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Pre-requisites of successful strategic electronic coordination: the moderation effect of the ownership mechanism of inter-organisational information systems

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ABSTRACT
In this paper, we attempt to explain how the ownership mechanism of an inter-organisational information system (IOS) may impact strategic information exchange (electronic coordination) induced by specific investments in the IOS. Recent research and practice show that heavy investments in IOSs demonstrate mixed results with respect to their impact on the electronic coordination. Consequently, the search of additional factors is needed to help and explain under what circumstances the IOS investments for strategic purposes become beneficial for the companies in a buyer-supplier dyad. Transaction cost economics (TCE) and the hostage model are used as a framework for the research. 198 observations of Norwegian companies in different branches of industry constitute the base of the empirical study. A buyer-supplier dyad is the unit of the analysis. A regression model of the relation between the IOS ownership mechanism and the strategic information sharing is used to test two hypotheses about the buyer-supplier collaboration via an IOS. The results demonstrate that the risk of unilateral specific investments in an IOS made by the buyer or the seller is attenuated by the ownership mechanism of the IOS. The willingness of a buyer to share their strategic information with the supplier via the IOS increases if the supplier invests in the IOS which is owned and controlled by the buyer. Conversely, the supplier becomes motivated to share certain sensitive strategic information with the buying company if the latter invests in the IOS which is owned and controlled by the supplier.

KEY WORDS
hostage model, inter-organisational information system (IOS), IOS ownership, specific IOS investment, strategic electronic coordination

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Introduction

Information sharing is one of the key constructs in Supply Chain Management (SCM). It is one of the most investigated direction in SCM research. Despite the large body of research in this area, there is a lack of ubiquitously accepted scientific frameworks considering the phenomena of information sharing in SCM (Kembro et al., 2014). The most commonly used theories in this field are Transaction Cost Economics (TCE), relational governance theories, contingency theory, resource dependency theory (RDT), and resource-based view (RBV). These theories aim to answer the following questions: "Why to share or not to share the information with others?", "What information should to be shared and with whom?", "How to share the information?", and "What are the pre-requisites, barriers and drivers of the information sharing?"

This paper focuses on the pre-requisites to information sharing, namely, the exchange of the strategic information in buyer-supplier dyads via inter-organisational information systems (IOS). A literature review by Kembro et al. (2014) reveals the most important and studied pre-requisites of information sharing in supply chains. They are formal contracts which aim at preventing opportunism (Porterfield et al., 2010), norms of reciprocating benefits (Nyaga et al., 2010), the lack of competitive capabilities that promotes collaboration (Tan et al., 2010), and mutual dependence (Vijayasarathy, 2010). Examining each of the mentioned pre-requisites requires theoretical lens. Since it is a difficult task to use different theoretical frameworks in one model where information sharing is represented as a dependent variable, we choose TCE as the basis for this study. The influence of the basic TCE dimensions (such as asset specificity, environmental uncertainty, and frequency of exchange) on the information sharing is described in the literature rather well. Based on different levels of the mentioned constructs, companies choose proper governance forms which, in their turn, determine the scope and the intensity of information sharing in the supply chains. In this paper, we attempt to clarify the relation of the specific investment into an inter-organisational informational systems (IOS) and the exchange of the strategic information. To do this, we propose to include the IOS ownership mechanism in the analysis as a moderator in the relation "asset specificity – information sharing". There are two main reasons behind this proposition. First, norms and extra-contractual mechanisms are underestimated in TCE despite their impact on the way the relationships are governed in the supply chain (Kembro et al., 2014). Second, ownership mechanisms are closely related to incomplete contracts (Han et al., 2008). A firm who owns an asset can easily exclude the other firm from using it in case it is not specified in the contract (Hart & Moore, 1990). This argumentation leads to a proposition that the IOS ownership is an important dimension in finding the antecedents of information exchange in the supply chain and particularly in buyer-supplier dyads.

The investigated scope of information sharing via IOSs (which is represented as a dependent variable in the model) has been deliberately limited to the strategic type of information. We disregard the exchange of the operational information (such as information about payments, invoices, and inventory levels) because normally it requires neither heavy investments in IOSs nor sophisticated mechanisms for governance of the relations between the firms. Therefore, finding antecedents for strategic information exchange appears a much more difficult task than examining the operational one. Instead, we propose to examine the exchange of the operational information as a prerequisite to the strategic one.

To specify the knowledge under consideration in this respect, we define strategic information exchange as the coordination of production plans, sharing the data about the product and design modifications, as well as the development and the testing of new products. To show that the study deals with the information transferred via an IOS, we entitle the strategic information exchange "strategic electronic coordination". Information technology (IT) and IOS terms are used interchangeably in the context of our paper, although such an approach may not be suitable for different research directions. We use the term IT instead of IOS only when citing scientific literature where the term IT is used to describe the system that connects two or more companies in a supply chain.

