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Transparency dilemmas, information technology and alliances in agriculture and food industry

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Introduction

This working paper will present a detailed overview of transparency dilemmas in interorganizational forms of cooperation (*i.e.,* alliances) in Dutch agriculture and food industry. The overview of dilemmas and related alliance factors are based on a literature research and analysis of two collaborative transparency cases in Dutch agriculture and food industry. The occurrence of these transparency dilemmas can be partly explained by research on alliances in general and transaction costs economics theory in particular. This paper is one of the first attempts to investigate the nature of possible transparency conflicts in alliances. It provides practitioners with a concise overview of possible transparency dilemmas and some solutions to overcome these.

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Background

The Dutch agriculture and food industry is in transition. In recent years numerous projects and initiatives have started to define and create new competencies and new organizational forms to cope with increased competition on global and home markets (*e.g.* projects of klict, akk or lto). Traditional bases of competitive advantage (primarily low-cost production and economies of scale) are no longer viewed sufficient to cope with increased competition. Moreover, consumer preferences in Western-European markets have changed and place new demands on food quality, food safety, and food diversity. These developments have initiated a reorientation of companies in Dutch agriculture and food industry on their roles, activities and strategies. A major issue in this reorientation is the development of 'transparent' food supply chains and networks. A 'transparent' company or supply chain is able to provide relevant stakeholders, customers and consumers with reliable information about the quality, the production methods used, the inputs used and other characteristics of the food product and its production and distribution processes. A transparent company is, for instance, able to provide consumers with reliable answers to what the origin of the product is, which ingredients are used, what quality standards have been applied, and so on. The need for transparent food supply chains stems from, amongst others, the increased consumer concern with food safety, caused by large food safety incidents in recent years (BSE, dioxin contamination, MPA, Nitrofen, classical swine fever) in Dutch and European agriculture and food industry. Not only food safety is an important consumer concern, but also animal welfare, fair trade and environmental friendliness. These characteristics of food products are difficult to asses by consumers on the basis of the observable properties of the products (form, colour, taste, smell, etc.). Hence, consumers depend on information that is included with the product about animal welfare, production methods, and quality standards and labelling. Consumers demand that this information is reliable and controllable. These and other consumer concerns are adopted and formalized by most large retailers. In Europe and the USA retailers clearly voice their views and demands with respect to required quality, safety and integrity (Beulens, 2003). Examples of formalized food safety requirements and protocols are the Eurep-GAP and British Retail Consortium (BRC) demands. A large impulse to the development of these protocols has been the Global Food Safety Initiative (GFSI).

The development of transparent food supply chains and networks is not only relevant to regain trust from consumers and retailers; it also enables companies in food supply chains to execute business processes more efficiently and effectively. Being able to trace the flow of batches of products and raw materials through the supply chain enables companies to recall suspected batches when quality or safety incidents have occurred. This can be done both proactively and reactively. Hence, companies are able to (pro-actively) limit the possible damage of food safety and quality incidents. Moreover, the increased availability of information about product quality and other product and process characteristics in transparent supply chains and networks enables companies to identify 'weak' aspects of products and processes and hence, improve overall product and process quality. The development of transparent food supply chains and networks is not only a 'defensive' response to increased consumer concerns and demands; it is also viewed

as an 'offensive' strategy to improve the quality of products and processes and to enable product and process innovation.

Problem analysis

Most 'transparency' projects focus on the development and implementation of supply chain or network wide information systems. In these systems information from different actors in the supply chain or network about product and process related characteristics is stored and can be retrieved by relevant stakeholders. Hence, very different actors make use (access, search, store, retrieve, exchange, etc.) of these information systems. These interorganizational systems (IOS) are information and communication technology based systems that transcend legal enterprise boundaries (Kumar & van Dissel, 1996). This implies that companies that make use of (or develop) IOS have to cooperate and coordinate their activities more closely than they used to do. The level of cooperation and coordination goes beyond the level of the traditional arms-length relationship that exists between companies acting as free-agents in a market (Kumar & van Dissel, 1996). However, the relationship between cooperating companies is in most cases not as tightly coupled as in vertically integrated hierarchies. Organizational forms such as these, that exist in between market and hierarchy forms, we call alliances. Alliances refer to inter-firm cooperation aimed at joint competitive advantage, in which partners remain independent and take risks individually (de Man & Duysters, 2002; Gulati, 1998; Hamel, 1991). Hence, we can state that the development and use of IOS are embedded in alliances or are part of alliances between companies. These alliances are not only restricted to bilateral cooperation (cooperation between two independent companies) but also concern cooperation between multiple companies in for instance, supply chains, buyer or supplier groups, standardisation consortiums and so on. Alliances can be organized and governed in very different ways. A distinction can be made between equity and non-equity forms of governance in alliances (Hagedoorn, 1993). And organizational forms range from equity joint ventures, to R&D consortia, to longer-term joint marketing and sales contracts, and to collaborative supply chain planning and forecasting programs (Hagedoorn, 1993; Gulati, 1998); Doz & Hamel, 1998).

From literature and from practice we know that increased transparency and collaboration in supply chains and networks can contribute to the performance of the supply chain and business network. Pointing out the promising aspects of IOS and collaboration is of course important. However, we also know that collaboration itself is difficult and that a large part of alliances fail (Hagedoorn, 1993; de Man & Duysters, 2002; Larsson *et al*, 1998). One of the common difficulties concerns how partners cope with combined competitive and cooperative behaviour of the partners of the alliance. Especially in large IOS with multiple users, it is common that users are also market competitors to each other, and hence cooperation is not the most obvious thing to do.

We also know that increased transparency can be feared by relevant actors in supply chains and networks (van Dorp *et al.*, 2002; Heimeriks *et al.,* 2002). Actors in supply chains and networks not only see possible

benefits of transparency but also risks and pitfalls. Actors are confronted with transparency dilemmas in which trade-offs between benefits and risks have to be assessed. Increased information availability and exchange in supply chain and networks between actors contain risks for the involved parties. Parties fear loss of control of strategically sensitive information. Or, they fear the consolidation of dominance by large partners that control the developed IOS (Kumar & van Dissel, 1996). Moreover, increased information accessibility through centralized databases and systems (independent of time and place) can be threatening to parties that traditionally were sources and providers of information. Hence, increased information availability and accessibility can result in wanted, but also unintended changes in the strategic roles and activities of actors in supply chains and networks.

Companies in Dutch agriculture and food industry are confronted with both positive and negative consequences of transparency in supply chains and networks. In the alliances and projects that have been set up during recent years, companies have tried to limit or solve the potential negative consequences of transparency while enabling the positive aspects of it. In this working paper we will try to clarify the issues surrounding these transparency dilemmas in alliances. We will try to define in which situations transparency dilemmas have occurred and what the source of the dilemma was. To analyze these dilemmas we will make us of recent theory and literature about cooperation and information sharing in alliances (more specifically transaction cost economics). In the next paragraphs we will summarize our main findings with respect to recent research and literature on transparency and alliances. After that, two cases are analyzed and relevant transparency dilemmas will be explored. In the final paragraph our findings will be confronted with former research findings and new elements will be summarized.

