen. Dit kan onderzoekers helpen om: (a) meer inzicht te verkrijgen in de complexiteit van de problemen die bedrijven ondervinden bij het maken van contractuele keuzes; (b) meer specifieke aanbevelingen te geven. Ten tweede draagt het proefschrift bij aan een verschuiving binnen de TCE-literatuur van een focus op bilaterale transacties, naar het analyseren van transacties binnen een ketenbrede context. Dit kan onderzoekers helpen bij het bestuderen van de vraag hoe contractuele beslissingen in de verschillende stadia van de keten elkaar beïnvloeden.

Een belangrijke implicatie van het proefschrift voor managers is dat ze een meer ketenbrede benadering moeten nemen bij het managen van hun relaties. Verschillende typen contractuele strategieën zijn gepresenteerd die bedrijven kunnen gebruiken om risico's in de keten te minimaliseren, aan te passen, te delen of over te dragen aan andere partijen. Misschien wel de belangrijkste bijdrage van dit proefschrift voor managers is dat voorheen 'verborgen' transactierisico's meer zichtbaar gemaakt zijn voor de ketenpartijen. Hoewel managers wellicht beperkt zijn in de vrijheid die ze hebben om de meest optimale contractuele strategie te implementeren, kan een hoger bewustzijn van de onderlinge afhankelijkheid tussen transacties en de externe effecten die hieruit voortvloeien, de samenwerking tussen bedrijven en (tweedelijns)leveranciers (afnemers) versterken.

REFERENCES

- Agrell, P.J., Lindroth, R. and A. Norrman. 'Risk, Information and Incentives in Telecom Supply chains', *International Journal of Production Economics*, (90), 2004, pp. 1-16.
- Akerlof, G.A. 'The Market for "Lemons": Quality Uncertainty and the Market Mechanism', *Quarterly Journal of Economics*, (84), 1970, pp. 488-500.
- Albersmeier, F., Schulze, H., Jahn, G. and A. Spiller. 'The Reliability of Third-Party Certification in the Food Chain: From Checklist to Risk-Oriented Auditing', *Food Control*, (20), 2009, pp. 927-935.
- Alchian, A.A. and H. Demsetz. 'Information Costs and Economic Organization', *The American Economic Review*, (62:5), December 1972, pp. 777-795.
- Anderson, E. and D.C. Schmittlein. 'Integration of the Sales Force: An Empirical Examination', *The RAND Journal of Economics*, (15:3), Autumn 1984, pp. 385-395.
- Arnold, U. 'New Dimensions of Outsourcing: a Combination of Transaction Cost Economics and the Core Competencies Concept', *European Journal of Purchasing & Supply Management*, (6), 2000, pp. 23-29.
- Arrow, K.J. 'The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Non-market Allocation', In Joint Economic Committee of Congress (Ed.), *Analysis and Evaluation of Public Expenditures: The PPP System*, Volume 1, Government Printing Office, Washington D.C., 1969.
- Artz, K.W. and T.H. Brush. 'Asset specificity, Uncertainty and Relational norms: an examination of Coordination Costs in Collaborative Strategic Alliances', *Journal of Economic Behavior & Organization*, (41), 2000, pp. 337-362.
- Baird, I.S. and H. Thomas. 'Towards a Contingency Model of Strategic Risk Taking', *The Academy of Management Review*, (10:2), April 1985, pp. 230-243.
- Barney, J.B. and W. Lee. 'Multiple considerations in making Governance Choices: Implications of Transaction Cost Economics, Real Options Theory and Knowledge-Based Theories of the Firm'. In N. Foss and V. Mahne (Ed.), *Competence, Governance and Entrepreneurship*, Oxford University Press, New York, NY, 2000.
- Barrat, M. and A. Oke. 'Antecedents of Supply Chain Visibility in Retail Supply Chains: A Resource-Based Perspective', *Journal of Operations Management*, (25), 2007, pp. 1217-1233.
- Barzel, Y. 'Measurement Cost and the Organization of Markets', *Journal of Law and Economics*, (25), April 1982, pp. 27-48.
- Bijman, J. 'The role of producer organizations in consumer-oriented agrifood chains; an economic organization perspective'. In R. Ruben, M. van Boekel, A. van Tilburg and J. Trienekens (Ed.), *Tropical Food chains. Governance regimes for quality management*, Wageningen Academic Publishers, Wageningen, The Netherlands, 2007.
- Bogetoft, P. and H.B. Olesen. *Design of Production Contracts*, Copenhagen Business School, Denmark, 2004.

- Borgatti, S.P. and X. Li. 'On Social Network Analysis in a Supply Chain Context', *Journal of Supply Chain Management*, (45:2), April 2009, pp. 5-22.
- Brousseau, E. and M. Fares. 'Incomplete Contracts and Governance Structures: Are Complete Contract Theory and New-Institutional Economics Substitutes or Complements?'. In C. Ménard (Ed.), *Institutions, Contracts and Organizations: Perspectives from New Institutional Economics*, Edward Elgar, Cheltenham, United Kingdom, 2000.
- Buchanan, J.M. and Wm.C. Stubblebine. 'Externality', *Economica*, (29:116), November 1962, pp. 371-384.
- Burt, R.S. 'Cooptive Corporate Actor Networks: A Reconsideration of Interlocking Directorates Involving American Manufacturing', *Administrative Science Quarterly*, (25:4), December 1980, pp. 557-582.
- Buvik, A. 'Hybrid Governance and Governance Performance in Industrial Purchasing Relationships', *Scandinavian Journal of Management*, (18), 2002, pp. 567-587.
- Cai, S. and Z. Yang. 'Development of Cooperative Norms in the Buyer-Supplier Relationship: The Chinese Experience', *Journal of Supply Chain Management*, (44:1), January 2008, pp. 55-70.
- Camps, T.W. 'Double Dutch', *Journal on Chain and Network Science*, (5), 2005, pp. 1-3.
- Carlton, D.W. 'Vertical integration in competitive markets under uncertainty', *The Journal of Industrial Economics*, (27:3), March 1979, pp. 189-209.
- Chaddad, F.R. and M.L. Cook. 'Understanding New Cooperative Models: An Ownership-Control Rights Typology', *Review of Agricultural Economics*, (26:3), 2004, pp. 348-360.
- Chance, D.M., Grant, K. and J. Marsland. 'Risk Management'. In J.L. Maginn, D.L. Tuttle, J.E. Pinto and D.W. McLeavey (Ed.), *Managing Investment Portfolios: A Dynamic Process*, John Wiley & Sons Inc., Hoboken, NJ, 2007.
- Chen, S-F.S. 'A General TCE Model of International Business Institutions: Market Failure and Reciprocity', *Journal of International Business studies*, (41), 2010, pp. 935-959.
- Cheung, S.N. 'The Contractual Nature of the Firm', *Journal of Law and Economics*, (26:1), April 1983, pp. 1-21.
- Cheung, S.N. 'The Structure of a Contract and the Theory of a Non-Exclusive Resource', *Journal of Law and Economics*, (13:1), April 1970, pp. 49-70.
- Chiles, T.H. and J.F. McMackin. 'Integrating Variable Risk Preferences, Trust, and Transaction Cost Economics', *The Academy of Management Review*, (21:1), January 1996, pp. 73-99.
- Choi, T.Y. and Z. Wu. 'Triads in Supply Networks: Theorizing Buyer-Supplier-Supplier Relationships', *Journal of Supply Chain Management*, (45:1), January 2009, pp. 8-25.
- Chung, T.-Y. 'Incomplete Contracts, Specific Investments and Risk Sharing', *Review of Economic Studies*, (58), 1991, pp. 1031-1042.