198 buyer-supplier dyads have been investigated to test the proposition. Dyads represent Norwegian companies in various industries: manufacturing, retail, service, public procurement and others. Primary data is collected from the buyer's perspective.

The structure of the paper is as follows. The upcoming section briefly reviews the main theoretical frameworks, clarifies the problem area and formulates the hypotheses. The following two sections describe the research method and introduce a regression model of the IOS ownership's influence on the information sharing. Next, statistical results of the hypotheses testing are presented and described. In the last section, we discuss the results and the limitations of the research presented in this paper.

1. Theory and hypotheses

Strategic coordination problem has received considerable attention from various SCM researchers. The term "coordination" may have various meanings in the SCM literature. The examples are joint planning and product development, orientation on long-term cooperation, profit sharing, extensive information exchange, etc. (Larsen, 2000). Malone, Yates, and Benjamin (1987, p. 489) define coordination as "the information processing involved in tasks such as selecting suppliers, establishing contracts, scheduling activities, budgeting resources, and tracking financial flows". Since it is a difficult task for any researcher to grasp all the above-listed dimensions, we will concentrate on such aspects of strategic coordination as activity scheduling, i.e., production planning, product and design modifications, development and testing of new products. To facilitate coordination, companies in different industries often invest in a variety of IT tools (Sahaym et al., 2007). Examples of a successful IT implementations demonstrate a reduction in bureaucratic costs of coordination (Afuah, 2003), tighter links to customers, increased product variety (Johnston and Vitale, 1988). However, company efforts to improve the coordination by investing in IOSs do not always lead to a desirable outcome. Such factors as the expectation of an opportunistic behaviour, the power dependency structure, the type of the buyer and supplier market and others can either obstruct or significantly alter the expected results of strategic electronic coordination. That explains a considerable number of scientific frameworks provided in the literature trying to describe the reasons and the drivers of information exchange. For example, a literature review by Kembro et al. (2014) revealed 23 theories which can be used to explain information sharing in a supply chain. At the same time, this review identified that five out of 23 theories constitute 80% of all the suggested theoretical frameworks. These are TCE, relational governance theories (RGT), contingency theory, resource dependency theory, and the resource-based view (RBV). Among the reviewed articles, 66 out of the 82 papers use the dyadic relationships as a unit of analysis.

In the following subsection, we will present a TCE-based theoretical framework with the emphasis on hostage model as the one suitable for our research.

1.1. Transaction cost economics (TCE). Hostage model

The main stress of TCE is transaction governance (Williamson, 1985). Transaction costs can be minimised when appropriate forms of governance mechanisms are applied by contractual parties. In turn, the choice of the governance modes depends on the three basic TCE constructs. They are the frequency of exchange, the environmental uncertainty, and the asset specificity. TCE assumes that the actors may behave opportunistically. To reduce the risk of opportunism and safeguard the investments into specific assets, the companies can apply formal contracts (Williamson, 1985). Therefore, the formal contracts may be viewed in TCE as a pre-requisite for effective information sharing in the considered supply chains.

TCE may also be useful in understanding why information sharing is important, as well as in what cases it may be preferable not to share certain data. The main argument for information sharing is the reduction in the transaction costs and the uncertainty (Tan et al., 2010). On the contrary, partners may prefer to withhold sensitive information to diminish the threat of opportunism (Klein et al., 2007). In this case, the information is considered an asset that requires additional safeguarding mechanisms (Kembro et al., 2014). Therefore, it may lead to unwillingness to invest into highly specific IOSs (Tan et al., 2010; Klein et al., 2007).

At the same time, formal contracts cannot cope with all contingencies that may occur at the contractual stage. TCE underestimates the impact of extra-contractual tools that are also important in managing the supply chain relationships (Kembro et al., 2014). Therefore, the contracts leave room for including different ex-post tools that could serve as safeguards to specific investments (Ménard & Valceschini, 2005).

Asset ownership can be considered an important tool that serves as a safeguarding mechanism in addition to formal contracts. A firm owning a specific asset has the full control over the asset and can easily preclude a certain partner from using it (Han et al., 2008). The mentioned research underlines that the asset ownership mechanism provides the owner of the asset with a bargaining power. The authors suggest investigating the IOS ownership as a partial solution to coordination problem induced by specific investments.