Research on transparency

Transparency is a relatively new concept in organization science and management studies. This means that relatively little research has been done on this specific construct and a final definition has not yet been developed. To get a grasp of what is meant by for instance 'transparency' or 'transparent supply chains' we will discuss different definitions of transparency. We will try to identify common aspects and elements of transparency and elaborate on the aspects we will address in this paper. About four different definitions can be found in recent literature:

1) Transparency of a netchain is: "...the extent to which all the netchain's stakeholders have a shared understanding of, and access to, the product related information that they request, without loss, noise, delay and distortion..." (Hofstede, 2002).
2) Value transparency is "...the creation, nurture, and delivery of value, for the benefit, and thus continued existence of both parties…value transparency goes beyond the bilateral sharing of sensitive information and involves managed risk for both parties..." (Lamming *et al.,* 2001).
3) Relationship transparency is "... an individual's subjective perception of being informed about the relevant actions and properties of the other party in the interaction..." (Eggert & Helm, 2003).

4) Transparency refers to "...the learning opportunity that each partner affords the other, either intentionally or inadvertently…receptivity refers to the capacity of each partner to absorb the others know-how..." (Doz & Hamel, 1998; Hamel, 1991).

Based on these definitions we can determine some common characteristics:

a) Transparency refers to a *system*; transparency refers to *a netchain*, to a *relationship*, or to a *partner*.
b) Transparency is *subjective* and *interpreted* by the *observer of the system*; transparency refers to the understanding and access of *stakeholders,* and it refers to *individual's* subjective perception.
c) The level of transparency can be influenced by the observed system itself; the stakeholder *is granted access* to information, the observer *is informed about*, and *a partner affords the other* a learning opportunity.

As can be seen in our analysis of former definitions of transparency, the actual level of transparency is determined by the observer of a system. The observer compares the information about properties of the system he/she actually acquires, with the necessary information he/she wants for specific reasons. This means that only the observer can declare that a system is 'transparent' in his/her view. The actual realisation of a certain level of 'transparency' is of course also influenced by the system itself. The system has to be able to communicate about its system properties. It needs means of communication with observers and it has to be able to provide descriptions and information about its properties. Of course it then has to know in which system properties an observer is interested. Moreover, the system has to be willing to provide observers with the necessary information about its system properties. A system can actively limit the amount of information it is prepared to communicate to observers. Based on these general characteristics of transparency we conclude that the level of 'transparency' is dynamically constructed in the interaction between system and observer. Hence, the level of transparency can continuously change, dependent on changes in the observer's reasons and the ability and willingness of the system to provide information to satisfy observer's needs.

In our analysis of former transparency constructs we place particular emphasis on the 'willingness' of the observed system to provide the observer with relevant information. In the competitive environment of companies in agriculture and food industry this aspect is important. Although most parties and stakeholders in this context acknowledge the relevance of providing information about product and process characteristics (Beulens, 2003; van Dorp *et al.*, 2002) as showed in the background section of this paper, in practice not all parties are actually willing to do so. Managers concerned with transparency projects and the development and implementation of IOS will continuously try to strike a balance between the required efforts to provide information and the realized cost, benefits and side-effects of this

provision. They will continuously make assessments of possible risks and also search for new business opportunities. Hence, we can state that the realisation of a certain transparency level between system and observer (*e.g.,* firm and stakeholder or buyer and supplier) is an ongoing negotiation process between system and observer.

This negotiation process between related parties and the continuous assessment of benefits, efforts, risks and opportunities concerning transparency projects, has received little research attention. Most publications address (information) technology solutions (*e.g.*, tracking & tracing systems, product coding, distributed databases, information reference models, EDI) to transparency issues (Beulens, 2003). We believe that research on strategic alliances, in which the negotiation and coordination process between independent firms is a central theme, could offer some interesting theoretical links to determine potential sources of conflict regarding the realisation of transparency. Hence, in the next paragraph we will address recent literature concerning information sharing in alliances (in supply chains and networks) and the development of IOS.

Interorganizational information systems (IOS) and alliances

This section will give an overview of some recent publications on the potential sources of conflict in the development and realisation of IOS. These interorganizational (information) systems are embedded in alliances between relatively independent companies. We will examine possible information sharing conflicts in alliances that have been identified in literature. Central theory we will use is transaction cost economics (TCE). TCE is one of the important theoretical frameworks which has been used to explain alliances and interorganizational forms of cooperation (Dyer, 1997; Kale *et al.,* 2001; Mohr & Sengupta, 2002; Nooteboom *et al.,* 1997). In the next section we will use these identified transparency dilemmas to analyse two business cases.

One of the more elaborate publications on collaboration between firms and the development and use of interorganizational information systems is that of Kumar & van Dissel (1996). They have developed a typology for characterizing IOS along dimensions of interorganizational interdependency and identify related risks of conflict. This typology classifies interorganizational systems in three types of OISs: pooled information resource IOS, value/supply chain IOS, and networked IOS. Their typology is inspired by traditional organizations research on coordination mechanisms between interdependent units. These different types of coordination mechanisms (type of interdependence) are: pooled interdependency, sequential interdependency, and reciprocal interdependency. With pooled interdependency units can execute tasks independently from each other, although they make use of the same information and use a common information infrastructure (*e.g.* shared databases). With sequential interdependency units are structurally dependent on each other. The output of the task of one unit is input to the task of another unit. Tasks and units are structurally linked to each other. This type of IOS occurs as a consequence of customer-supplier relationships and related business processes in supply chains (EDI, tracking & tracing,

continuous replenishment programs, POS data). Reciprocal interdependency denotes high interdependency between units. Tasks are executed by multiple different units and need inputs from multiple other tasks and units (Lazzarini *et al.*, 2001). This type of OIS supports for instance collaborative work (*e.g.,* joint R&D) between differently located units (*e.g.,* CAD/CASE data interchange and repositories, web-based virtual workplaces) (Kumar & van Dissel, 1996). For each of these types of OIS the authors have identified different sources of conflict. We will only elaborate on the IOS types pooled information resource IOS and value/supply chain IOS. The networked IOS type is less relevant to our problem statement as it primarily concerns systems for collaborative work teams.

The tragedy of the Commons

In their article Kumar & van Dissel (1996) refer to "The tragedy of the commons" publication of Hardin (1968) to define risks of the use of common or pooled information resources. The tragedy of the commons refers to the old England village commons, where a common piece of ground was held for use by everyone in the village. On this common ground villagers could hold their herds of cattle (Hardin, 1968). However, there are certain risks associated with the common use of commons. These risks and sources of conflict seem also applicable to the use of pooled information resources, according to Kumar & van Dissel (1996). Three risks are in this context relevant: the risk of contamination, poaching and stealing.

