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Theoretical Basics for Developing Business Information Systems for Jointly Managing Uncertainty, Communication, and Trust in Supply Chains

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ABSTRACT (REQUIRED)

Uncertainty is a major problem in any supply chain. Inventory and excess capacities used to cope with uncertainty are significant cost drivers. Advanced information systems have been employed to support information exchange along the supply chain and were successful in synchronizing supply and demand and downsizing inventories. However, close cooperation requires mutual trust as a basis. Current information systems do not specifically address this issue. This paper outlines the relation of uncertainty to communication and trust and sketches approaches for information systems to enable integrated process-oriented cooperation and trust management.

Keywords (Required)

Information Systems, Uncertainty, Communication, Trust, Supply Chain.

INTRODUCTION

Business information systems for production planning have evolved steadily during the last decades from Material Requirements Planning (MRP) to Manufacturing Resource Planning (MRP II) and finally to Advanced Planning and Scheduling Systems (APS) which are no more limited to planning a single location only. Coordinating plans across multiple facilities is in accordance with the assumption that not single companies, but entire supply chains are competing on the markets. In order to use information systems (IS) for close cooperation between companies, a sufficient level of trust has to be established first. The resulting combination of trust, open communication, and planning concepts helps to reduce uncertainty and realize benefits for all parties. Accordingly, the question arises how reaching this state can be supported by IS. In the following, first an overview of the underlying theories is given and then their interrelations with regard to how IS can be developed to actively assist trust-related processes are examined.

UNCERTAINTY IN SUPPLY CHAIN MANAGEMENT

Uncertainty is frequently referred to in Supply Chain Management (SCM) literature, but most often a definition is not given and the term is used in a colloquial sense, i.e. describing a lack of knowledge, especially about the future. Also, while several definitions of uncertainty do exist, e.g. from management science, no generally accepted definition has been found and some are even contradictory. This is surprising given the fact that uncertainty in supply chains and its importance for success is increasing due to diversified markets, increased competition, and global outsourcing.

Knight was one of the first to work on uncertainty in a business context. He differentiated the terms risk and uncertainty, the former being a measurable quantity and the latter a non-quantifiable phenomenon (Knight, 1921). This view has been criticized by others, most notably by Taleb who considered this distinction as artificial (Taleb, 2007). Tannert, Elvers and Jandrig outline a framework which considers risk and danger as two types of uncertainty related to “possible future events with known adverse outcomes”. Here, risk is an accepted or imposed threat whereas danger is a threat neither accepted nor imposed. Probabilities for risks are known whereas those for dangers are not. This description is based on the work of Luhmann (Luhmann, 1993). Some researchers (cf. Rao and Goldsby, 2009) also argue that risk does not solely apply to adverse outcomes but also to desirables ones, thus being an indicator of ignorance rather than of the possibility of harmful effects. We will adopt the view that uncertainty refers to future events for whose occurrence probabilities do not necessarily have to be known and that uncertainty can result in any kind of outcome.

One of the few definitions for uncertainty in supply chains is given by van der Vorst and Beulens (van der Vorst and Beulens, 2002): “Supply chain uncertainty refers to decision making situations in the supply chain in which the decision maker does

not know definitely what to decide as he is indistinct about the objectives; lacks information about (or understanding of) the supply chain or its environment; lacks information processing capacities; is unable to accurately predict the impact of possible control actions on supply chain behavior; or, lacks effective control actions (non-controllability)". This definition is appropriate as it translates the afore mentioned concepts to SCM terminology.

Sources of Uncertainty

Authors in SCM have used a variety of approaches to distinguish sources of uncertainty or risk. Geary et al. make a distinction between process, supply, demand, and control uncertainty (Geary, Childerhouse and Towill, 2002); Ritchie and Marshall use environmental, industry, organizational, problem-specific, and decision maker factors (Ritchie and Marshall, 1993); Ivanov and Sokolov use environmental uncertainty, human knowledge and decision-making uncertainty, and uncertainty of knowledge and conclusions of decision-support systems (Ivanov and Sokolov, 2009); and Wagner gives process and demand uncertainty (Wagner, 2009). Finally, Milliken uses three types of environmental uncertainty: state, effect, and response uncertainty (Milliken, 1987). State uncertainty describes the inability of a company to understand the actual state of affairs in its surroundings, i.e. their customers and suppliers in case of supply chains. Effect uncertainty describes the inability to assess the consequences of external developments on the own company. Response uncertainty denotes ignorance about the actions that are available to react to changes in the environment. This definition will be used in the following, because the focus is on uncertainties that stem from being part of a supply chain, i.e. environmental factors, and because it also fits well with the concept of mutual contingency.