To explain the mechanism of the influence that IOS ownership has on the coordination, Williamson's (1983) hostage model is used. The model is based on the idea that "the investments made by the suppliers are influenced by the incentives experienced by the buyers" (Williamson, 1983, p. 520). Williamson claims that the specific investments made by the suppliers on behalf of the buyer are at risk due to the fluctuations of the final demand which can negatively affect the buyer's commitments to buy the negotiated volumes of goods from the supplier. That may result in low levels of the supplier's investment into specific assets. To maintain specific investments at high levels, the supplier may want the buyer to post a "hostage" that is lost if the contract is terminated ahead of time (Ahmadjian & Oxley, 2005). In turn, high levels of specific investments into the IOS made by the contractual parties are crucial for reaping full benefits from the IOS collaboration (Han et al., 2008). That makes the hostage model an appropriate scientific framework that could help to understand the drivers for the efficient strategic electronic collaboration.

There are several types of hostage models described in the literature: mutual hostages (Gemser & Wijnberg, 2001), partial equity stake hostage-based arrangements (Ahmadjian & Oxley, 2005), hostages in the form of reciprocal specific investments (Williamson 1983; Wathne & Heide, 2000). Hostage-based relationships are also described in the business-to-consumer environment (Dorsch et al., 2001).

In our study, investments in an IOS can be regarded as an example of a hostage model which is based on the reciprocity principle. Investments in the IOS made by the actors in the supply chain represent an example of the reciprocal investments. According to Williamson (1985, p. 532), this type of investments creates a "mutual reliance relation". In other words, these relations can be characterized by bilateral dependence which contributes to trustful relationships and reduces the incentives for the opportunistic behaviour.

A research paper by Heide and John (1990) highlights the idea that symmetric investments in specific investments made by the original equipment manufacturer (OEM) and the supplier create hostage relationships which act as a safeguard to the specific investments. The main drivers of the mentioned situation are high procedural and switching costs (Burnham, Frels & Mahajan, 2003). If mutual reliance relationship is prematurely terminated, the hostage company sacrifices their time and money spent on attuning/integrating its information system (IS) to the partner's IS. Also, in the case of investing in a highly customized IOS, the partners may face high switching cost due to the consecutive specific investment in personnel training programmes (human asset specificity). New personnel training programmes may be needed in the case of changing a business partner. High switching costs represent a strong bonding mechanism that forces companies to maintain relationships (Geiger et al., 2012; Blut et al., 2016).

With respect to our research goals, the question can be formulated as follows, "What conditions/factors may increase the robustness of hostage agreements based on reciprocal investments into an IOS and, therefore, increase the willingness to share the sensitive strategic information via the IOS?".

Investments in an IOS can be initiated by buyers or by suppliers. For instance, a buying company installs the software and hardware at its production site first and then it tries to establish electronic links with the supplier. In other words, the buyer who purchases and therefore owns the IOS makes the major share of the investment into the IOS for collaboration purposes and puts themselves at risk if the relationship with the supplier is prematurely terminated. In this situation, the supplier's contribution to IOS investments is limited basically to the investments in the IOS hardware and the following IOS integration procedures conducted both by the buyer and by the supplier. To simplify, when the buyer plays the major role in IOS investments and, thereby, owns and controls the IOS, the supplier's role in the IOS investment process becomes limited to adaptation/integration actions which costs less. Combining this example with the described hostage model and TCE, we can conclude that the buyer posts a hostage in the form of the owned IOS. The buyer may face high switching cost in case of a premature relationship termination. This type of hostage acts as a safeguarding mechanism for the supplier's specific IOS investments, and it relaxes the threat of the buyer's opportunism and, therefore, motivates the supplier to share the strategic information with the buyer. The other noticeable side of the IOS ownership mechanism is that it provides the full control over the IOS (control over databases, the possibility to exclude the supplier from IOS usage, etc.) and gives bargaining power to the IOS owner (Han et al., 2008). That relaxes a potential threat of the supplier's opportunism and, in turn, increases the buyer's willingness to exchange the strategic information with the supplier. We also assume that the same theoretical predictions are valid for the opposite situation when the supplier owns and controls the IOS, and the buyer adjusts its information system to the supplier's IS.

Hence, we offer the following hypotheses:

- **hypothesis 1**: when the buyer owns and controls the IOS, there is more positively shaped association between the supplier specific IOS investments and the strategic electronic coordination than under the conditions when the supplier owns and controls the IOS;
- **hypothesis 2**: when the supplier owns and controls the IOS, there is more positively shaped association between the buyer specific IOS investments and the strategic electronic coordi-

nation than under the conditions when the buyer owns and controls the IOS.

1.2. Other antecedents to strategic electronic coordination

To validate our regression model which may be referred to as "IT system ownership – strategic electronic coordination", we introduce four control variables to the model: the supplier's industry type (SUPIND), the length of IT cooperation (LNITCOOP), the product complexity (PRODCOMP), and the operational information exchange (OPER). The variable corresponding to the strategic electronic coordination is denoted COORD.