The risk of fouling or contamination in IOS occurs when one or more users are fouling the system with non-standard or corrupt data and transactions (Kumar & van Dissel, 1996). Because of this, the IOS will become inconsistent and will contain unreliable information. This will limit the effective use of the common information resource by other users. Purposefully damaging the IOS will in the end lead to a reduction in the number of users or even termination of the IOS.

The risk of poaching occurs when one of the participants diverts commonly held resources (IOS) for his/her own private use (Kumar & van Dissel, 1996). With respect to pooled information resources this could mean that a participant will use the IOS to monitor other participant's transactions or to collect and summarize information from the IOS to develop strategic information.

The risk of stealing occurs when one participant 'steals' away customers or strategic suppliers of other participants. Participants can monitor online transactions and database lookups to find out information about customers and suppliers of other participants (Kumar & van Dissel, 1996). These three sources of possible conflict are not only applicable to pooled information resources, but also apply to value/supply chain IOS. However, according to Kumar & van Dissel (1996) there are other and different sources of conflict in value/supply chain IOS that relate to transaction cost economies (TCE).

Transaction cost economics

TCE aims to integrate organizational and economic theory. This means TCE tries to identify economic arguments that determine organizational form. The basic premise of TCE is that the costs associated with an exchange between economic agents determine the organizational form (coordination, control, communication) between these agents. If transaction costs are relatively high vertical integration (integrated hierarchies) of the economic agents (or companies) is the obvious choice. If transaction costs are relatively low the market governance structure will be the obvious choice. Williamson as the most well-known contributor to transaction cost economics argued that mixed modes of governance (cooperative agreements) are preferred if asset specificity is intermediate (Williamson, 1975; Ouchi, 1980; Trienekens, 2002). TCE assumes that economic agents in these exchanges are likely to behave opportunistically when incomplete goal congruence exists between them. Transaction costs relate to the costs of managing the exchange relationship while keeping opportunistic behaviour under control (Kumar & van Dissel, 1996). Transaction costs include the costs of managing the exchange, costs of performance evaluation, costs related to safeguarding the relationship, and adaptation costs (Trienekens, 2002). The height of transaction costs is determined by the frequency of the transaction, uncertainty in the transaction (information asymmetry and performance measure ambiguity), and the asset specificity of the transaction. Although TCE theory has been criticized on the fact that its predictions of organizational form have not always been empirically confirmed (Gulati, 1998), TCE offers some interesting links to investigate potential transparency dilemmas in alliances. Kumar & van Dissel (1996) have worked out some risk aspects of TCE with regard to interorganizational information systems. We will elaborate on two of these risks in the case of value/supply chain IOS, namely: asset specificity risk and the risk of loss of resource control.

Asset specificity risk occurs when the investment in the relationship (and related IOS) by one of the partners has little or no value in uses other than in the specific relationship for which it was undertaken (Kumar & van Dissel, 1996). According to Williamson (1985: 54) "… specialized assets cannot be redeployed without sacrifice of productive value if contracts should be interrupted or prematurely terminated". Hence, the specific partner then has an asset specificity risk. If the other partners behave opportunistically and terminate the relationship, relationship specific investments are lost.

The asset specificity risk is for instance relatively high if a small number of independent companies in a supply chain want to develop a dedicated and specialized supply chain information system for their own use. If specialized investments are incurred companies become increasingly dependent on each other. This has a strong impact on the choice of contractual modes. Standard market contract could then well lead to very high contractual costs in order to prevent so-called 'hold-up' situations in which, one party could threaten to withdraw unless the contract is revised in a profitable way for this party (Williamson, 1979; 1985). The threat of 'hold up' situations becomes higher when transactions are recurrent. Under these conditions, the costs of setting up a bilateral governance structure (cooperative agreement) may well be

able to offset the costs involved in spot market contracting. However, under conditions of very high asset specificity, unified governance structures are often more efficient.

Loss of resource control risk occurs when resources are transferred as part of the transaction, and these resources cannot be returned or controlled in the event of termination of the relationship (Kumar & van Dissel, 1996). These resources are not like asset specificity; they do have value in other (future) transactions. Information and knowledge are resources that are difficult to control or return in the event of termination. Information that has been provided by one partner to other partners (and is stored in an IOS) can be used for all kinds of other reasons by these partners. Information can be easily distributed across different parties that reside outside of the span of control of the providing party. In this respect conflicts can occur concerning user rights and property rights of exchanged information. Moreover, if traditionally specific information was only available through specific parties (limited and controlled accessibility in space and time), the implementation of an IOS could lead to a loss of control for these parties, and could eventually lead to the bypass of these parties. The loss of resource control can lead to changing roles and activities among supply chain actors.

Above mentioned transparency dilemmas or sources of conflict concerning interorganizational information systems have been identified in literature (Kumar & van Dissel, 1996; Monge *et al.*, 1998). In the case analysis in the next section of this paper we will confront these dilemmas with practice. After that, we will evaluate the findings of the case studies and develop an integrated overview of transparency dilemmas. We have summarized the identified dilemmas or conflicts in table 1.

Table 1 *Preliminary overview of transparency dilemmas*

Transparency dilemma	Explanation
Risk of contamination	Purposefully damaging or fouling a common IOS by users with corrupt, inconsistent, or non-standard data.
Risk of poaching	Diverting commonly held resources (IOS) for private use and benefits.
Risk of stealing	Monitoring transactions of other participants on the IOS and stealing away their customers or suppliers.
Asset specificity risk	Caused by an investment in the relationship by one of the partners which has little or no value outside of the specific relationship.
Loss of resource control risk	Occurs when resources (*e.g.* knowledge and information) are transferred as part of the agreement, and when these resources cannot be controlled or returned in the event of termination of the relationship. Theses resources do have value outside of the specific relationship.

Case analysis

In this section we will analyze two business cases in which interorganizational information systems and transparency play an important role. One case study is done in retrospect, because it concerns an already finished transparency project in an egg and poultry supply chain sponsored by KLICT, called "MKB in V" (van Dorp *et al.*, 2002; Heimeriks *et al.*, 2002). The other case study concerns the actual developments of the NuTrace® supply chain information system of Nutreco in their pork supply chain. In the rest of this section we will talk about the "MKBinV"-case and the "NuTrace"-case. Both cases differ on several important characteristics as will be shown. This offers us the opportunity to investigate the occurrence and characteristics of transparency dilemmas in very different situations and contexts and to determine cross-case analogies. For the NuTrace-case we have held several in-depth interviews (2-3 hours) with the project manager of the NuTrace-system who was and is actively involved with the development, implementation and improvement of the system. He is currently involved with the investigation of more advanced applications of the NuTrace-system in the pork supply chain. For the MKBinV-case we have examined all relevant documents (reports, interviews, workshop reports) which have been generated during the execution of this project.