- Coase, R.H. 'The Nature of the Firm: Influence', *Journal of Law, Economics, and Organization*, (4:1), Spring 1988, pp. 33-47.
- Coase, R.H. 'The Problem of Social Cost', *Journal of Law and Economics*, (3), October 1960, pp. 1-44.
- Cooper, D.P. and M. Tracey. 'Supply Chain Integration via Information Technology: Strategic Implications and Future Trends', *Int. J. Integrated Supply Management*, (3:1), 2005, pp. 237-257.
- Coronado, J.J. *Supply Chain Practices, Performance and Organizational Configuration in the Mexican Avocado Industry*, Wageningen Academic Publishers, Wageningen, The Netherlands, 2010.
- Crocker, K.J. and S.E. Masten. 'Pretia Ex Machina? Prices and Process in Long-Term Contracts', *Journal of Law & Economics*, (34), April 1991, pp. 69-99.
- Darby, M.R. and E. Karni. 'Free Competition and the Optimal Amount of Fraud', *The Journal of Law and Economics*, (16:1), 1973, pp. 67-88.
- Den Butter, F.A. 'The macroeconomics of the credit crisis: in search of the externalities for macro prudential supervision'. In E. F. Wubben (Ed.), *Institutions and Regulation For Economic Growth? Public Interests versus Private Incentives*, Edward Elgar Publishing, Cheltenham, United Kingdom, 2011.
- Deimel, M., Frentrup, M. and L. Theuvsen. 'Transparency in food supply chains: empirical results from German pig and dairy production', *Journal on Chain and Network Science*, (8), 2008, pp. 21-32.
- Dooley, K.J., Yan, T., Mohan, S. and M. Gopalakrishnan. 'Inventory Management and the Bullwhip Effect during the 2007-2009 Recession: Evidence from the Manufacturing Sector', *Journal of Supply Chain Management*, (46:1), January 2010, pp. 12-18.
- Dubois, A. and P. Fredriksson. 'Cooperating and competing in supply networks: making sense of a triadic sourcing strategy', *Journal of Purchasing and Supply Management*, (14:3), 2008, pp. 170-179.
- Dyer, J.H. 'Effective Interfirm Collaboration: How Firms Minimize Transaction Costs and Maximize Transaction Value', *Strategic Management Journal*, (18:7), 1997, pp. 535-556.
- Eisenhardt, K.M. 'Building theories from case study research', *Academy of Management Review*, (14:4), 1989, pp. 532-550.
- Ellram, L.M., Tate, W.L. and C. Billington. 'Offshore Outsourcing of Professional Services: A Transaction Cost Economics Perspective', *Journal of Operations Management*, (26), 2008, pp. 148-163.
- Ellram, L.M. and M.C. Cooper. 'Supply Chain Management, Partnerships and the Shipper – Third Party Relationship', *The International Journal of Logistics Management*, (1:2), 1990, pp. 1-10.

- Emerson, R.M. 'Social Exchange Theory', *Annual Review of Sociology*, (2), 1976, pp. 335-362.
- Ettlie, J.E. and K. Sethuraman. 'Locus of Supply and Global Manufacturing', *International Journal of Operations and Production Management*, (22:3), 2002, pp. 349-370.
- Fama, E.F. 'Agency Problems and the Theory of the Firm', *Journal of Political Economy*, (88:2), April 1980, pp. 288-307.
- Fawcett, S.E. and G.M. Magnan. 'The Rhetoric and Reality of Supply Chain Integration', *International Journal of Physical Distribution & Logistics Management*, (32:5), 2002, pp. 339-361.
- Folta, T.B. and K.D. Miller. 'Real Options in Equity Partnerships', *Strategic Management Journal*, (23:1), January 2002, pp. 77-88.
- Ford, D. 'The Development of Buyer-Seller Relationships in Industrial Markets', *European Journal of Marketing*, (14:5/6), 1980, pp. 339-353.
- Foss, K. and N. Foss. 'The Knowledge-based-approach and organizational economics: How much do they really differ? And how does it matter?'. In N. Foss and V. Mahnke (Ed.), *Competence, Governance and Entrepreneurship*, Oxford University Press, New York, NY, 2000.
- Foster Jr., S.T. 'Towards an Understanding of Supply Chain Quality Management', *Journal of Operations Management*, (26), 2008, pp. 461-467.
- Frazier, G.L. 'Organizing and Managing Channels of Distribution', *Journal of the Academy of Marketing Sciences*, (27:2), 1999, pp. 226-240.
- Galaskiewicz, J. 'Studying Supply Chains from a Social Network Perspective', *Journal of Supply Chain Management*, (47:1), January 2011, pp. 4-8.
- Gellynck, X. and A. Molnár. 'Chain governance structures: the European traditional food sector', *British Food Journal*, (111:8), 2009, pp. 762-775.
- Gereffi, G., Humphrey, J. and T. Sturgeon. 'The Governance of Global Value chains', *Review of International Political Economy*, (12:1), February 2005, pp. 78-104.
- Geyskens, I., Steenkamp, J.E. and N. Kumar. 'Make, Buy, or Ally: a Transaction Cost Theory Meta-Analysis', *The Academy of Management Journal*, (49:3), 2006, pp. 519-543.
- Ghosh, M. and G. John. 'Governance Value analysis and Marketing Strategy', *The Journal of Marketing*, (63), 1999, pp. 131-145.
- Gibbert, M., Ruigrok, W. and B. Wicki. 'Research notes and commentaries: what passes a rigorous case study?', *Strategic Management Journal*, (29), 2008, pp. 1465-1474.
- Goldberg, V.P. and J.R. Erickson. 'Quantity and price adjustment in long-term contracts: A case study of petroleum coke', *Journal of Law and Economics*, (30), October 1987, pp. 369-398.