The product complexity was included in the model, as earlier research showed significant positive correlation between product complexity and vertical integration (Novak & Eppinger, 2001). Greater product complexity may increase coordination via an IOS although in cases when the product complexity is too high, personal meetings may be preferred to communication via the IOS (Hannås, 2007). We expect a positive association between PRODCOMP and COORD.

The length of IT cooperation with the supplier (LNITCOOP) was measured as the natural logarithm of the number of years the buyer and the supplier have been collaborating via an IOS (Heide & John, 1990). The duration of the prior relationship has a positive influence on the commitment (Deutsch, 1962) and encourages attachment (Levinthal & Fichman, 1988). Sometimes, the cooperation length may lead to defection patterns rather than the cooperation (Heide & Miner, 1992). In these cases, no effect of relationship duration on the cooperation should be expected. We expect a positive association between LNITCOOP and COORD.

The supplier industry type is included in the model to control for the possible differences between the IOS cooperation with the suppliers from the manufacturing sector and the suppliers from other industry types. The manufacturing industry is often used as a control variable in marketing research in the settings with specific investments (Stump 1995). We expect that the need for COORD is bigger for the dyads operating in the manufacturing sector due to the higher complexity of production process requiring more volumes of business information exchange compared to other industry branches. The variable is coded as a dummy variable: 1 – manufacturing industry, 0 – other industries (service, retail, public administration).

The operational information exchange (OPER) is defined in our study as the exchange of invoices, orders and the information about active replenishment of inventories conducted via an IOS. Premkumar (2000) and Saeed et al. (2005) identify the levels of the IOS development where the lowest level is considered the exchange of the simplest types of information like orders and payments. The authors claim that the IOS collaboration in the supply chains normally starts with the simplest operational level, and later, it may grow into a more sophisticated strategic form. We assume that operational exchange can be positively correlated with the electronic coordination because the efficient fulfilment of strategic actions (for example, collaboration over the development and testing of new products) requires operational information exchange on the purchase of materials and components for the tested new products. Also, we can expect a low level of system malfunctioning at the strategic level of the information exchange if the IOS have been previously tested and used for operational purposes.

2. Research method

A structural equation model (regression model) has been developed to test the hypotheses. For this model, the data has been collected with the help of the survey research. The e-mail based questionnaire with close-ended questions has been developed to collect empirical data, which was further processed for the model. The subsections below describe the process of data collection and present confirmatory factor analysis for the constructs used in the model "IT system ownership – strategic electronic coordination".

2.1. Data collection

A buyer-supplier dyad is used in this paper as a unit of analysis. We assume that IOSs have been used as the primary means of information exchange in the dyads. The information for this research is adopted from Norwegian companies of various industry types. 20 firms were used for pilot testing of the questionnaire to check the item reliability and to avoid potential misunderstandings in the questions (Hunt, Sparkman & Wilcox, 1982). The pilot questionnaire was revised upon obtaining feedback from respondents.

The Norwegian Association of Purchasing and Logistics (NIMA) took the responsibility to send the questionnaire to its members by e-mail. The size of the sample was 1365 companies. Data collection process has been conducted in two rounds with a time gap of two weeks. 198 answers were received for the hypotheses testing. The T-test had been conducted to measure the non-response bias between the two rounds of data collection (Armstrong & Overton, 1977). The test results have not revealed a significant difference between the two groups with respect to the annual sales volume, the number of employees, and the purchasing volume (Hannås, 2007).

The key informant approach was used to obtain reliable knowledge about the studied problem. This approach is widely used to investigate business-to-business relationships (Heide & John, 1992; Bensaou & Anderson, 1999; Buvik & John, 2000). With respect to our research objectives, we interviewed specialists who possessed specific knowledge in upstream supply chain operations (Hannås, 2007).

2.2. Measures for the regression model "IT system ownership – strategic electronic coordination"

To obtain the measures for model variables, we conducted the confirmatory factor analysis (CFA) in AMOS graphics extension to SPSS 22 software.

2.3. Confirmatory factor analysis for the construct electronic coordination

To grasp the potential scope of information exchange between companies via an IOS and pick items for the electronic coordination construct, we analysed literature on coordination and IOSs (Buvik & John, 2000; Joshi & Stump, 1999; Zaheer & Venkatraman, 1995; Subramani, 2004).