Transparency dilemmas in the NuTrace-case

The NuTrace -system has been developed in recent years by Nutreco N.V. for use in their different supply chains. Nutreco consists of many different companies in many different countries which can largely be divided in two focus areas, namely: aquaculture (fish production and processing, fish feed) and agriculture (animal production and processing, animal feed). The supply chain we will investigate in this analysis is the pork supply chain of Nutreco. Two large Nutreco companies play an important role in this supply chain: a Nutreco feed producer and a Nutreco meat processor (and breeding). Both these companies are fully-owned by Nutreco. This pork supply chain is not an integrated supply chain. This means that the pig farmers are relatively independent from the Nutreco meat processor and feed producer. They can choose to sell their products to non-Nutreco meat processors and can choose to source their feed from non-Nutreco feed producers. Most pig farmers work together with pig traders which trade (and distribute) the pigs to the meat processors. In figure 1 a part of the business network and pork supply chain of Nutreco is shown.

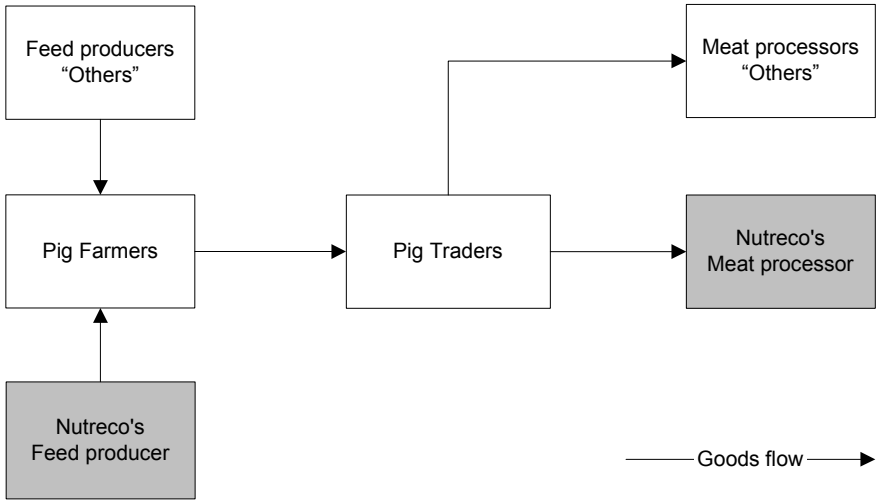

Figure 1 Part of Nutreco's pork supply chain

The NuTrace-system has been implemented in the Nutreco pork supply chain. The NuTrace system is developed to support four general supply chain processes, namely:

1. Quality certification – information about production, distribution and processing of pork and feed is stored and accessible to comply with necessary quality systems and standards.
2. Monitoring – information about production, distribution and processing of pork and feed is stored to monitor transactions, product quality and production efficiencies. In general this information can be used to improve quality and performance of the supply chain.
3. Risk Management - information about production, distribution and processing of pork and feed is stored to minimize the risks of food safety incidents.
4. Tracking & Tracing - information about production, distribution and processing of pork and feed is stored to be able to track and trace batches and products in the supply chain.

The NuTrace –system has been implemented in its basic form (quality certification support, monitoring, risk management and T&T) and is used by feed producers, meat processors, farmers and pig traders. Currently, some parties in the supply chain see new opportunities for the use of information that is stored in NuTrace. This concerns specifically the exchange of information about realized pork quality and the results of the slaughter process from the Nutreco meat processor to relevant parties in the supply chain. The feedback of quality information into the supply chain should lead to overall quality improvement, cost reduction and to better sales of pork meat. The meat processor views this as a big opportunity of the NuTrace –system to improve pork quality and achieve better sales results. However, although all parties in the supply chain agree that it is an interesting opportunity, there exist very different views among the parties as to how this should be realized. In this case analysis we will focus on the transparency dilemmas

that occur in this specific situation. We will give an overview of dilemmas (sources of conflict) that have been identified by the relevant parties in this case. After that, we will evaluate these dilemmas and confront them with those that have been identified in literature. In this case different parties perceive three different dilemmas. We have called them: conflicting roles, loss of comparative advantage, and the risk of increased competition. We have also investigated the relevance of the dilemmas that have been found in literature. We will address all of these dilemmas in the next sections.

Conflicting roles

Information from the meat processor about the realized quality of the pork and the slaughter process results are of primary interest to the pig farmer. On the basis of this information the farmer can adjust production conditions and feed to improve quality and match the relevant criteria. Traditionally this information was made available to the pig trader who transferred this information to the farmer and concurrently gave him advice concerning feed and production management (as part of his trading service). Traditionally, the pig farmer also gets advice from the Nutreco feed producer regarding feed and feeding regimes. Giving advice about production management and feed is also an important aspect of the service activities of this feed producer. Both feed producer and pig trader view their advisory activities as important customer binding factors. The meat processor wants to make his quality and slaughter information available through the NuTrace –system. Both pig traders and feed producer are very interested to have this information. Being able to get reliable information in a fast way will help them to improve their advice to the pig farmer. Hence, both parties compete with each other for this information and for this specific advice service. The increased availability of reliable and fast information has thus revealed a role conflict in the pork supply chain and in the use of the NuTrace –system.

Loss of comparative advantage

The supply network of Nutreco is not a fully-owned network. This means that farmers are free to purchase feed from other feed producers and are able to sell pigs to other meat processors than that of Nutreco. At this moment a smaller part of the pig farmers that sell their pigs to the Nutreco meat processor source their feed from the Nutreco feed producer. A larger part of the pig farmers purchase feed from other feed producers. Consequently, when Nutreco's meat processor wants to improve pork quality in the supply chain (regarding feed) it will not only return quality and slaughter information to Nutreco's feed producer, but also to the other large feed producers that supply feed to the pig farmers. Hence, some of the functionalities and advantages of the NuTrace –system are also available to non-Nutreco companies. For the Nutreco feed producer this is a source of conflict; if other feed producers can have access to the same benefits, the comparative advantage of the NuTrace –system (and being part of Nutreco together with the meat processor) is reduced. Hence, some of the strategic benefits of the NuTrace –system are not exclusive to Nutreco companies. This is primary a consequence of the open arrangements that exist between the companies that can access the system (and are part of the supply

network of Nutreco). The pork supply chain is not a fully integrated supply chain, although some important actors are fully-owned by Nutreco.

Risk of increased competition

Although the Nutreco meat processor sees some specific advantages of giving feedback on quality and slaughter results to parties in the supply chain (farmers, traders, feed producers), it also fears increased competition. Because it will provide suppliers with detailed information about its quality evaluation criteria and related financial rewarding criteria, its suppliers are better able to assess which batches of pigs should be sold to the Nutreco meat processor and which batches should be sold to others. By giving more detailed and reliable information about evaluation and rewarding criteria traders and pig farmers are better able to optimize their sales strategy. Suppliers of the Nutreco meat processor could use the information to improve their quality, but could also use the information to search and explore other sales channels. For the Nutreco meat processor it is still unclear in which direction the behaviour of suppliers will develop.

The risks of contamination, poaching and stealing

In the discussion of the risks of contamination, poaching and stealing in common interorganizational information systems the interviewed manager of Nutreco argued that these risks are easily solved with information technology solutions. The activities of users can be logged and user do not have access to information that is not relevant to them. All other information is secured. Also Kumar & van Dissel (1996) have argued that most risks of common information resources are limited by the use of recent secure database technologies.