- González-Díaz, M., Barcala, M. and B. Arruñada. 'Quality assurance mechanisms in agrifood: the case of the Spanish fresh meat sector', *Journal of Agricultural Resource, Governance and Ecology*, (2:3/4), 2003, pp. 361-382.
- Gow, H.R. and J.F. Swinnen. 'Private Enforcement Capital and Contract Enforcement in Transition Economies', *American Journal of Agricultural Economics*, (83:3), August 2001, pp. 686-690.
- Grandori, A. 'A Network Approach to Organizational Design', Working Paper, Bocconi University Milan, Italy, January 2005.
- Grandori, A. 'Governance Structures, Coordination Mechanisms and Cognitive Models', *The Journal of Management and Governance*, (1), 1997 (a), pp. 29-47.
- Grandori, A. 'An Organizational Assessment of Interfirm Coordination Modes', *Organization Studies*, (18:6), 1997 (b), pp. 897-925.
- Grandori, A. and G. Soda. 'Inter-firm Networks: Antecedents, Mechanisms and Forms', *Organization Studies*, (16:2), 1995, pp. 183-214.
- Granovetter, M. 'Economic Action and Social Structure: The Problem of Embeddedness', *American Journal of Sociology*, (91:3), November 1985, pp. 481-510.
- Granovetter, M.S. 'The Strength of Weak Ties', *American Journal of Sociology*, (78:6), May 1973, pp. 1360-1380.
- Gray, A.W. and M.D. Boehlje. 'Risk Sharing and Transaction Costs in Producer-Processor Supply Chains', *Choices*, (20:4), 2005, pp. 281-286.
- Grossman, S.J. and O.D. Hart. 'The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration', *The Journal of Political Economy*, (94:4), August 1986, pp. 691-719.
- Grover, V. and M. K. Malhotra. 'Transaction Cost Framework in Operations and Supply Chain Management Research: Theory and Measurement', *Journal of Operations Management*, (21), 2003, pp. 457-473.
- Gulati, R., Lawrence, P.R. and P. Puranam. 'Adaptation in Vertical Relationships: Beyond Incentive Conflict', *Strategic Management Journal*, (26), 2005, pp. 415-440.
- Gulati, R. and H. Singh. 'The Architecture of Cooperation: Managing Coordination Costs and Appropriation Concerns in Strategic Alliances', *Administrative Science Quarterly*, (43), 1998, pp. 781-814.
- Håkansson, H. and B. Wootz. 'A Framework of Industrial Buying and Selling', *Industrial Marketing Management*, (8), 1979, pp. 28-39.
- Haldane, A.G. 'Risk-Pricing and the Sub-Prime Crisis', *World Economics*, (9:3), July–September 2008, pp. 31-46.
- Hallikas, J., Karvonen, I., Pulkkinen, U., Virolainen, V.-M. and M. Tuominen. 'Risk Management Process in Supplier Networks', *International Journal of Production Economics*, (90), 2004, pp. 47-58.

- Hart, O.D. and J. Moore. 'Foundations of Incomplete Contracts', *The Review of Economic Studies*, (66:1), January 1999, pp. 115-138.
- Hart, O.D. 'Incomplete Contracts and the Theory of the Firm'. In O.E. Williamson and S.G. Winter (Ed.), *The Nature of the Firm: Origins, Evolution and Development*, Oxford University Press, New York, NY, 1991.
- Hart, O.D. 'An Economist's Perspective on the Theory of the Firm', *Columbia Law Review*, (89:7), November 1989, pp. 1757-1774.
- Heide, J. B. and G. John. 'Alliances in Industrial Purchasing: The Determinants of Joint Action in Buyer-Supplier Relationships', *Journal of Marketing Research*, (27:1), February 1990, pp. 24-36.
- Hendrikse, G. and J. Winsperger. 'Determinants of Contractual Completeness in Franchising', In M. Tuunanen, J. Windsperger, G. Cliquet and G. Hendrikse (Ed.), *New Developments in the Theory of Networks*, Physica-Verlag, Heidelberg, Germany, 2011.
- Heyder, M., Theuvsen, L. and Z. Von Davier. 'Strategies for coping with uncertainty: the adaptation of food chains to volatile markets', *Journal on Chain and Network Science*, (10:1), 2010, pp. 17-25.
- Hobbs, J., Kerr, W. and K. Klein. 'Creating international competitiveness through supply chain management: Danish pork', *Supply Chain Management: An International Journal*, (3:2), 1998, pp. 68-78.
- Holström, B. and J. Roberts. 'The Boundaries of the Firm Revisited', *The Journal of Economic Perspectives*, (12:4), Autumn 1998, pp. 73-94.
- Houlihan, J.B. 'International Supply Chains: A New Approach', *Management Decision*, (26:3), 1988, pp. 13-19.
- Hueth, B., Ligon, E., Wolf, S. and S. Wu. 'Incentive Instruments in Fruit and Vegetable Contracts: Input Control, Monitoring, Measuring and Price Risk', *Review of Agricultural Economics*, (21:2), Autumn-Winter 1999, pp. 347-389.
- Humphrey, J. and H. Schmitz. 'How does Insertion in Global Value Chains Affect Upgrading in Industrial Clusters', *Regional Studies*, (36:9), 2002, pp. 1017-1027.
- Humphrey, J. and H. Schmitz. 'Governance in Global value chains', *IDS Bulletin*, (32.3), 2001.
- Jack, E.P. and A.S. Raturi. 'Measuring and Comparing Volume Flexibility in the Capital Goods Industry', *Production and Operations Management*, (12:4), Winter 2003, pp. 480-501.
- Jacobs, B.I. 'Tumbling Tower of Babel: Subprime Securitization and the Credit Crisis', *Financial Analysts Journal*, (65:2), March/April 2009, pp. 17-30.
- Jacobs, B.I. 'Risk Avoidance and Market Fragility', *Financial Analysts Journal*, January/February 2004, pp. 26-29.

- Jang, J. and F. Olson. 'The Role of Product Differentiation for Contract Choice in the Agri-Food Sector', *European Review of Agricultural Economics*, (37:2), 2010, pp. 251-273.
- Jensen, M.C. and W.H. Meckling. 'Theory of the Firm: Managerial Behavior, Agency Cost and Ownership Structure', *Journal of Financial Economics*, (3), 1976, pp. 305-360.
- Joskow, P.L. 'Contract Duration and Relationship-Specific Investments: Empirical Evidence from Coal Markets', *The American Economic Review*, (77:1), March 1987, pp. 168-185.
- Joskow, P.L. 'Vertical Integration and Long-Term Contracts: The Case of Coal-Burning Electric Generating Plants', *Journal of Law, Economics & Organization*, (1:1), Spring 1985, pp. 33-80.
- Kamann, D. and V. van Nieulande. 'A Four-Filter Method for Outsourcing to Low-Cost Countries', *Journal of Supply Chain Management*, (46:2), April 2010, pp. 64-79.
- Kaplan, S.N. and P. Strömberg. 'Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts', *Review of Economic Studies*, (70), 2003, pp. 281-315.
- Kaynak, H. and J.L. Hartley. 'A Replication and Extension of Quality Management into the Supply Chain', *Journal of Operations Management*, (26), 2008, pp. 468-489.
- Kim, J. and J.T. Mahoney. 'Property Rights Theory, Transaction Costs Theory, and Agency Theory: An Organizational Economics Approach to Strategic Management', *Managerial and Decision Economics*, (26), 2005, pp. 223-242.
- Klein, B. 'The Role of Incomplete Contracts in Self-Enforcing Relationships', *Revue d'Economie Industrielle*, (92:2/3), 2000, pp. 67-80.
- Klein, B. 'Contracts and Incentives: The Role of Contract Terms in Assuring Performance', In L. Werin and H. Wijkander (Ed.), *Contract Economics*, Basil Blackwell, Cambridge, MA, 1992.
- Klein, B., Crawford, R.G. and A.A. Alchian. 'Vertical Integration, Appropriable rents, and the Competitive Contracting process', *Journal of Law and Economics*, (21:2), October 1978, pp. 297-326.
- Kleindorfer, P.R. and G.H. Saad. 'Managing Disruption Risks in Supply Chains', *Production and Operations Management*, (14:1), Spring 2005, pp. 53-68.
- Koste, L.L. and M.K. Malhotra. 'A Theoretical Framework for Analyzing the Dimensions of Manufacturing Flexibility', *Journal of Operations Management*, (18), 1999, pp. 75-93.
- Kumar, K. and H.G. van Dissel. 'Sustainable Collaboration: Managing Conflict and Cooperation in Interorganizational Systems', *MIS Quarterly*, (20:3), September 1996, pp. 297-300.
- Lambert, D.M. and M.C. Cooper. 'Issues in Supply Chain Management', *Industrial Marketing Management*, (29), 2000, pp. 65-83.