The dependent variable COORD and the independent variable OPER were obtained from the electronic coordination construct. The three-factor solution is offered for the electronic collaboration construct. The results of the CFA for the construct electronic coordination are listed below:
chi-square = 52.424; degrees of freedom = 24; probability level = 0.001; CMIN/DF = 2.184; CFI = 0.953; NFI = 0.920; TLI = 0.912; RMSEA = 0.078.
Strategic electronic coordination (COORD: 3 items, Cronbach's α = 0.842):

- (Q11_4) coordination of production plans (0.73),
- (Q11_5) product and design modifications (0.87),
- (Q11_6) development and testing of new products (0.83).

Operational electronic exchange (OPER: 3 items, Cronbach's α = 0.619):

- (Q11_2) ordering process (0.58),
- (Q11_3) invoicing and payments (0.65),
- (Q11_9) active replenishment of our inventories (0.57).

Documentation exchange (3 items):

- (Q11_8) tender processing (0.71),
- (Q11_10) document exchange (0.75),
- (Q11_11) product specifications (0.76).

Items Q11_8, Q11_10, Q11_11, which constitute the variable of documentation exchange, were not incorporated in our model.

2.4. Independent variables of the regression model "IT system ownership – strategic electronic coordination"

The supplier IT specific investments (SITINV) describe the investments in the IOS made by the supplier to exchange information with the buyer. This variable aims to cover different types of asset specificity such as physical (investments in the software and the hardware), procedural (efforts to integrate the supplier's IS with the buyer's IS), human (personnel training programs). The CFA suggests one factor construct (Cronbach's α = 0.887) that has four items:

- (Q13_1) the supplier invested extensively in their own IT competence (0.84),
- (Q13_2) the supplier invested extensively in IT systems by our standards and requirements (0.96),
- (Q13_3) the supplier invested substantially in the training of their employees (0.79),
- (Q13_6) made extensive investments to integrate their IT systems with our IT systems (0.69).

Chi-square = 1.316; degrees of freedom = 2; probability level = 0.518; CMIN/DF = 0.658; CFI = 1.00; NFI = .997; TLI = 1.00; RMSEA = 0.000.

The buyer IT specific investment (BITINV) describes the investments in the IOS made by the buyer for the purpose of collaboration with the supplier. Same types of the asset specificity have been used to describe the variable as for the SITINV variable. The CFA suggests one factor construct (Cronbach's α = 0.914) with four items:

- (Q15_2) Our company has invested in extensive internal training to learn the IT systems used with this supplier (0.80),
- (Q15_3) Our company has made extensive adaptations of our IT systems (0.93),
- (Q15_4) Our company has made substantial investments to integrate our IT systems with the supplier's systems (0.85),
- (Q15_5) Our company has made substantial investments in technical competence to support the IT system we use with this supplier (0.79).

Chi-square = 0.000; Degrees of freedom = 1; Probability level = 0.938; CMIN/DF = 0.006; CFI = 1.00; NFI = 1.00; TLI = 1.00; RMSEA = 0.000 (we allowed one error term to co-vary between items Q15_4 and Q15_5 in the single measurement model).

The ownership of the buyer's IT system (BUYITSYS) is a dummy variable, where "1" corresponds to the IOS being owned and controlled by the buyer. "0" value comprises other ownership options, for example, the supplier owning and controlling the system (1), the buyer and the supplier using the e-market system (2), the buyer and the supplier using an integrated IT system which is controlled by both parties (3), the buyer and the supplier using e-mail systems such as Microsoft Outlook for information exchange, which means that none of the parties owns and control the system (4).

The ownership of the supplier's IT system (SUPITSYS) is a dummy variable that is opposite to the BUYITSYS. Value "1" means that the buyer owns and controls the IOS. "0" value corresponds to the other ownership options which are listed in the paragraph above.

The product complexity (PRODCOMP) control variable consists of the following four items below (Cronbach's $\alpha = 0.846$).

"The product we purchase from this supplier…
- (Q18_1) …is very complex",
- (Q18_4) …is technically complex to use",
- (Q18_5) …requires high level of expertise in production",
- (Q18_6) …is very difficult to specify".

Chi-square = 0.334; degrees of freedom = 2; probability level = 0.846; CMIN/DF = 0.167; CFI = 1.00; NFI = 0.999; TLI = 1.00; RMSEA = 0.000.

The operational electronic exchange (OPER) is a control variable which is derived from a broader construct electronic coordination (see above).

The supplier Industry Type (SUPPIND) and the length of IT cooperation with the supplier (LNITCOOP) variables, which are included in the model, however, are not subject to reliability tests.