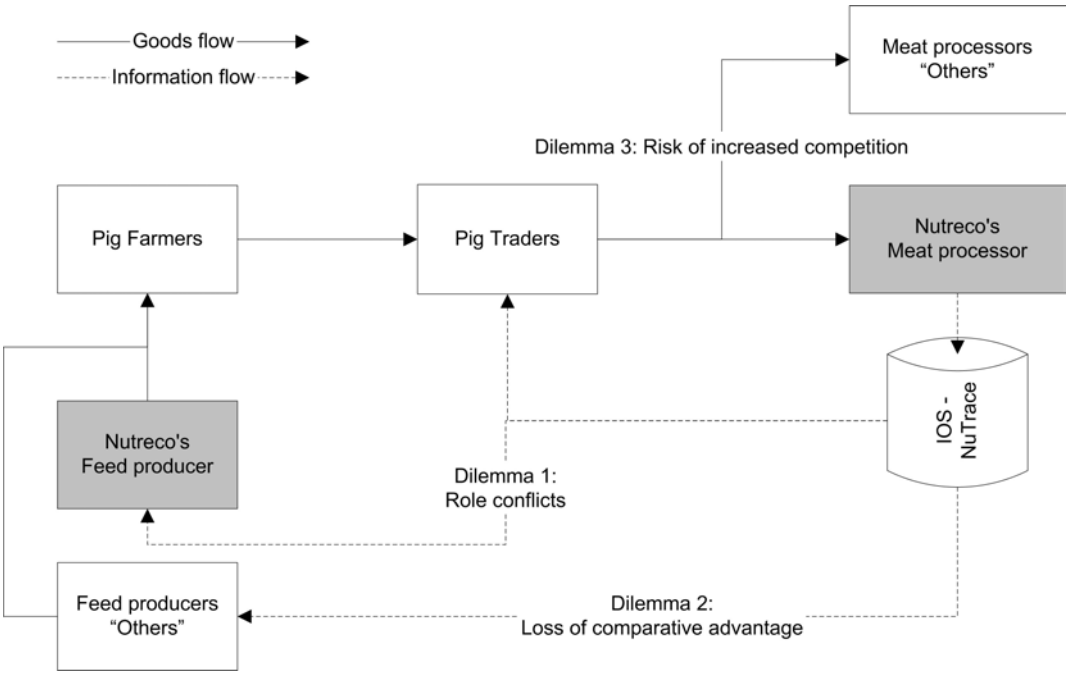

Figure 2 Transparency dilemmas in NuTrace case

The asset specificity risk

The asset specificity risk of the NuTrace –system has been relatively low for the Nutreco companies in this case. The system is developed for different Nutreco supply chains, and hence the general development costs are shared (only specific costs occur for a specific supply chain, when the system has to be adapted to this supply chain). The system has been developed by a large software developer in close cooperation with Nutreco. The system is not a fully customized job, but is build up from standardized components, which has reduced specific investments. Moreover, the software developer may resell the system (and its functionalities and components) to other interested parties. Hence, the total development costs can be earned back from different customers of the software developer. The specific development costs of the system for Nutreco and Nutreco companies could thus be lowered. Regarding other companies that are not part of Nutreco (such as the other feed producers in this case), these are able to make use of this system without large investments. If they sell feed to the pig farmer (that sells his pigs to the Nutreco meat processor), then they're asked to transfer relevant information about this feed to the NuTrace –system. They only have to account for a simple interface (XML-dump file) between their own proprietary information systems and the NuTrace –system.

The risk of loss of information control

The risk of the loss of resource control (in this case information about pork quality and slaughter results) is not a major concern for any of the relevant parties. The use of this information by the receiving parties (*e.g.,* pig traders) is monitored and unwanted uses of this information will be prohibited. If receiving parties still continue to use information for unwanted purposes (*e.g.* distributing it to competitors) they will lose their access and user rights.

Transparency dilemmas in the MKBinV –case

The MKBinV –case concerns a project between several parties in the egg supply chain who wanted to develop a shared supply chain information system and the necessary form of interorganizational cooperation (van Dorp *et al.*, 2002; Heimeriks *et al.,* 2002). The parties are all independent companies (not organized in a vertical integration or whatsoever) which are primarily connected to each other on the basis of buyer-suppliers relations. The parties are cooperating in this project to explore future collaboration and the development of an IOS. The different parties consist of two feed producers, two egg packaging and sales companies, an egg producer/farmer, two broiler houses/farmers, a hatchery, and two animal veterinaries. Hence, most important roles in the egg supply chain are represented in the project. Some parties fulfil the same roles and combined competitive and cooperative behaviour was suspected. In figure 3 an overview of part of the egg supply chain and the participants is given.

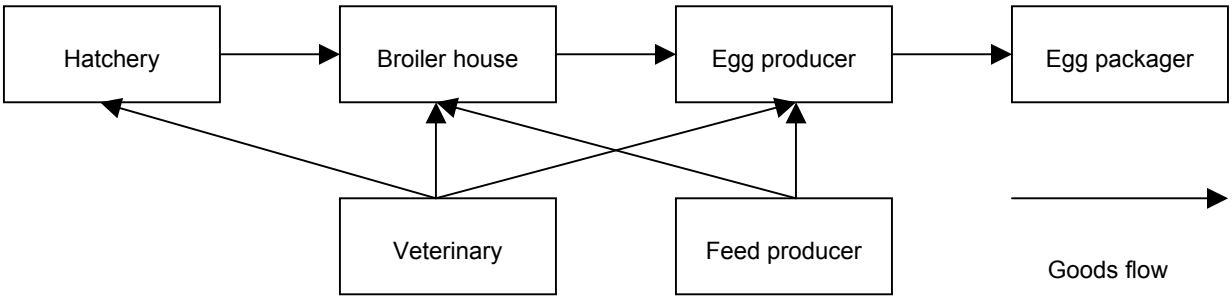

Figure 3 Overview of roles in the egg supply chain

Before the project started all companies had worked independently on the issues of transparency and information availability. All parties recognized that interorganizational collaboration was necessary to realized more transparency in their supply chains and business network. Before collaboration was possible the objectives and expectations of the different parties had to be aligned. Four different scenarios were developed (with different levels of ambition) on which the parties could collaborate (van Dorp *et al.*, 2002; Heimeriks *et al.,* 2002). These scenarios were:

I. Recall management: collaboration specifically focussed on the ability to incidentally recall unsafe food products in the supply chain. Primary functionality of the IOS is Tracking & Tracing.
II. Incident process control : collaboration specifically focussed on the ability to incidentally improve unsafe food production processes in the supply chain. Primary functionality of the IOS is Tracking & Tracing and the exchange of aggregated quality information
III. Structural innovation : collaboration specifically focussed on the ability to develop and market safe food products. No primary functionality of the IOS was defined.
IV. Process quality improvement : collaboration specifically focussed on the ability to continuously improve process quality and food safety. Primary functionality of the IOS is Tracking & Tracing, and the exchange of aggregated quality information and detailed quality information

Scenario I and II are primarily concerned with customer demands regarding quality certification and product liability. The parties have to comply with these demands, in the same way as all actors in the egg industry have to do. The participants view both these scenarios as minimal requirements to being able to continue competition in this industry. Primary benefit of these scenarios is that the participants are able to stay in business and reduce some of the administrative load of quality certification and tracking & tracing. Scenario III and IV go a step further regarding possible benefits. Structural innovation concerns the collaborative development and marketing of safe egg products. This should differentiate the eggs supplied by this network from other supplier-networks. Hence, cooperation is focused on an added-value strategy regarding food safety and other quality characteristics. Scenario IV is not focused on the development and marketing of new products, but is concerned with continuous supply chain process improvement. Primary

benefits of this scenario are product quality improvement, reduction of quality costs, improving production efficiency, and hence increasing the profit margin on eggs.