- Lazerson, M.H. and G. Lorenzoni. 'The Firms that Feed Industrial Districts: A Return to the Italian Source', *Industrial and Corporate Change*, (8:2), 1999, pp. 235-266.
- Lazzarini, S.G., Claro, D.P. and L.F. Mesquita. 'Buyer-supplier and supplier-supplier alliances: do they reinforce or undermine one another?', *Journal of Management Studies*, (45), 2008, pp. 561-584.
- Lazzarini, S.G., Chaddad, F.R. and M.L. Cook. 'Integrating Supply Chain and Network Analyses: The Study of Netchains', *Journal on Chain and Network Science*, (1:1) 2001, pp. 7-22.
- Lee, H.L., Padmanabhan, V. and S. Whang. 'The Bullwhip Effect in Supply Chains', *Sloan Management Review*, (38:3), Spring 1997, pp. 93-102.
- Leiblein, M.J. 'The Choice of Organizational Governance Form and Performance: Predictions from Transaction Cost, Resource-based, and Real Options Theories', *Journal of Management*, (29:6), 2003, pp. 937-961.
- Leiblein, M.J. and D. Miller (2003). 'An empirical examination of transaction- and firm-level influences on the vertical boundaries of the firm', *Strategic Management Journal*, (24), pp. 839-859
- Macaulay, S. 'Non-Contractual Relations in Business: A preliminary Study', *American Sociological Review*, (28:1), February 1963, pp. 1-22.
- Macher, J.T. and B.D. Richman. 'Transaction Cost Economics: An Assessment of Empirical Research in the Social Sciences', *Business and Politics*, (10:1), 2008, Article 1.
- Martinez, S. and K. Zering. 'Pork Quality and the Role of Market Organization', *Agricultural Economic Report*, (835), 2004.
- Masten, S.E. 'Contractual Choice', In B. Boukaert and G. De Geest (Ed.), *Encyclopedia of Law and Economics*, Edward Elgar Publishing and University of Ghent, 1999.
- Masten, S.E., Meehan Jr., J.W. and E.A. Snyder. 'The Costs of Organization', *Journal of Law, Economics and Organization*, (7), Spring 1991, pp. 1-25.
- Masten, S.E. and K.J. Crocker. 'Adaptation in Long-Term Contracts: Take-or-Pay Provisions for Natural Gas', *The American Economic Review*, (75:5), December 1985, pp. 1083-1093.
- McGrath, R.G., Ferrier, W.J. and A.L. Mendelow. 'Real Options as Engines of Choice and Heterogeneity', *The Academy of Management Review*, (29:1), January 2004, pp. 86-101.
- McIvor, R. 'How the Transaction Cost and Resource-Based Theories of the Firm Inform Outsourcing Evaluation', *Journal of Operations Management*, (27), 2009, pp. 45-63.
- Ménard, C and E. Valceschini. 'New Institutions for Governing the Agri-Food Industry', *European Review of Agricultural Economics*, (32:3), 2005, pp. 421-440.
- Ménard, C. 'The Economics of Hybrid Organizations', *Journal of Institutional and Theoretical Economics*, (160), 2004, pp. 345-376.

- Ménard, C. 'The Enforcement of Contractual Arrangements', Paper presented at NIE Meeting, Saint-Louis, MO, September 1997.
- Mentzer, J.T., De Wit, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Z.G. Zacharia. 'Defining Supply Chain Management', *Journal of Business Logistics*, (22:2), 2001, pp. 1-25.
- Milgrom, P. and J. Roberts. *Economics, Organization and Management*, Prentice Hall, Upper Saddle River, NJ, 1992.
- Molm, L.D. 'Dependence and Risk: Transforming the Structure of Social Exchange', *Social Psychology Quarterly*, (57:3), September 1994, pp. 163-176.
- Moran, P. and S. Ghoshal (1996). 'Theories of economic organization: the case for realism and balance', *The Academy of Management Review*, (21:1), pp. 58-72.
- Mulherin, J.H. 'Complexity in Long-Term Contracts: An Analysis of Natural Gas Contractual Provisions', *Journal of Law, Economics & Organization*, (2:1), Spring 1986, pp. 105-117.
- Nair, A. 'Meta-analysis of the relationship between quality management practices and firm performance – Implications for quality management theory development', *Journal of Operations Management*, (24:6), 2006, pp. 948-975.
- Neiger, D., Rotaru, K. and L. Churilov. 'Supply Chain Risk Identification with Value-Focused Process Engineering', *Journal of Operations Management*, (27), 2009, pp. 154-168.
- Nickerson, J.A., Hamilton, B.H. and T. Wada. 'Market position, Resource profile and Governance: Linking Porter and Williamson in the Context of International Courier and Small Package Services in Japan', *Strategic Management Journal*, (22), 2001, pp. 251-273.
- Nooteboom, B. 'Governance and Competence: How can they be Combined?', *Cambridge Journal of Economics*, (28), 2004, pp. 505-525.
- North, D. C. 'The New Institutional Economics', *Journal of Institutional and Theoretical Economics*, (142:1), 1986, pp. 230-237.
- Omta, S.W., Trienekens, J.H. and G. Beers. 'Chain and Network Science: A Research Framework', *Journal on Chain and Network Science*, (1:1), June 2001, pp. 1-6.
- Ordóñez, H.A., Zuurbier, P., Senesi, S.I., and H. Palau. 'Do food quality assurance systems demand complex governance structures?'. Paper presented at 7th International Conference on Management in AgriFood Chains and Networks, Ede, The Netherlands, 2006.
- Oxley, J. 'Institutional Environment and the Mechanisms of Governance: The Impact of Intellectual Property Protection on the Structure of Inter-firm Alliances', *Journal of Economic Behavior & Organization*, (38), 1999, pp. 284-309.
- Ponte, S. and P. Gibbon. 'Quality standards, conventions and the governance of global value chains', *Economy and Society*, (34:1), February 2005, pp. 1-31.
- Pozzobon, D.M. and D. Zylbersztajn. 'The Costs of Cooperative Governance: Democratic and Agency Costs'. In: Proceedings of the VIII PAA-PENSA Conference, Buenos Aires, Argentina, November-December 2011.

Raynaud, E., Sauvée, L., and E. Valceschini. 'Aligning Branding Strategies and Governance of Vertical Transactions in Agri-food Chains', *Industrial and Corporate Change*, (18:5), June 2009, pp. 835-868.

Raynaud, E., Sauvée, L., and E. Valceschini. 'Alignment between Quality Enforcement Devices and Governance Structures in the Agro-food Vertical Chains', *Journal of Management and Governance*, (9:47), 2005, pp. 47-77.

Rindfleisch, A. and J.B. Heide. 'Transaction Cost Analysis: Past, Present and Future Applications', *Journal of Marketing*, (61:4), October 1997, pp. 30-54.

Roberts, M.J. and N. Key. 'Losing Under Contract: Transaction-Cost Externalities and Spot Market Disintegration', *Journal of Agricultural and Food Industrial Organization*, (3:2), 2005, Article 2.

Rogers, E.M. and D.L. Kincaid. *Communication Networks: Toward a New Paradigm for Research*, The Free Press, New York, NY, 1981.

Rooks, G., Raub, W., Selten, R. and F. Tazelaar. 'How Inter-firm Co-operation Depends on Social Embeddedness: A vignette Study', *Acta Sociologica*, (43), 2000, pp. 123-137.