We use the factor analysis to access the discriminant validity for 18 items which describe the following variables: COORD, OPER, SITINV, BITINV, and PRODCOMP. We used varimax rotation option for factor analysis. It suggested five factors. The factor loadings are presented in Tab. 1. Most researchers use the value of 0.6 as a cut-off point for factor loadings (Kim et al., 2010), although others, e.g. (Stevens, 1992), recommend values above 0.4. All factor loadings in Tab. 1, except for the item 11.9, are chosen above 0.6. As a result of the factor analysis, we removed items 18.2 and 18.3 for PRODCOMP variable, item 15.1 from BITINV variable, items 13.4 and 13.5 from SITINV variable. Loadings for the two variables COORD (11.4, 11.5, 11.6) and OPER (11.2, 11.3, 11.9) are reported from the three-factor solution for the electronic collaboration construct.

3. Specification of the regression model "IT system ownership – strategic electronic coordination"

We constructed an OLS-regression model in SPSS 22 software to test our hypotheses. The model looks as follows in (1).

$$\begin{gathered} COORD = b_0 + b_1 \cdot BITINV + b_2 \cdot SITINV + b_3 \cdot BUYITSYS \\ +b_4 \cdot SUPITSYS + b_5 \cdot BUYITSYS \cdot SITINV \\ +b_6 \cdot SUPITSYS \cdot BITINV + b_7 \cdot SUPIND + b_8 \cdot OPER \\ +b_9 \cdot LNITCOOP + b_{10} \cdot PRODCOMP + \varepsilon \end{gathered} \tag{1}$$

In (1), COORD is the strategic electronic coordination, BITINV is the buyer specific IOS investments, SITINV is the supplier specific IOS investments, BUYITSYS is the ownership of the buyer's IT system, SUPITSYS is the ownership of the supplier's IT system, SUPIND is the supplier's industry type, OPER is the operational electronic exchange, LNITCOOP is the length of IT cooperation with supplier, and PRODCOMP is the product complexity.

Based on Schoonhoven (1981), we took the partial derivative of the equation (1) to analyze hypotheses 1 and 2. For the hypothesis 1, we estimated the effect of the supplier specific IT investments on the strategic electronic coordination under the condition of the buyer's control and ownership of the IOS

Tab. 1. Rotated Component Matrix

	Components				
	1	2	3	4	5
18.1. Product is very complex	0.044	0.865	0.042	0.125	-0.108
18.4. Product is technically complex to use	-0.006	0.785	0.154	0.185	0.034
18.5. Product requires specific expertise	0.068	0.740	-0.007	0.071	0.052
18.6. Product specifications are very complex	-0.072	0.735	0.082	0.208	0.148
11.4. Collaboration over production plans	0.028	0.105	0.082	0.776	0.161
11.5. Collaboration over product/design	0.034	0.179	0.047	0.862	-0.123
11.6. Collaboration over development/testing	0.085	0.139	0.132	0.840	-0.007
11.2. Collaboration over ordering processes	0.052	0.013	0.024	0.056	0.844
11.3. Collaboration over invoicing/payment processes	0.140	0.049	0.180	0.164	0.698
11.9. Collaboration over replenishment systems	0.050	0.043	0.406	0.313	0.414
15.2. Buyer_ITspecinv_IT training for buyer's personnel	0.841	-0.045	0.241	0.041	0.051
15.3. Buyer_ITspecinv_upgrading IT systems	0.885	0.112	0.158	-0.037	0.079
15.4. Buyer_ITspecinv_integrate buyer/supplier's IT systems	0.876	0.188	0.111	0.027	0.017
15.5. Buyer_ITspecinv_technical skills for operating IT system	0.841	0.139	0.159	0.063	-0.009
13.1. Supp_ITspecinv_upgrading IT skills	0.191	0.011	0.850	0.074	-0.014
13.2. Supp_ITspecinv_IT systems	0.216	0.047	0.876	0.097	0.068
13.3. Supp_ITspecinv_training supplier's personnel for e-coord	0.197	0.117	0.825	0.213	0.132
13.6. Supp_ITspecinv_reorg internal routines	0.162	0.083	0.773	0.159	0.168

Note: extraction method: Principal Component Analysis, rotation method: Varimax with Kaiser Normalization, rotation converged in 5 iterations.

$$\frac{\partial COORD}{\partial SITINV} = b_2 \cdot + b_5 \cdot BUYITSYS \tag{2}$$

$$\frac{\partial COORD}{\partial BITINV} = b_1 \cdot + b_6 \cdot SUPITSYS \tag{3}$$

(equation (2)). For the hypothesis 2, the effect of the buyer specific IT investments on the strategic electronic coordination was estimated under the condition of the supplier's full control and ownership of the IOS system (equation (3)).

According to H1, more extensive strategic electronic coordination is expected when the supplier increases the level of investments in the IOS under the condition of the buyer's ownership and control over the IOS rather than under the condition of other types of the IOS ownership.

According to H2, more extensive strategic electronic coordination is expected when the buyer increases the level of investments in the IOS under the condition of the supplier's ownership and control over the IOS rather than under the condition of other types of the IOS ownership.