Implications of Uncertainty

The foremost consequence of uncertainty is that it leads to buffers and inventory: "[...] inventory exists more or less as simple insurance against uncertainty" (van der Vorst and Beulens, 2002). If there was no uncertainty in supply chains, no robustness would be required as no exceptions and deviations occur and so the supply chain could be configured optimally. Or, as Geary et al. put it, "supply chain professionals spend their days reacting to uncertainty [...]" (Geary, Childerhouse, and Towill, 2002). Spare capacities are held available to make this possible in case of unforeseen demand peaks or a machine breakdown. Uncertainty therefore is a major cost driver.

In many cases, it is beneficial to respond to identified environmental uncertainties by intensifying the volume, frequency, or quality of data exchange between partners in the supply chain. However, it can be observed that more information also leads to new uncertainty. This phenomenon is called the Information Uncertainty Paradox (Becker, Beverungen, Delfmann and Räckers, 2011). Anyway, this is no panacea and might not even be an option as partners are often not willing to closely integrate and cooperate. In these cases, it is rather a matter of trust and not a technical problem that hinders the reduction of uncertainties. The active management of trust is therefore a fundamental element of cooperation in the supply chain.

TRUST AND COMMUNICATION IN SUPPLY CHAIN MANAGEMENT

Trust in Supply Chains

There is a large variety of different trust definitions in literature focusing on various aspects of trust and trust building. Laequddin, Sahay, Sahay and Waheed as well as Wilhelm overview different trust definitions (Laequddin, Sahay, Sahay and Waheed, 2010; Wilhelm, 2007). In management literature, trust is mainly defined as a risky advance action resp. input, which is done voluntarily, and without any contractual safeguarding or control mechanisms. Furthermore, it is assumed that the counterparty will voluntarily disclaim opportunistic behavior (Ripperger, 1998). This means that there are two parties involved when talking about trust – one trust-giving party and one trust-receiving party (Wilhelm, 2007). The trust-giving party initiates the trustful relationship and searches for a trustworthy counterparty (Schmidtchen, 1994). After the risky advance action of the trust-giving party, there must be a trustworthy return, otherwise the trustful relationship would fail. Anderson and Narus define trust as "[...] the firm's belief that another company will perform actions that will result in positive outcomes for the firm, as well as not to take unexpected actions that would result in negative outcomes for the firm (Anderson and Narus, 1990). This expectation is crucial for trust, as there is a time shift in the initiating trustful action and the reaction of the counterparty. The trust-giving party faces uncertainty regarding the behavior of its counterparty (Luhmann, 1973). Ripperger states that expectation itself is not sufficient for characterizing trust in an economic relationship; instead, trust is both, expectation and action. She postulates expectation (belief that the other party will not act in an opportunistic way) and action (advance provision of the trust-giving party) as the key characteristics of trust (Ripperger, 1998).

Trust can be built on different levels. One can trust in a person or an organization resp. company. These trust relations are based on different levels: trust between two individuals is based on a personal level, trust between two companies is based on a company level, and trust between an individual and a company is based on a system level (Winand and Pfohl, 2000). Generally, it is important to identify the level on which trust is built when analyzing trust relations (Zaheer, Mc Evily and

Perrone, 1998). In a supply chain, trust can be built on personal level, company level, and system level (Wilhelm 2007). On personal and company level, actors are either persons or companies. Swan, Trawick and Silva found out that in buyer-seller relationships trust is mainly built on the reputation of the seller or the selling company, which means positive information about the seller indicates trustworthiness to the buyer. (Swan, Trawick and Silva, 1985). With regard to the different trust levels, trust is often transferred from personal level to company level and reverse. If a buyer trusts a seller as an individual person, his or her trust will be carried over to the seller's company and the other way around (Doney and Cannon, 1997; Young and Wilkinson, 1989). Zaheer, McEvily and Perrone confirm a positive correlation of inter-personal and inter-company trust and state the more trust between two employees on a personal level, the more trust between the two companies they work for (Zaheer, McEvily, and Perrone, 1998).