Sahin, F. and E.P. Robinson Jr. 'Information Sharing and Coordination in Make-To-Order Supply Chains', *Journal of Operations Management*, (23), 2005, pp. 579-598.

Sanchez, R. 'Integrating Transaction Costs Theory and Real Options Theory', *Managerial and Decision Economics*, (24), 2003, pp. 267-282.

Sanchez, R. 'Demand Uncertainty and Asset Flexibility: Incorporating Strategic Options in the Theory of the Firm'. In N. Foss and V. Mahnke (Ed.), *Competence, Governance and Entrepreneurship*, Oxford University Press, New York, NY, 2000.

Sauvée, L.C. 'Efficiency, Effectiveness and the Design of Network Governance', Paper presented at the 5th International Conference on Chain Management in Agribusiness and the Food Industry, Noorwijk aan Zee, The Netherlands, June 2002.

Schmitz, P.W. 'The Hold-Up Problem and Incomplete Contracts: A Survey of Recent Topics in Contract Theory', *Bulletin of Economic Research*, (53:1), January 2001, pp. 1-17.

Schulze, B., Spiller, A. and L. Theuvsen. 'A Broader View on Vertical Coordination: Lessons from German Pork Production', *Journal on Chain and Network Science*, (7), 2007, pp. 35- 53.

Scitovsky, T. 'Two Concepts of External Economies', *Journal of Political Economy*, (62:2), April 1954, pp. 143-151.

Shervani, T., Frazier, G. and G. Challagalla. 'The Moderating Influence of Firm Market Power on the Transaction Cost Economics Model: An Empirical Test in a Forward Channel Integration Context', *Strategic Management Journal*, (28), 2007, pp. 635-652.

Simon, H.A. *Models of Man: Social and Rational. Mathematical Essays on Rational Human Behavior in a Social Setting*, John Wiley & Sons, New York, NY, 1957.

Smith DeWaal, C. 'Safe food from a consumer perspective', *Food Control*, (14), 2003, pp.75-79.

Sporleder, T.L. and P.D. Goldsmith. 'Alternative Firm Strategies for Signaling Quality in the Food System', *Canadian Journal of Agricultural Economics*, (49), 2001, pp. 591-604.

Theuvsen, L. and A. Spiller. 'Perspectives of quality management in modern agribusiness'. In L. Theuvsen, A. Spiller, M. Peupert and G Jahn (Ed.), *Quality Management in Food Chains*, Wageningen Publishers, Wageningen, The Netherlands, 2007.

Thompson, J.D. *Organizations in Action: Social Science Bases of Administrative Theory*, McGraw-Hill, New York, NY, 1967.

Tomek, W. G. and H.H. Peterson. 'Risk Management in Agricultural Markets: A Review', *The Journal of Futures Markets*, (21:10), November 2001, pp. 953-985.

Tomlin, B. 'On the Value of Mitigation and Contingency Strategies for Managing Supply Chain Disruption Risks', *Management Science*, (52:5), May 2006, pp. 693-657.

Trienekens, J., Nijhoff-Savvaki, O., Wognum P. and M. Wever. 'Developments and challenges in the European pork sector'. Paper presented at the IAMA Symposium, Monterey, CA, 2008.

Trienekens, J. and P. Zuurbier. 'Quality and safety standards in the food industry, developments and challenges', *Int. J. Production Economics*, (113), (2008), pp. 107-122.

Trienekens, J.H. and J.G. Van der Vorst. 'Traceability in Food Supply Chains'. In P.A. Luning, F. Devlieghere and R. Verhé (Ed.), *Safety in the Agri-Food Chain*, Wageningen Academic Publishers, Wageningen, The Netherlands, 2006.

Trigeorgis, L. 'Making use of real options simple: An overview and application in flexible/modular decision making ', *The Engineering Economist*, (50:1), (2005), pp. 25-53.

Turvey, C.G. 'Managing Food Industry Business and Financial Risks with Commodity-Linked Credit Instruments', *Agribusiness*, (22:4), 2006, pp. 523-545.

Uzzi, B. 'Embeddedness in the Making of Financial Capital: How Social Relations and Networks Benefit Firms seeking Financing', *American Sociological Review*, (64:4), August 1999, pp. 481-505.

Uzzi, B. 'The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect', *American Sociological Review*, (61:4), Augustus 1996, pp. 674-698.

Van Hengel, M. and K. Knot. 'How to reconcile public risks and private interests in the banking industry'. In E. F. Wubben (Ed.), *Institutions and Regulation For Economic Growth? Public Interests versus Private Incentives*, Edward Elgar Publishing, Cheltenham, United Kingdom, 2011.

Van de Ven, A.H., Delbecq, A.L. and R. Koenig Jr. 'Determinants of Coordination Modes within Organizations', *American Sociological Review*, (41:2), April 1976, pp. 322-338.

Van der Vorst, J.G. and A.J. Beulens. 'Identifying Sources of Uncertainty to Generate Supply Chain Redesign Strategies', *International Journal of Physical Distribution & Logistics Management*, (32:6), 2002, pp. 409-430.

Van Plaggenhoef, W. *Integration and self regulation of quality management in Dutch agri-food supply chains*, Wageningen Academic Publishers, Wageningen, The Netherlands, 2007.

Voß, S. and G. Schneidereit. 'Interdependencies between Supply Contracts and Transaction Costs.' In: S. Seuring and M. Goldbach (Ed.), *Cost Management in Supply Chains*, Physica-Verlag, New York, NY, 2002.

Voeth, M. and U. Herbst. 'Supply Chain Pricing: A New Perspective on Pricing in Industrial Markets', *Industrial Marketing Management*, (35), 2006, pp. 83-90.

Wallenburg, C.M. 'Innovation in Logistics Outsourcing Relationships: Proactive Improvement by Logistics Service Providers as a Driver of Customer Loyalty', *Journal of Supply Chain Management*, (45:2), April 2009, pp. 75-93.

Webster Jr., F.E. 'The Changing Role of Marketing in the Corporation', *The Journal of Marketing*, (56:4), 1992, pp. 1-17.

Wever, M., Wognum, P.M., Trienekens, J.H., Omta, S.W.F. 'Supply Chain-Wide Consequences of Transaction Risks and their Contractual Solutions: Towards an Extended Transaction Cost Economic Framework', *Journal of Supply Chain Management*, January 2012, (48:1), pp. 73-91.

Wever, M., Wognum, N., Trienekens, J. and O. Omta. 'Alignment between Chain Quality Management and Chain Governance in EU Pork Supply Chains: A Transaction-Cost-Economics Perspective', *Meat Science*, (84), 2010, pp. 228-237.

Whinston, M.D. 'On the Transaction Cost Determinants of Vertical Integration', *The Journal of Law, Economics and Organization*, (19:1), 2003, pp. 1-23.

White, L.J. 'The Credit-Rating Agencies and the Subprime Debacle', *Critical Review*, (21:2/3), 2009, pp. 389-399.

Wilhelm, M.M. 'Managing coopetition through horizontal supply chain relations: linking dyadic and network levels of analysis', *Journal of Operations Management*, (29), 2011, pp. 663-676.

Williams, S.P. 'Intercompany Investments.' In T.R. Robinson, J.H. van Greuning, R. E. Henry and M.A. Broihahn (Ed.), *International Financial Statement Analysis*, John Wiley & Sons Inc., Hoboken, NJ, 2009.