4. Results

We tested our model for heteroscedasticity. The test demonstrated that no heteroscedasticity had been found (F = 0.525; p = 0.871). The correlation matrix and the descriptive statistics are presented in Tab. 1 and 2, respectively. The goodness of fit of the model is deemed acceptable, R^2Adj = 0.258 (F = 7.316; df = 10; p = 0.000). We also tested the significance of the two interaction effects to answer the question whether they add any explanatory power to the regression model (Akien & West, 1991). For that purpose, we used a hierarchical multiple regression. The results show that the interaction effect described in Hypothesis 1 provides 2.1% improvement to the goodness of fit of the model. This improvement is significant at p = 0.027 (F = 5.000; df = 1). For Hypothesis 2, the interaction effect improves the goodness of fit by 2%. The improvement is significant at p = 0.031 (F = 4.712; df = 1).

The regression analysis results (Tab. 3) supports hypothesis 1 and hypothesis 2. The impact of the interaction effect between the supplier specific IOS investments and the ownership of the buyer's IT system on the strategic electronic collaboration (hypoth-

Tab. 2. Correlations matrix

		COORD	SITINV	BITINV	BUYITSYS	SUPITSYS	BITINV × SUPITSYS	SITINV × BUYITSYS	SUPIND	OPER	LNITCOOP	PRODCOMP
COORD	Pearson Corr-n	1	0.240	0.109	-0.084	-0.069	0.203	0.246	0.270	0.336	0.133	0.289
	Sig. (1-tailed)		0.000	0.064	0.121	0.168	0.002	0.000	0.000	0.000	0.035	0.000
	N	198	198	197	198	198	198	198	193	198	186	198
SITINV	Pearson Corr-n	0.240	1	0.451	0.035	-0.076	0.093	0.520	-0.106	0.389	0.040	0.117
	Sig. (1-tailed)	0.000		0.000	0.310	0.143	0.096	0.000	0.071	0.000	0.292	0.050
	N	198	198	197	198	198	198	198	193	198	186	198
BITINV	Pearson Corr-n	0.109	0.451	1	-0.023	-0.060	0.450	0.275	-0.208	0.222	0.094	0.127
	Sig. (1-tailed)	0.064	0.000		0.375	0.199	0.000	0.000	0.002	0.001	0.102	0.037
	N	197	197	197	197	197	197	197	192	197	185	197
BUYIT SYS	P Pearson Corr-n	-0.084	0.035	-0.023	1	-0.289	0.031	0.051	0.075	0.081	0.111	0.056
	Sig. (1-tailed)	0.121	0.310	0.375		0.000	0.332	0.236	0.151	0.128	0.065	0.217
	N	198	198	197	198	198	198	198	193	198	186	198
SUPIT SYS	Pearson Corr-n	-0.069	-0.076	-0.060	-0.289	1	-0.107	-0.015	-0.177	-0.178	-0.079	-0.190
	Sig. (1-tailed)	0.168	0.143	0.199	0.000		0.066	0.418	0.007	0.006	0.143	0.004
	N	198	198	197	198	198	198	198	193	198	186	198
BITINV × SUPIT SYS	Pearson Corr-n	0.203	0.093	0.450	0.031	-0.107	1	0.002	0.044	0.108	-0.001	0.116
	Sig. (1-tailed)	0.002	0.096	0.000	0.332	0.066		0.491	0.271	0.065	0.497	0.052
	N	198	198	197	198	198	198	198	193	198	186	198
SITINV × BUYIT SYS	Pearson Corr-n	0.246	0.520	0.275	0.051	-0.015	0.002	1	-0.074	0.267	0.007	0.073
	Sig. (1-tailed)	0.000	0.000	0.000	0.236	0.418	0.491		0.155	0.000	0.461	0.153
	N	198	198	197	198	198	198	198	193	198	186	198
SUPIND	Pearson Corr-n	0.270	-0.106	-0.208	0.075	-0.177	0.044	-0.074	1	0.050	0.141	0.267
	Sig. (1-tailed)	0.000	0.071	0.002	0.151	0.007	0.271	0.155		0.244	0.028	0.000
	N	193	193	192	193	193	193	193	193	193	184	193
OPER	Pearson Corr-n	0.336	0.389	0.222	0.081	-0.178	0.108	0.267	0.050	1	0.176	0.098
	Sig. (1-tailed)	0.000	0.000	0.001	0.128	0.006	0.065	0.000	0.244		0.008	0.086
	N	198	198	197	198	198	198	198	193	198	186	198
LNIT COOP	Pearson Corr-n	0.133	0.040	0.094	0.111	-0.079	-0.001	0.007	0.141	0.176	1	0.267
	Sig. (1-tailed)	0.035	0.292	0.102	0.065	0.143	0.497	0.461	0.028	0.008		0.000
	N	186	186	185	186	186	186	186	184	186	186	186
PROD COMP	Pearson Corr-n	0.289	0.117	0.127	0.056	-0.190	0.116	0.073	0.267	0.098	0.267	1
	Sig. (1-tailed)	0.000	0.050	0.037	0.217	0.004	0.052	0.153	0.000	0.086	0.000	
	N	198	198	197	198	198	198	198	193	198	186	198