As supply chains are established in order to cope with customer requirements in products and services, companies are forced to cooperate and therefore interact with other companies in order to create a product or service, which fits best to customer needs (Fladnitzer, 2006). Because interactions and reactions of the supply chain members are liable on several influencing factors, e.g. the behavior of markets as well as competitors, uncertainty regarding the behavior of cooperation partners arises. Luhmann identified mutual contingency in business networks, like supply chains. He defines mutual contingency as a situation in which one actor needs to orientate its actions to the actions of a second actor whereupon the second actor also orientates its actions to the action of the first actor. Even there is a pressure to act; it could happen that there is inability to act on both sides (Luhmann, 1984). Uncertainty arises because one actor does not know which option the other actor will choose. With regard to the three kinds of uncertainty mentioned above, mutual contingency could be considered as mutual state and effect uncertainty. In this context, trust enables the trustful actor to consider a future situation or act as a certain event; even there are different future events possible. If one actor trusts its counterparty, the actor acts like the result of the counterparty's decision-making would be for sure, although there is no sufficient knowledge about the counterparty's decision (Roettger and Voß 2007). Potential threats are neutralized, even when they cannot be controlled or mitigated entirely (Luhmann, 1973). Information, which is missing, incomplete, or too late for checking, require trust if cooperation partners should execute their actions in the intended way (Niederhaus, 2004). Trust enables acting while knowingly disclaiming information. In this case, trust replaces the need for more information. With reference to the Information Uncertainty Paradox, trustful relationships face the problem of having more uncertainty because of more information to a lesser extent than relationships without fully developed mutual trust, because the course of action of the partners is known from previous experiences and not solely judged on basis of factual information.

In supply chains three kinds of problems lead to uncertainty: organizational problems, coordination problems, and motivational problems. An organizational problem arises because processes for goods and services and information exchange about production outputs need to be organized in the network. A coordination problem is related to the efficient execution of processes, meaning which supply chain member does which task. Optimal allocation of tasks and reasonable integration of tasks serving the overall task are key aspects. Coordination in this context focuses on the competences of a supply chain member in fulfilling predefined plans. A motivational problem deals with the willingness of an actor to fulfill predefined plans meaning the will to serve the overall goal of a supply chain. The motivational problem mainly depends on the members' benefits from supply chain cooperation (Ripperger, 1998).

Besides the positive effects of trust, there are some negative aspects especially regarding the appropriate level of trust. In general, one can state that on the one hand trust reduces uncertainty but on the other hand is risky at the same time. Passing over too much information to the counterparty reduces notably the uncertainty concerning the cooperation partner's behavior, but generates the problem of future dependency. Very low and very high uncertainty is dysfunctional to trust creation. If there is little uncertainty, trust is not needed. If there is too much uncertainty, trust can be very costly in terms of investments in relational assets such as frequent communication. Under high uncertainty conditions trust can fail more easily respectively, opportunistic behavior is more likely. Accordingly, firms need to view the decision to trust a partner as one of strategic thinking (Adobor, 2006).

Interaction of Trust and Communication

The interdependency of trust and communication is discussed controversially in literature and cannot be determined ultimately. Further research needs to be done in order to identify the correlation of communication and trust. The question is whether communication is only possible with a certain level of trust or does trust depend necessarily on communication. Gilbert generally assumes a bidirectional process, which means that communication leads to trust and the other way around, trust leads to a better communication in terms of quality and quantity (Gilbert, 2003). According to him, communication is a starting point for the evolution of trust (Gilbert, 2003). Given some pre-conditions (see chapter "requirements for trust-building), trust arises as a consequence of a communication process and determines the communication process simultaneously (Hubig and Siemoneit, 2007). Anderson and Narus state that communication between companies leads to

deeper trust. In later periods, trust will lead to better communication (Anderson and Narus, 1990). Preconditions for trustful communication are continuity, regularity, and consistency (Herger, 2006). Through positive multiple and repetitive communication, trust can be built and enhanced, which in turn influences future communication behavior (Schewe and Nienaber, 2009).

In a business context, communication can be defined as the transmission of information and content in order to form an opinion, mental attitude, expectation or behavior pattern (Bruhn, 2005). Merten emphasizes the interactive aspect of communication: Communication is a process of statements between sender and receiver in a social context (Merten, 1977). Via communication, information is transmitted and through that knowledge and new insights are conveyed to cooperation partners (Scheufele, 2007). Corporate communication implies the management of all communication processes initiated by a company and can be defined as a process contributing to the task definition and task fulfillment in profit-oriented economic units. Furthermore, communication serves as an instrument for internal and external coordination as well as declaration of interest for the company's stakeholders (Zerfaß, 2007). With regard to trust building and trust maintenance, communication must be credible and suit the action to the word (Hubig and Siemoneit, 2007). Communication is fundamental for information exchange between supply chain partners and therefore influences the relationship of supply chain members. Trust increases the willingness of honest and open information exchange, whereas the quality of information exchange is as important as quantity (Gilbert, 2003).