Williamson, O.E. 'Outsourcing: Transaction Cost Economics and Supply Chain Management', *Journal of Supply Chain Management*, (44:2), April 2008, pp. 5-16.

Williamson, O.E. 'The Theory of the Firm as Governance Structure: From Choice to Contract', *The Journal of Economic Perspectives*, (16:3), Summer 2002, pp. 171-195.

Williamson, O.E. 'Strategy research: Competence and Governance Perspectives.' In N. Foss and V. Mahnke (Ed.), *Competence, Governance and Entrepreneurship*, Oxford University Press, New York, NY, 2000.

Williamson, O.E. Theories of economic organization: the case for candor, *The Academy of Management Review*, (21:1), 1996, pp. 48-57.

Williamson, O.E. 'Comparative Economic Organization: The Analysis of Discrete Structural Alternatives', *Administrative Science Quarterly*, (36:2), June 1991, pp. 269-296.

Williamson, O.E. 'Corporate Finance and Corporate Governance', *The Journal of Finance*, (43:3), July 1988, pp. 567-591.

Williamson, O.E. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, The Free Press, New York, NY, 1985.

Williamson, O.E. 'Credible Commitments: Using Hostages to Support Exchange', *The American Economic Review*, (73:4), September 1983, pp. 519-540.

Williamson, O.E. 'The economics of organization: The Transaction Cost Approach', *The American Journal of Sociology*, 87 (3), 1981, pp. 548-577.

Williamson, O.E. 'Transaction-Cost Economics: The Governance of Contractual Relations', *Journal of Law and Economics*, (22:2), October 1979, pp. 233-261.

Wilson, W.W. and B. Dahl. 'Grain Contracting Strategies to Induce Delivery and Performance in Volatile Markets', *Journal of Agricultural and Applied Economics*, (41:2), August 2009, pp. 363-376.

Wognum, P.M. and M. Wever. Quality and coordination in supply chains – the case of pork chains in The Netherlands'. In K.D. Thoben, K.S. Pawar, R. Gonçalves (Ed.), *Proceedings of the 14th International Conference on Concurrent Enterprising. A new wave of Innovation in Collaborative Networks*, ICE, Lisbon, Portugal, 2008.

Xu, L. and B.M. Beamon. 'Supply Chain Coordination and Cooperation Mechanisms: An Attribute-Based Approach', *Journal of Supply Chain Management*, (42:1), Winter 2006, pp. 4-12.

Yin, R.K. 'Enhancing the quality of case studies in health services research', *HSR: Health Services Research*, (34:5), December 1999, pp. 1209-1224.

Yin, R.K. *Case Study Research: Design and Methods*, (2nd Ed.), SAGE Publications, Thousand Oaks, CA, 1994.

Yin, R.K. 'The case study crisis: some answers', *Administrative Science Quarterly*, (26:1), March 1981, pp. 58-65.

Ziggers, G.W. and J.H. Trienekens. 'Quality Assurance in Food and Agribusiness Supply Chains: Developing Successful Partnerships', *International Journal of Production Economics*, (60-61), 1999, pp. 271-279.

Zylbersztajn, D. and S.G. Lazzarini. 'On the survival of contracts: Assessing the Stability of Technology Licensing Agreements in the Brazilian Seed Industry', *Journal of Economic Behavior & Organization*, (56), 2005, pp. 103-120.

Zylbersztajn, D. and E.M. Farina. 'Strictly Coordinated Food-Systems: Exploring the Limits of the Coasian Firm', *International Food and Agribusiness Management Review*, (2:2), 1999, pp. 249-265.

APPENDIX A

INVENTORY PROTOCOL⁹⁹

1. Aim and Set-up of the Inventory¹⁰⁰

The aim is to achieve a thorough insight in different (types) of pork chains throughout Europe and to define major bottlenecks and opportunities for these chains to be tackled by future R&D programmes.

The inventories take place in four steps:

1. General description of the pork sector in your country
2. Analysis of selected chains/cases
3. SWOT analysis
4. Comparison and bundling of inventories from different countries and identification of research topics

2. Choice of Experts per Country:

Assignment

Assignment

Choose approximately 15 experts from *research, business and government* covering various aspects of the pork chain as identified below (Additional aspects may be taken into account). The aim is to arrive at a balanced representation of experts with different knowledge fields, functions and views on the pork sector in your country. Therefore, the number of experts chosen may differ per country.

Give a short description of organisation and function per expert and give good argumentation for your choice of these experts.

3. General Description of Pork Chains per Country

First 3-5 experts have to be selected with an overall insight in the pork chain of your country. They must deliver a basic overview of the sector and give input for the further selection of specific case chains.

⁹⁹ The general structure for the interviews with the experts and supply chain actors in the first case study phase are based on the document outlined in Appendix A (Sections 3-4 in particular).

¹⁰⁰ The protocol was largely developed by one of my co-promoters, Dr. Trienekens (Wageningen University). The protocol was developed to examine a broad range of issues, including topics like 'sustainability' and 'innovation'. Because the protocol is a very extensive document, only those parts of the protocol which have actually been used in the data collection and analysis of the results discussed in Study One are presented here.

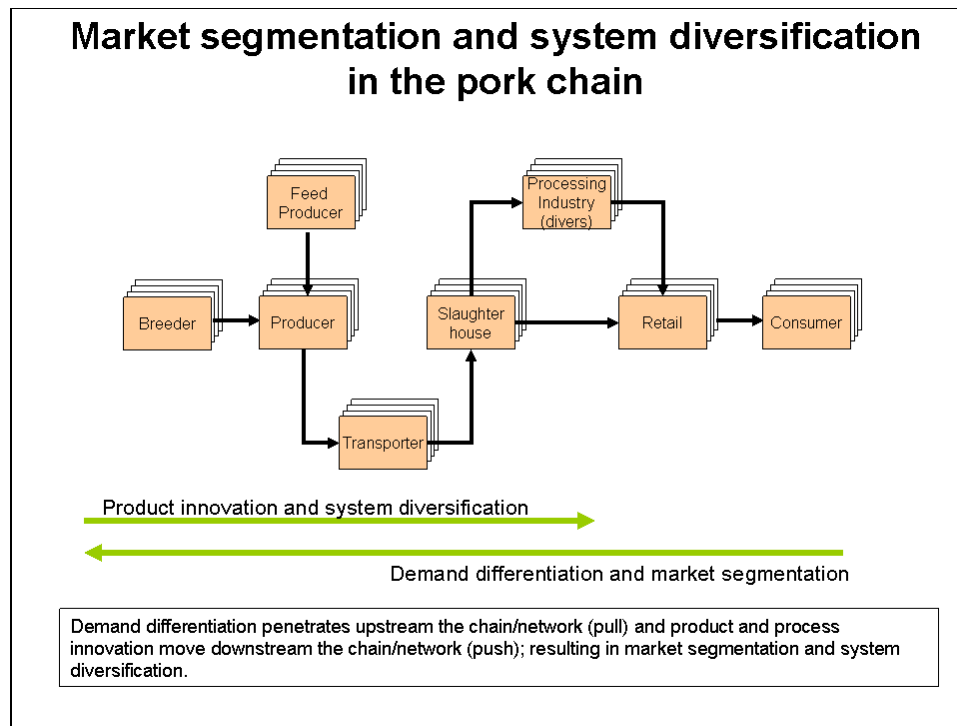


Figure 1. The pork chain

Figure 1 gives a basic description of the pork chain. An important starting point in our analysis is that there exist multiple production systems on the one hand and multiple market segments on the other hand, leading to various types of chains connecting these.