The participants decide to work out scenario I and II on the short-term and scenario IV on the longer-term. Scenario III was left out of the project. In working out scenario I and II (and investigating the consequences of IV) the participants of the collaborative project encountered several transparency dilemmas. We will address these dilemmas in the following paragraphs:

Risk of loss of autonomy

Although the participants agreed to develop scenario I and II, and in the end IV, they did not want to formalize the collaboration during the project. At a certain moment during the project it was suggested to develop a memorandum of understanding and principles in which the future cooperation was outlined. However, the participants did not want to sign this memorandum but instead wanted to rely on trust in the development of the scenarios. This could suggest that the levels of 'trust' between the participants were very high and sufficient to support the collaborative venture. It could also suggest that the participants were at that time not willing to give up part of their autonomy and flexibility, and hence were not prepared to commit themselves (both financially and formally) to the collaborative venture and development of the IOS. During the project it was frequently stated by different participants that 'remaining independent' was of primary importance. Moreover, although general agreement was reached on the content of the scenarios, participants found it difficult to asses the consequences of collaboration for their own company. This could have hindered the assessment of individual trade-offs between benefits and costs, and hence caused the reluctance to make individual commitments to the collaborative venture at that moment.

Risk of increased competition

One of the supplier-participants stated that "honesty doesn't always pay"; this refers to the situation in which batches of products do not completely comply to the quality demands of the buyer. In the situation of non-transparency this non-compliance would not directly be noticed, and rewards would be according to what has been agreed upon before the actual transaction. In the case of increased transparency non-compliance would be noticed immediately and hence rewards will be adjusted to this situation. Moreover, for buyers it is also easier to monitor and penalize suppliers in the case of defects or food safety incidents. Because of increased transparency buyers can identify more easily *liable* suppliers in the case of food incidents. The costs of a large food scandal can then be claimed on the liable supplier. Suppliers perceive this as a threat. In their perspective this could mean that the 'rewards' in a situation of increased transparency could be lower than in a situation of incomplete transparency. Otherwise said, buyers are better able to monitor and evaluate suppliers and transactions, and thus are better able to define appropriate rewards and penalties and optimize their purchasing strategy.

Risk of consolidation of dominance

Most participants in the project were against dominance of anyone of the other participants. Dominance of one of the parties had to be avoided during the project, but also during future collaboration and during the use of the to-be developed IOS. Some of the participants feared that if one of the participants was able to control (or own) the IOS, this participant could misuse its power to impose restrictions and changes to the use of the IOS. This was especially relevant to participants that fulfilled the same roles, as for instance the feed producers. Participants that were also competitors of each other, feared possible consolidation of dominance of one of the competing parties by means of the IOS.

Risks of contamination, poaching and stealing

The participants of the MKBinV are not concerned about the risks of contamination and stealing. The participants rely on secure database and internet technologies to solve these issues. The risk of consolidation of dominance could be interpreted as a certain risk of poaching (diverting common resources for personal use: to 'dominate' other parties). However, in common IOS the users are not able to formally own or control the IOS, as is the case in the MKBinV –project. Hence, strictly argued these risks are not the same. The risk of poaching we have mentioned in the former paragraphs is not of real concern to the participants of the project. The parties rely on information technology solutions to secure their information and transactions within the IOS.

Risks of asset specificity

During the project no real asset specificity risks occurred for the participants. The participants have not made (large) specific investments that were of little value outside of the collaborative relationships with the other participants. No specific investments have been made in the development of the IOS during the project, because no full-scale system has been developed and implemented during the project. This would have been done after the project had finished. Because we have no documents or data concerning the period afterwards the project, we cannot give a complete analysis of the risk of asset specificity. We will try to give an assessment of this risk on the basis of some issues that have been addressed during the project.

One of the objectives of the development of the IOS was to make it available to companies that are active in the business network and supply chains of the participants. The scope of the IOS regarding its use is larger than the group of participants of the project. Hence, the asset specificity of the IOS is reduced by making it available to a larger group of buyer-supplier companies. Hence, at a longer term the initial investments in the development of the IOS (and its exploitation) would not lead to a large asset specificity risk. However, we know that parties were hesitant to commit themselves both formally and financially to the collaborative venture. If we analyze this, we can argue that the asset specificity risk at the *shorter term* was instead relatively high. This can be explained by the fact that the number of users of the IOS at the initial stages of exploitation and implementation will be very low (consisting of the project participants

and some of their buyers and suppliers). Hence, in the initial stages of exploitation the asset specificity risk will be relatively high for the investing parties in the IOS. Only when the number of users of the IOS grows, the asset specificity risk will reduce. And this (the future number of users) was very difficult to assess at the development phase of the IOS, during the project. This uncertainty was also increased by the fact that there existed several other IOS-initiatives in the egg and poultry industry. For the participants (and their buyers and suppliers) it was uncertain which of these systems would become the largest system with the most users. For the participants this was very important because most of them (and their suppliers and buyers) were active in different supply chains and business networks. Hence, the participants needed an IOS that could be used in the main part of these chains and networks.

Based on this assessment of the asset specificity risk we can conclude that the asset specificity risk of the to-be developed IOS is relatively high at the shorter-term with a low number of users. And, that the asset specificity risk is reduced at the longer-term when the number of users increases. The risk is also reduced by *generic* system solutions, instead of highly customized information systems.

Risk of loss of information control

The risk of the loss of information control is an issue to some of the participants of the project. With some of the participants there existed the fear that proprietary information about quality and product characteristics and transactions would get available to competing parties. Information confidentiality is of concern to the participants (in the project a specific non-disclosure agreements has been signed by all participants regarding the project itself). The risk of loss of information control plays an important role for horizontally related participants. The two feed producers do not want that the other has insight in their product quality and ingredients. The specific recipes are proprietary information of the feed producers which determine in part the price of the feed product. If this information has to be exchanged with farmers and processors (buyers and suppliers), it could end up at competing parties through the buyer-supplier network.