Requirements for Trust Building

In the past, researchers identified requirements for trust-building and maintenance in relationships between two actors. Jennings postulates four conditions, which are loyalty (loyalty of employees), accessibility (being open-minded), availability (physical accessibility), and predictability (consistent acting and decision-making) (Jennings, 1971). Gabarro extended these conditions to nine basic principles: integrity (honesty, morality), motives (benevolent intentions), consistent behavior (reliability, predictability), openness, confidentiality, expertise, interpersonal competence, business sense, and ability to judge (Gabarro, 1987). Butler finally states ten conditions: availability, competence, consistency, discreetness, fairness, integrity, loyalty, openness, promise fulfillment, and receptivity (Butler, 1991).

In a more detailed way, Kohring states eight preconditions for trust (Kohring, 2004):

- Simultaneous pressure to act: both parties are forced to act.
- Mutual consciousness: both, trust giving and trust receiving party, perceive each other, accept restrictions in mutual perception, and/or use certain substitution mechanism.
- Perception of mutual contingency: each party is aware of its own options for action (at least two) and the other party's options for action (at least two).
- Addressability: the trust receiving party must be concrete and available (no nebulous "faceless" authority).
- Freedom of action: each party is free to choose one of its options for action (betrayal of trust possible).
- Subsequent sanction: If trust is not rewarded or betrayed, the trust sending party must be able to act with far-reaching consequences for the counterparty.
- Compliance: each party must be able to gain new experiences and reflect previous ones.
- Personal justification: The trust sending party must be able to justify its action retrospectively with regard to itself or others in reference to prior experiences, even there is not full certainty or safety (full knowledge).

Generally, trust building on company level can be defined as an iterative process. Previous experiences in a cooperation lead to trust. Trust encourages the firms to cooperate in the future. Cooperation will lead to trust again and so forth (Anderson and Narus 1990). Repeated interactions reduce the opportunity of being exploited by the counterpart and force companies to invest in the interaction, which in turn motivates them to act consistently and trustfully (Madhok, 1995). Furthermore, close interaction initiates relationship-specific asset investment and reduces information asymmetries (Axelrod, 1984).

It has to be noted that uncertainty is not directly reduced by trust building, but that cooperation and integration are only possible if a sufficient level of trust exists. Trust therefore is a necessary but not sufficient criterion for the reduction of uncertainty.

Approaches to Trust Assessment

Measuring or assessment of trust is difficult because of different reasons. Usually, there are two ways for assessing trust: surveys and surveys combined with experiments. Researchers face the problem of individual interpretation of trust and of trust-related questions, like the question "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" Survey questions are mostly interesting but also vague, abstract, and hard to interpret. Furthermore, direct questions about trust unfortunately do not lead to knowledge about the trust or trustworthiness of a

person because people tend to cheat in their answering (Glaeser, Laibson, Scheinkman and Soutter, 2000). Kohring states that a lot of trust research fails because of direct measuring (Kohring, 2004). Further research in the supply chain context is done regarding the measurement of factors influencing trust in supply chain relationships. Kwon and Suh examine the relationship between the level of trust and specific asset investments, behavioral uncertainty, and partner's opportunism as well as information sharing (Kwon and Suh, 2004; Kwon and Suh, 2005; Suh and Kwon, 2006). Handfield and Bechtel examine the influence of trust and relationship structure on supply chain responsiveness using human-specific asset investments, site-specific asset investments, contracts, trust, and buyer-dependence as test variables (Handfield and Bechtel, 2001). Because of the vague and subject character as well as a lot of time and effort of these survey based trust assessment approaches, they are hard to handle and difficult to apply in a supply chain management context.