Assignment (use this as a structure for your expert interviews)

- Make a distinction between the different (types of) chains in your country
- Describe product-market combinations of different types of pork chains in your country (including products for export and imported products).
 - Describe also major developments in consumer demand in your country (regarding pork meat products).
- Describe for every link in these pork chains:
 - type of players.
 - include the industry and service sector (consulting, laboratories, advisors etc.) in your distinction as detailed as possible.
 - please also note the division in breeding (reproduction), piglet production, fattening (if existent)
 - are e.g. the butchers included in the retail link? And self-slaughtering
 - (estimated) number of players
 - value of export, import and domestic production
 - production volumes in each link (in particular breeder, producer and slaughterhouse)
 - type of production means and technology used in different links (in the context of the European ‘average’)
 - general information about type of investments in the sector and the subsidising system
 - description of input-output-process of each link including throughput times of processes (excluding processing industry and retail)

- short description of most important companies and their market share
 - butchers in the slaughterhouses?

Try to use a figure alike the figure in appendix1 as a basis for your description!

- **ask the key experts for a SWOT analysis of the pork sector of your country!** (see also 5. “SWOT analysis” in this protocol)

Assignment

In your inventory a choice for two or three distinctive chain types should be made. Special attention, if applicable, should be paid to regional chains. The choice for these chains should be based on the interviews with the 3-5 experts and on secondary literature. Good argumentation of the final choice should be given by positioning the chosen chains in the context of the (total) pork sector in your country.

4. Description of Specific Pork Supply Chains (cases) in Your Country:

All questions/assignments below should be answered for the 2-3 selected pork chain types.

For initial answers to these questions approximately 10-12 experts from research, business and government should be interviewed. Thereafter companies should be visited to collect additional information.

!Please note that the structure of pork chains may differ across countries. If necessary, please adjust the below tables if you need to add or remove links/rows (e.g. divide Production in Piglet production and Fattening)!

4.1 Governance¹⁰¹

In table 1 (exchange dimensions in the pork chain) for every dimension the two extreme perspectives are given. Of course, it is very well possible that the chains in your country have an in-between perspective.

Assignment

Describe for every relationship between links in the selected pork chains (one table per chain) the exchange dimensions as given in table 1. *Give a thorough explanation of the tables filled in.* Describe also the degree of vertical integration.

Include, with respect to governance relationships, for every link-to-link relationship also an overview of

- major bottlenecks
- best practices
- major changes that have occurred in the last 10 years and expectations with regard to changes in the next 5 years (trend analysis).

¹⁰¹ The table for ‘Governance’ shown in Section 4.1 of this Protocol was used to: (1), generate data about the type of contracts used in the examined supply chains; and (2), to make a first ordering of the gathered data. Subsequently, the data was analyzed by means of the coding rules discussed in Section 3.2 of Chapter Two. Note that some of the terminology used in the Protocol, which was developed by a collective of researchers, is not completely consistent with the terminology used in the thesis (e.g., ‘governance’ instead of ‘contract’).

	<u>Purpose of exchange:</u> single transaction versus long-term relationship	<u>Nature of communication:</u> anonymous versus firm to firm	<u>Formality of exchange:</u> formal versus informal	<u>Type of contract:</u> classic (closed) versus relational (open)
Breeder- Producer				
Breeder- Veterinarian				
Feed producer- Producer				
Producer- Veterinarian				
Producer- Transporter				
Transporter- Slaughterhouse				
Slaughterhouse- Processor				
Processor- Retail				
Slaughterhouse- Retail				

Table 1: Exchange dimensions in the pork chain

4.2 Quality management and standards¹⁰²

Table 2 goes into the quality management used in various links in the pork chain. Quality standards are based on quality management. They can be national or international, public or private (please distinguish). Quality management is based on the Plan-Do-Check-Act cycle (PDAC-Cycle) following the spirit of *continuous* (quality) improvement (see ISO 9000:2000). Include also attention to audit tasks of public authorities.

Assignment

Fill in this table (one for each chain selected). *Give a thorough explanation of the tables you fill in.* Give, regarding quality management and standards, for every link also an overview of:

- major bottlenecks
- best practices
- major changes that have occurred in the last 10 years and expectations with regard to changes in the next 5 years (trend analysis)

Note: Have also a special look at the *quality management elements* in case of non-existing quality standards/ programs

¹⁰² The table for 'Quality managements and standards' shown in Section 4.2 of this Protocol was used to: (1), generate data about the type of quality management system used in the examined supply chains; and (2), to make a first ordering of the gathered data. Subsequently, the data was analyzed by means of the coding rules discussed in Section 3.2 of Chapter Two.

		What kind of quality management elements are used? ¹⁰³				
	Quality programs/ standards (*for national standards add general description as annex)	Plan quality objectives, hazard analysis	Do risk treatment, process control, quality handbook, training practices, etc.	Check types of internal and external audits etc.	Act define and implement corrective measures	Inspection and audit tasks of public authorities. (e.g. meat inspection)
Breeder						
Feed producer						
Producer						
Veterinarian						
Transporter						
Slaughterhouse						
Processor						
Retail						

Table 2 Quality management in pork chains

4.3 Regulations in the chains

Table 3 makes a distinction between various types of regulations/legislation in the pork chain: regulations regarding quality and safety, traceability, animal health and animal welfare, and environment (e.g. manure).

Assignment.

Specify in tables regulations in your country for the various links in the (selected) pork chain(s). *Give a thorough explanation of the tables you fill in.* Give, related to legislation/regulations, for every link also an overview of:

- major bottlenecks (e.g. what is the level of compliance to regulations/legislation; what are fines in case of non-compliance)

¹⁰³ Note that some of the terminology used in the Protocol, which was developed by a collective of researchers, may not be completely consistent with the terminology used in the thesis. For example, in the thesis the terms 'monitoring mechanisms' is used, while in the protocol the term 'audit type' is used. The terms have broadly the same meaning.

- major changes that have occurred in the last 10 years and expectations with regard to changes in the next 5 years (trend analysis)

	<u>Quality and safety</u> (incl. hygiene)	<u>Traceability</u>	<u>Animal health and</u> <u>animal welfare</u>	<u>Environment</u>
Breeder				
Feed producer				
Producer				
Veterinarian				
Transporter				
Slaughterhouse				
Processor				
Retail				

Table 3 Legislation/regulations in the pork chains

5. SWOT Analysis

To identify opportunities and threats for the pork sector in your country, a SWOT analysis should be performed, see figure 2.

Assignment

Make a SWOT analysis (with table and explanation) about the pork sector in your country and the selected chains (separate table for each chain)!

	Strenghts	Weaknesses
Opportunities		
Threats		

Figure 2 SWOT analysis of the pork sector in your country

APPENDIX B

Protocol for semi-structured interviews¹⁰⁴

Section A: Supplier Relations¹⁰⁵

Type of supplier(s)

What percentage of the fresh pork meat you market is sold under the <insert brand name of case> label?

From how many different suppliers do you annually source the pork meat that you market under the <...> label?

What type of supplier is your main supplier for the pork meat that you market under the <...> label?