Evaluation of results

In the former section we have analyzed two cases on the existence of transparency dilemmas. The dilemmas that already have been identified in literature (Kumar & van Dissel, 1996) are more or less relevant to the cases. We also have identified new transparency dilemmas which have not been explicated before. In this paragraph we will shortly evaluate the main results of the case analysis with respect to the sources of conflict identified by Kumar & van Dissel (1996) and in relation to transaction cost economics. The identified transparency dilemmas and their characteristics have been summarized in table 2.

In the research presented by Kumar & van Dissel (1996) several potential risks or sources of conflict in interorganizational systems have been explored. In our two cases part of these dilemmas have been found

relevant. The risks concerning stealing, contamination and poaching are less of concern to the actors in the cases. This could mean that most of these risks have been largely solved (or reduced) by software developers in their efforts to develop secure internet and database technology. However, this remains to be investigated. Based on our analysis we can only conclude that most actors and users of IOS trust the security of these systems. It could of course also mean that other risks and issues are of more concern to the actors in these supply chains and business networks.

From a transaction cost economics perspective the asset specificity risk and the risk of loss of resource (information) control are relevant to both cases. These risks are central issues in the organization and governance of the development, implementation and exploitation of interorganizational systems and the exchange relationships between the actors (as also argued by Kumar & van Dissel, 1996). In the case analysis we have viewed the investments by actors in an interorganizational system as investments in specific assets that enable the actors to continue business transactions with each other (relation-specific assets, *cf.* Dyer, 1997). These systems can be more or less specific to the transaction relationship. We have shown in the case analysis that the number of users (buyers and suppliers in the network or supply chain) is partly determining the asset specificity of the system. If this number is relatively high the specificity risk is low. If this number is relatively low and does not increase fast enough, the specificity risk remains high.

According to transaction cost economics additional safeguards and incentives have to be installed to reduce a high asset specificity risk (to limit the opportunism of actors). These safeguards and incentives concern for instance, contracts and monitoring, shared ownership, long-term perspective, reputation and reciprocal dependence (Nooteboom *et al.*, 1997; Williamson, 1985). Next to this, the development of trust between different actors will reduce the perceived risk of opportunism and specificity. Trust is associated with shared values and norms of proper conduct by the actors and bonds of friendship, kinship or empathy between the actors (Nooteboom *et al.*, 1997; Kale *et al.,* 2000). Within the MKBinV –case we see that although the actors 'trust' each other and the relationships between them are both economically and socially based, no legal and other safeguards have been installed to reduce potential opportunism. This could partly explain why no full-scale IOS has been developed by these actors (moreover, the initial individual investments would be very high relative to the size of these companies).

Closely related to the asset specificity risk and the necessary safeguards is the risk of 'loss of autonomy' as identified in the case analysis. The use of safeguards (contracts, monitoring, reputation, hostages) limits the autonomy and flexibility of the actors involved. It formalizes the dependence between the actors as caused by high asset specificity. We can argue that high asset specificity and the application of stricter safeguards can lead to a 'lock in' of the actors in the collaborative relationship. From the case analysis we can see that this risk of 'lock in' or 'loss of autonomy' is of central importance to different actors. Hence, the risk of loss of autonomy is related to the asset specificity risk, but is also different from it.

Table 2 *Transparency dilemmas*

Transparency dilemma	NuTrace case	MKBinV case
Risks of contamination, poaching and stealing	– Very low	– Very low
	– Reliance on secure internet and database technologies to reduce these risks	– Reliance on secure internet and database technologies to reduce these risks
Asset specificity risk	– Relatively low	– Relatively high on the short term – Relatively low on the longer term
	– Internal development – Large number of users at start (both Nutreco and non-Nutreco companies) – Simple, generic and low-cost interfaces with other information systems (also for the farmers) – Main users are fully-owned by Nutreco (feed and meat processor)	– Relatively high initial investments (SME) – Low number of users at start (only participants) – Uncertainty regarding growth of number of users – Competition with other systems – Participants active in many different supply chains and networks
Risk of loss of information control	– Low	– Medium
	– Monitoring procedures available – Partly integrated supply chain	– Limited safeguards (non-disclosure agreement) during project – No monitoring procedures – Very open business network – Loosely coupled actors
Risk of conflicting roles	– High	– Not identified
	– Increased information availability – Different actors are able to perform the same role	
Risk of loss of comparative advantage	– Medium	– Not identified
	– Partly integrated supply chain – IOS accessible by non-Nutreco companies – Information of strategic value to both Nutreco and non-Nutreco companies (product development and quality improvement)	
Risk of increased competition	– Medium	– Medium
	– Increased opportunities for monitoring and evaluation of rewards and transactions by suppliers – Increased opportunity to optimize sales strategy	– Increased opportunities for monitoring and evaluation of rewards and transactions by buyers – Increased opportunity to optimize purchasing strategy
Risk of loss of autonomy	– Not identified	– High
		– Higher interdependence between actors because of investments in development and exploitation of IOS – Traditional network is very loosely coupled and flexible
Risk of consolidation of dominance	– Not identified	– Medium
		– Competing actors within network and project – No agreement on ownership and control of IOS

With respect to transaction cost economics (TCE) and these cases an important remark has to be made. From a strict transaction cost perspective the implementation of an IOS (which enables doing transactions) could lower total transaction costs. Within TCE the concept of *information asymmetry* is important and closely related to the potential of opportunism. In TCE transaction costs are assumed to be zero because transactors have perfect information. Information asymmetry is necessary in order for transactors to behave opportunistically (Dyer, 1997). Increased information sharing on costs, production methods, technologies, or quality reduces the ability of actors to behave opportunistically. Hence, increased transparency should lead to lower costs of monitoring, contracting and enforcement (Dyer, 1997). We can identify this aspect also in the case analysis, but here it is addressed as a potential risk. The risk of 'increased competition' refers to the situation that buyers or suppliers are confronted with an increased ability of their transactors to monitor and evaluate the transactions with them. Hence, the ability of these buyers and suppliers to behave opportunistically is largely reduced. However, they perceive this aspect as a risk (!), although a more transparent situation reduces overall opportunism and increases trustworthiness of the supply chain or business network in totality. A possible explanation for the fact that actors perceive this as a risk is that in the case of a large food incident, liable suppliers can be more easily identified, and hence, can receive large financial claims.

With respect to transaction cost economics and the explored transparency dilemmas we conclude that the risk of loss of autonomy and the risk of increased competition can be partly explained by TCE. The risk of loss of autonomy is related to the asset specificity risk and applied safeguards. The risk of increased competition is related to reduced information asymmetry between transactors. Hence, increased transparency could lead to less opportunism and thus lower transaction costs in the supply chain.