TRUST MANAGEMENT AND INFORMATION SYSTEMS

Today's economy is based on networks of which supply chains are a part. Whereas in former times companies tried to achieve high vertical integration, they are now trying to focus on core competencies and outsource all non-related activities. As a result, inter-company cooperation gains importance and, inseparably along with it, trust. As was discussed earlier, trust is an important building block of cooperation. Trust management then refers to all activities that aim at building, assessing, and maintaining trust in cooperative business relations. It is part of general cooperation management and as such part of SCM. SCM is process-oriented so that consequently trust management must be reflected in business processes. As every process between companies requires some kind of communication, an in-depth understanding of communication forms the basis of trust building. Also, since these processes are supported by Information Systems, these too should be able to assist all activities related to trust management. In the following, the relation between uncertainty, communication, and trust are examined before examples are given for how to embed trust management in processes along the cooperation life cycle and how to make use of information systems.

The Implications of Uncertainty, Communication, and Trust on Cooperation

As was discussed earlier, uncertainty is an inherent characteristic of any complex system and is perceived in three different ways by companies when considering uncertainties that relate to the environment. The major questions to be investigated are: what are the reasons for these uncertainties and in how far does a lack of trust obstruct their mitigation?

State uncertainty occurs if sufficient information from partners is not available. The remedy in this case is an increase in information sharing. However, a lack of trust in partners often results in not exchanging information due to the risk that it might be used opportunistically. Keeping in mind the conditions for trust by Jennings, Gabarro, and Butler mentioned earlier, the assessment of the partner's loyalty, integrity, and fairness, among other factors, is then obviously below the threshold for close cooperation. Only if trust is built, information will be made available to eventually diminish state uncertainty. Still, as was discussed earlier, more information also leads to new uncertainty so that at a certain point it can become disadvantageous to exchange more information. Here, the assessment of trust is important again: is the level of trust sufficient to justify the remaining uncertainty and how can the information needed to make a qualified decision be obtained?

Effect uncertainty describes the circumstance that a company cannot estimate how changes in its environment will affect itself. It can be reduced by discussing tactical and strategic issues with partners in this environment. For example, a supplier can observe changes in the market of its customer, yet it does not know how the customer will answer them and what implications this answer would have on itself. Meetings and talks in time between partners would decrease this uncertainty. What keeps companies from doing so is for example a lack of trust regarding the level of commitment of the other party. Given the case that the partner is not believed to be interested in a lasting continuation of the relationship, he will not be included in such considerations.

Response uncertainty means that companies do not know which measures they possess to react to changes in the environment. In the SCM context this means that the interfaces between companies are not clearly defined. Interfaces relate to process definitions, communication channels, and connected IS. Several explanations are possible why this was not done. One is that at least one partner fears becoming dependent on this relation so that he was reluctant to closely integrate. Improvements can only be made if the intentions of the partnership can be truthfully communicated.

The Supply Chain Cooperation Life Cycle

The life cycle of supply chain cooperation is commonly divided in four phases (Hellingrath, Hegmanns, Maaß and Toth, 2008): initiation, establishment, operation, and closure. In each phase a different kind of uncertainty is encountered and different methods are to be used for trust management. Similarly, the relationship development process has been described as an iteration of five phases: awareness, exploration, expansion, commitment, and dissolution (Dwyer, Schurr and Oh, 1987). Aulinger specifically examines the phases of strategic alliance creation (Aulinger, 2003). In the following, all three cycles are

merged. The segmentation according to this framework allows for a structured analysis of what activities have to be supported, because literature often refers to life cycle phases.

Initiation

The first phase concerns internal activities only. It marks the starting point for cooperation when the possibility of cooperating with an external partner is examined. From the trust management perspective, processes have to be defined which clarify questions jointly with all responsible stakeholders. Especially, these are the need for trust, i.e. what uncertainties exist and how important are they, and what assets can be provided for trust building as commitment is not an unlimited resource. A result might be that rather a strict contract is being negotiated instead of building up a trustful long-term relationship. This is in accordance with Stage 1 of Aulinger, “Clarifying the attitude towards cooperation”, and the Awareness phase in the Relationship Development Process of Dwyer et al.

Establishment

In this phase, bilateral talks are held and the decision to cooperate has been made and trust building begins. SCM literature demands process re-design at this stage (Kuhn and Hellingrath, 2002) which includes IT-based and interpersonal communication processes. For example, process responsibilities have to be assigned at all partners and emergency processes have to be agreed upon. Furthermore, each party should make a communication plan which includes desired intensity of contact, people to be involved, what topics to discuss regularly, and how to organize meetings, e.g. online or in person. As previously shown, communication severely influences trust and consequently uncertainty, so the more prone the cooperation is to generate uncertainty the more sophisticated the communication plan should be. In addition, governance guidelines have to be set up which foster an atmosphere of common values, shared success and responsibility for failures, and overall commitment to mutual goals (cf. Davis and Spekman, 2004). The corresponding phases are “Developing a cooperation concept”, “Learning in the pilot phase”, and “Establishing the cooperation” by Aulinger and Exploration and Expansion by Dwyer et al.