- Slaughterhouse/processor__
- Trader/distributor/wholesaler__
- Internal supplier (or other company with which your firm has an equity relation)__
- Other (please specify)__

What percentage of your annual demand for <...> pork meat do you source from your main supplier?

How many years have you been sourcing <...> pork meat from this supplier?

Type of arrangement

In your relation with your main supplier, what method do you use?

- Written agreement__
- Verbal agreement__
- Other__

What is the duration of this arrangement?

- Output based agreement (please specify)__
- Time based arrangement (please specify)__
- Arrangement continues until cancelled by one of the parties__

Does the arrangement include a notice of termination period? (if so, please specify the period)

What terms are included in the arrangement (please mark an X next to the terms which are included):

- > Pre-agreed price__
- > Pre-agreed volume__
- > Delivery at a specify time of day or day of week__
- > Minimum quality standards of all deliveries__
- > Specific production practices__
- > Restrictions on supplier's choice of suppliers or other partners__
- > On-site inspections by retailer or other parties__
- > Inspection of supplier's records by retailer or other parties__

¹⁰⁴ Because the protocol is a very extensive document, only those parts of the protocol which have actually been used in the data collection and analysis of the results discussed in Study Two are presented here. The protocol's structure is based on various sources, in particular: Coronado (2010); and Van Plaggenhoef (2007).

¹⁰⁵ Similar questions were asked to respondents about their demand side relations. Thus, each respondent was asked the questions outlined in Section A of this document for both its supply and demand side transaction.

Appendix B

- > Clauses that define penalties if the terms of the contract are not fulfilled__
- > Procedures for dispute resolutions__
- > Product liability or other insurance requirements__
- > Credit provisions (or other types of financing arrangements)__
- > Technical assistance__
- > Other (please specify)__

Follow-up questions: ask respondent to provide details about each term (see topic list in Section D)

Section B: Brand Participation and Requirements

In order to participate in the <insert brand name of case> did you:

(See Section D for follow-up questions)

- Make investments in training of employees, equipment or production process__
- Obtain additional information about the brand's requirements from outside the company__
- Obtain technical assistance outside the company__
- Obtain credit/financing (for making the investments)__

How frequently are changes made to the following requirements of the <...>:

	More than once per year	At least once per year, but not more frequently	At least once every two years, but less than once per year	Less frequently than once every two years	No changes are made
Requirements of production process	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Requirements of inputs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Administrative requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Frequency of inspections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Focus of inspections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Costs of inspections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Whenever changes are made to the requirements of <...>, do you have to

(see Section D for follow-up questions)

- Make investments in training of employees, equipment or production process__
- Obtain additional information about the quality standard from outside the company__
- Obtain technical assistance from outside the company__
- Obtain credit/financing (for making the investments)__

Section C: Background information

Please obtain the following information about the company:

- Company output (e.g., annual finishing pig production, tonnage of meat etc.)__
 - Nr. of employees__
 - Type of company (proprietorship, partnership etc.)__
-

Section D: Topic list (for follow-up questions)

Details supplier arrangement

- Price-scheme:
 - Identify how many days before delivery the (base) price is determined__
 - Identify criteria for premiums/discounts (both product and market related criteria)__
 - Identify frequency of changes to criteria__
 - Is the supplier informed in advance of changes to the price-scheme? If so, how much in advance?__
- Volume requirements
 - Identify minimum/maximum volume requirements__
 - Identify allowed deviations from requirements__
- Scheduling process:
 - How far in advance is (possible) delivery planned__
 - Which party initiates contacts__
 - If delivery is required at a specific time of day or day of week, identify how strict this requirement is__
- Quality standards:
 - Identify minimum quality standards requested__
- Requirements of production practices: (not specified in quality standards)
 - Identify restrictions on choice of inputs__
 - Identify restrictions on production practices__
- Restrictions on choice of partners:
 - Identify supplier restrictions on choice of its own suppliers (i.e., second-tier suppliers)__
 - Restrictions on choice of other partners (please specify)__
- Inspection rights:
 - Identify monitoring mechanisms (e.g., on-site inspections) employed:__
 - Type of monitoring organization (e.g., counterparty or third-party):__
 - Frequency of monitoring__
- Dispute resolutions and penalties:
 - Identify procedures for dispute resolutions (e.g., third party arbitration)__
 - Identify types of penalties (e.g., financial)__
 - Identify when (formally) penalties should be enacted__
 - Identify if penalties are (frequently) enacted__
- Insurance requirements:
 - What type of insurances is the supplier/retailer required to have (e.g., product liability insurance)__
- Credit/financing provisions:
 - Does the supplier/retailer provide (trade) credit (or other types of financing)____
 - Does the agreement increase the supplier/retailer's access to other sources of credit (financing)____
 - If so, is credit (financing) provided on favourable conditions__
 - Is credit (financing) tied to the use of a specific type of inputs__
- Technical assistance:
 - Does the supplier have a dedicated technical help-service for retailers__
 - To what extent does the service provide advice and expertise__

Implementation/modifications to brand requirements

- Investments and sources of credit/financing
 - Identify the types of investments made to implement/adapt to changes in requirements:___
 - Identify the types of operational changes necessary to implement/adapt to changes in requirements:___
 - Identify the source of the credit/financing necessary for the investment (e.g., bank, supplier)___
 - Sources of information/assistance
 - Identify the types of information sources consulted (e.g., supplier)___
 - Identify the extent to which technical assistance was acquired in the implementation process___
 - Identify the extent to which information/technical assistance was useful___
-

ABOUT THE AUTHOR

Mark Wever (M.A., Radboud University Nijmegen) is a PhD candidate at the Management Studies Group of Wageningen University. He has worked as a guest researcher at Universidad Politécnica de Madrid (Department of Agricultural Economics and Social Sciences) and at Universidade de São Paulo (School of Economics, Business and Accounting). His research interests are in the area of institutional economics, in particular in the analysis of market failures and in the identification of the appropriate inter-organizational forms that can prevent them. Currently, he is studying how risks are transferred within supply chains and business networks as a result of misaligned incentive structures. Prior to his current position, Mr. Wever has worked at Shell Asset Management Company, ING and ITHAKA Marktanalisten. He is an affiliate member of the Chartered Financial Analyst (CFA) Society of The Netherlands and the CFA Institute (Charlottesville, VA).

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Completed Training and Supervision Plan



Name of the course	Department/ Institute	Year	ECTS (=28 hrs)
General part			
Governance	MG3S	2007	3
Economic institutions of agriculture	MG3S	2009	4
CFA study and examination program (level 1)	CFA Institute	2008	9
‘Alignment between governance and quality management in EU pork industry’	Presentation at 5th World Congress of Dry-Cured ham	2009	1
Mansholt-specific part			
Mansholt Introduction course	MG3S	2007	1,5
Work Shop Presentation Skills	WG3S	2009	0,4
PhD Research Proposal	MG3S	2008	5
Internship at foreign research institute	UPM, Madrid	2009	3
Internship at foreign research institute	USP, São Paulo	2010	3
‘Quality coordination in the pork sector: comparison between Brazil and Netherlands’	Presentation at 7 th International Pensa Conference	2009	1
Discipline-specific part			
CFA Study and Examination Program (level 2)	CFA Institute	2010	9
CFA Study and Examination Program (level 3)	CFA Institute	2011	9
Teaching and supervision activities (e.g. supervision of master thesis, course advanced Supply Chain Management)	MST, WUR	2008-2009	2
TOTAL			50,9

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