In both cases we also identified transparency dilemmas that have not already been explored in literature and cannot be related to TCE or the theory of 'commons'. These are the risk of conflicting roles, the risk of loss of comparative advantage and the risk of consolidation of dominance. The risk of consolidation of dominance is partly mentioned by Kumar & van Dissel (1996) in relationship to the risk of poaching. However, in our definition this risk is centrally concerned with the ownership and control structure of the developed IOS. This risk can be perceived high by actors, if competing actors want to control or own this system. The risk of conflicting roles is apparent in most supply chains and business networks. Different actors can develop similar activities or fulfil similar roles (based on newly available information). This aspect will require attention in the development of the collaborative relationship or alliance. Parties are able to agree together on the distribution of certain activities and roles. However, not in every situation (or transparency project) new activities or roles can be foreseen. Actors are able to develop new activities or services based on supply chain information which has been unavailable before the implementation of the IOS. Hence, it is always possible that new role conflicts will arise between participants and alliance

partners. The risk of the loss of comparative advantage is centrally concerned with the question how actors can secure strategic benefits for themselves based on the use of 'open' or 'common' information resources. If all relevant actors can make use of the same information and information infrastructure, how are actors able to create and secure individual benefits from its use which are different from other actors benefits. It seems plausible that actors who are more efficient and effective in making *use* of the information gain more benefits from this information. In this perspective, the strategic benefits originate from information *usage* and related business processes and competencies, with the information availability as an important pre-condition.

In the next paragraph we will elaborate on some managerial implications of the above mentioned transparency dilemmas. A part of these implications has already been explored in this section. Hence, the next paragraph will be more concise.

Some managerial implications

We will try to define some preliminary managerial implications based on our former case analysis and evaluation. We explicitly state that these are preliminary because our analysis has been limited to two cases and only incorporates TCE. Our implications will be highly stylized as business practice will show a manifold of the options we suggest in this section. We will limit ourselves to the risks of asset specificity, the risk of loss of information control, and the risk of consolidation of dominance.

Regarding the asset specificity risk for collaborating actors that want to develop and exploit an IOS several strategies can be followed. To reduce the specificity risk it is necessary to have as many users as possible and to lower the initial individual investments (see the case of NuTrace). This means that actors have to able to engage in transactions with all relevant suppliers and buyers. All these suppliers and buyers should make use of the developed system. If this group is still rather small (as perceived by the investing actors) additional safeguards have to be applied. This means that collaborative contracts have to be set up, monitoring procedures have to be developed, and enforcement procedures have to be determined and executed (Nooteboom *et al*, 1997). To reduce the risks of asset specificity the specific investments can be shared between the relevant actors, and the actors have to commit themselves to sustained longer term interaction (Dyer, 1997; Dyer & Nobeoka, 2000; Nooteboom *et al*, 1997). Next to these mechanisms the actors could partly depend on the development of trust to reduce opportunism and the related specificity risk. Trustworthiness can be developed by developing relational capital and applying integrative conflict management (Kale *et al.*, 2000; Nooteboom *et al.*, 1997; Duysters *et al.*, 1999). Relational capital refers to mutual trust, respect and friendship at the individual level between alliance partners. It resides upon close interaction at the personal level (Kale *et al.*, 2000). Integrative conflict management entails joint management of conflict with mutual concern for 'win-win' situations for all concerned. It is a communicative and contact-intensive process with honest and open lines of communication. Organized

monitoring of concerns and conflicts leads to higher levels of procedural justice and trust (Kale *et al.*, 2000).

Above mentioned suggestions also apply for the reduction of the risk of the loss of information control, and of the risk of consolidation of dominance. The loss of information control can be partly compensated by the development of monitoring and enforcement procedures. This risk is also reduced by the development of trust and relational capital, next to contractual and financial arrangements. Consolidation of dominance can be issue of the negotiation process regarding the set up of contracts and safeguards. A priori, most important aspects of the change, user and access rights of the IOS can be negotiated and formalized. Moreover, the development of trust and relation capital reduces the risk of the misuse of power by controlling or owning parties.

Discussion and future research

The primary result of this research is the identification of several transparency dilemmas in supply chains and business networks in Dutch agriculture and food industry. Moreover, we are able to partly explain these dilemmas based on transaction cost economics and the theory of 'commons'. These results are of course exploratory (which was the objective of this research), but do give us new insights in possible conflicts between actors which are involved in transparency projects or make use of an IOS. This paper shows that the realisation of transparent supply chains and business networks have intended, but also unintended consequences. It shows that actors also behave opportunistically, are only bounded rational, and are only limited aware of side-effects of the use of IOS. Hence, although 'rational' management (design and control) of transparency in supply chains is often pursued, practice shows a more fuzzy picture in which contingencies, uncertainty and side-effects are equally important in the actual realisation of transparent supply chains and business networks.

Several issues, which we think are important, have not been addressed in this paper. Future research will have to investigate these issues in more detail. These issues concern the content of shared information, the technological mechanisms for safeguarding, and the design of access, user and property rights of information.

In our analysis we have only paid limited attention to the different contents of information that is exchanged between actors in IOS. In the NuTrace –case the content specifically concerned detailed quality information about slaughtered pigs. In the MKBinV –case the contents of information ranged from aggregated quality certification information to detailed information about feed quality and ingredients. It is worthwhile to explore the relationship between the content of information exchange and the occurrence of specific transparency conflicts in more detail. It seems plausible that the type of content (or level of transparency) and its related sensitivity partly explains the type of conflict that can emerge within an IOS. In this paper we have only addressed this in a very general way. Future research could

focus on the development of a classification of information content in relation to the transparency level and transparency dilemmas in supply chains and business networks.

Another important issue that is relevant concerns the technological mechanisms available to solve transparency dilemmas. This partly refers to the actual effectiveness and dependability of authorisation, validation and security information technologies, but also to 'logical' mechanisms such as information aggregation and differentiated information views. We have only paid limited attention to these types of 'safeguards' that could be in place to reduce the identified risks. In the case of IOS development and exploitation the safeguards are not only limited to social, legal or economic types, but also include technological mechanisms. It is interesting to investigate how these different types of safeguards are related and applied.

Next to these issues the legal aspects of IOS in supply chains and business networks is of great interest. During our case analysis and interviews we frequently noticed that actors were unaware of the legal status of their information sharing activities. In IOS situations it is more difficult to determine the ownership of information stored in the IOS. As information is stored, combined and retrieved by many different actors the property, user and access rights tend to get very fuzzy. In most cases this would not immediately lead to conflicts. However, in situations where actors develop new activities on the basis of information, or use information for their own purposes other than what had been intended, conflicts can easily arise (*e.g.,* risks of poaching or role conflicts). These legal issues are partly related to the development of contracts and other safeguards to limit opportunism and uncertainty. It is worthwhile to explore these legal issues in relation to other safeguards in more detail in future research.

In this paper we have explored different types of transparency dilemmas and have identified some theoretical explanations for their occurrences. These findings can be used to develop a more detailed management tool that can be used to guide transparency projects in supply chains and business networks. However, it is necessary to validate above mentioned results in more detail, in more cases. Moreover, it is necessary to investigate safeguards that have already been applied in practice to solve transparency dilemmas. In future research a more closer examination of the relationships between dilemmas and possible solutions has to be executed. We think this research paper is a good start to do this and a good start in the exploration of transparency conflicts in supply chains and business networks in Dutch agriculture and food industry.

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