Operation

The operation phase is the longest running one and primarily concerned with executing and monitoring the trust-related processes that were developed in the previous phase and constantly maintaining and, if necessary, extending the level of trust. As an example, one important process for trust maintenance is the formalization of trust transference (cf. Sahay, 2003). It must be embedded in HR processes so that when it becomes known that an employee will leave the company, his successor can be introduced to partners in cooperating companies in time. The corresponding phase according to Dwyer et al. is Commitment.

Closure

Trust management in the closing phase is important to maintain a good reputation. Arnold points out that reliability and consistency are valued by potential business partners (Arnold, 2007). Ending cooperation on short notice and failing to cooperatively communicating with the former partner may hurt a company’s reputation. This leads to lower initial trust granted by future partners. Therefore, processes should be established which result in a smooth transition for both parties. Communication processes must timely trigger addressing the questions of which information should be passed on to the partner and when this should happen (Arnold, 2007).

Information Systems Support

Information systems themselves must not be mistaken for a method of trust building. Instead, they can only be the tool to enable the trust building process, especially by supporting communication. This applies to human communication as well as automated information exchange and processing. As was discussed earlier, trust is hard or even impossible to measure. The assessment is normally subjective and based on certain impressions. IS are suitable of compiling and aggregating indicators which have been identified to be closely trust related. Having that done, one way to use IS for trust building besides providing the technological basis for personal interaction is to implement a “trust dashboard” analogous to SCM dashboards showing indicators such as inventory levels, order backlog, or resource utilization. Possible trust indicators are personal meetings per month, number of late deliveries, or number of quality problems (cf. Kuhn and Hellingrath, 2002). A lot of these can refer to information already available in ERP systems. In addition to that, governance recommendations must be supported by the enterprise information systems. Last, the process of designing IS must be adapted so as to consider how the system relates to trust and if certain artifacts can make a contribution to building trust. For example, cooperative methods are not sufficiently implemented in today’s ERP systems. However, if these functions are implemented, they have to be tested in depth for their implications on trust building and maintenance as they provide a direct interface to supply chain partners.

CONCLUSIONS AND FURTHER WORK

Presently, trust management is not a codified part of cooperation management and most IS do not specifically regard “soft” factors as important for success as order quantities or due dates. Pfohl et al. argue that “research on the process of Supply Chain Risk Management implementation has been lacking entirely” (Pfohl, Köhler and Thomas, 2010) and define the cause of risk as decision making under uncertainty. Some researchers have worked on risk management processes (Hallikas, Karvonen, Pulkkinen, Virolainen and Tuominen, 2004), but to the best knowledge of the authors trust has so far not explicitly been considered.

The authors believe that companies, or even more so entire supply chains, applying processes that govern activities related to uncertainty, communication, and trust will gain a considerable competitive advantage, also considering that the economy is increasingly organized in networks. The more companies are involved in networks, the more communication is necessary and the more grows the importance of trusting partners. In addition, trust might be seen as a factor that contributes to the emergence of business networks, e.g. by taking on a resource-based view in which trust is described as a strategic resource. However, trust is an asset which cannot be held by a single company, but which rather exists between companies. This raises interesting questions for network theoretical considerations (cf. Dyer and Singh, 1998).

IS have to be designed to adhere to the outlined future requirements. Some relations have been highlighted in this paper, but additional work is required to attain a complete overview. However, due to the fact that first the implications of trust building measures are hard to observe directly and second that they take effect after months or years, results can only be obtained in a long term study. Thus, research will be conducted in two steps. First, a behavioral view is adopted. A taxonomy of trust indicators available in SCM will be created and related to the processes where they can be observed. The indicators will then be aggregated to specify meaningful decision values. If these are applicable in practice must be analyzed in an empirical study, taking into account conditions which may have an impact on the results, e.g. staff involved, industrial branch, or cultural setting. Subsequently, based on these findings a design approach will be pursued. Trust-supportive measures that were identified will be modeled in processes and embedded in IS artifacts, e.g. in ERP systems. Another empirical study will analyze the acceptance and performance in practice.

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