esis 1, Fig. 1) is positive and significant ($b_5 = 0.402$; $t = 2.475$; $p < 0.05$). The interaction effect between the buyer's specific IOS investments and the ownership of the supplier's IT system (hypothesis 2, Fig. 2) is also positive and significant ($b_5 = 0.406$; $t = 2.416$; $p < 0.05$).

Notably, the plots of the two interaction effects have similar shapes (Fig. 1 and 2). A steep slope of the two diagrams demonstrates a strong impact of both addressed interaction effects on the strategic electronic coordination. The observed similarity in the shape of two plots (i.e., close values of the coefficients b_5 and b_6) points to the applicability of

Tab. 3. Descriptive statistics

Variables	N	Mean	Standard Deviation
COORD	198	2.9084	1.48514
SITINV × BUYITSYS	198	0.0206	0.70005
BITINV × SUPITSYS	198	-0.0346	0.64144
BITINV	197	2.6586	1.43322
SITINV	198	2.8436	1.34618
BUYITSYS	198	0.2500	0.43300
SUPITSYS	198	0.2000	0.40300
PRODCOMP	198	3.0510	1.48319
OPER	198	4.3316	1.41242
SUPIND	193	0.3500	0.47700
LNITCOOP	186	1.2766	0.77164

the developed theoretical framework to both hypotheses. It is also necessary to point to the negative sign of coefficient b_1. This coefficient describes the direct effect BITINV has on COORD. The resulting setting where b_1 has a negative value and, simultaneously, b_2 assumes a positive value, may indicate that the significance of the IOS ownership mechanism for the considered coordination problem is much higher for the buyer than for the supplier. In other words, the buyer can avoid the negative correlation between BITINV and COORD if the buyer's IOS investments are complemented with other tools or actions. In our model, the IOS ownership is suggested as one of such tools.

The direct effect of all the independent variables which produce the two examined interaction effects is statistically insignificant: BITINV (b_1 = -0.068; t = -0.770; p = 0.442); SITINV (b_2 = 0.073; t = 0.787; p = 0.432). The insignificance of SITINV and BITINV variables in our model can be attributed to that fact that the IT investments only lead to the desired outcomes when both parties in the dyad invest in a common IT system simultaneously or if the IT investments are coupled with such factors as, for example, trust (Ibbott & O'Keefe, 2004) or power-dependency structures (Allen et al., 2000). Dummy variables that are included in the two interaction effects have neither demonstrated a strong statistical significance in our model. One variable (namely, BUYITSYS), however, may be regarded as somewhat significant at $p < 0.1$ (b_3 = -0.465; t = -1.977).

The control variables OPER, PRODCOMP, SUPIND demonstrate the expected effects on COORD:

- OPER (b_8 = 0.250; t = 3.302; p = 0.001),
- PRODCOMP (b_{10} = 0.192; t = 2.725; p = 0.007),
- SUPIND (b_7 = 0.684; t = 3.105; p = 0.002).

The control variable LNITCOOP is found statistically insignificant in our model (b_9 = 0.047; t = 0.350; p = 0.727).

Conclusions

The obtained research results presented in this paper contribute to one of the main streams in the supply chain literature, namely, the literature discussing the issues of coordination. Also, certain advice for top- and middle-level managers responsible for information-sharing decisions is proposed.

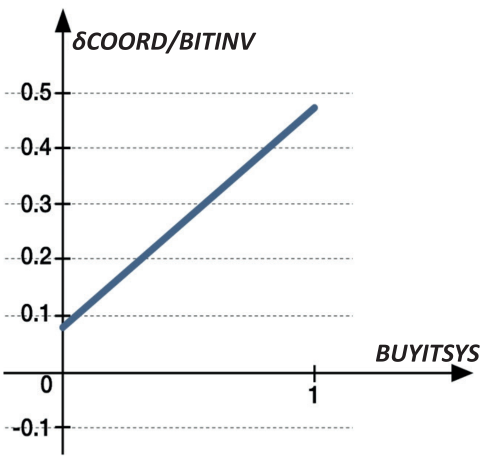

Fig. 1. Interaction effects for the two hypotheses (H1)

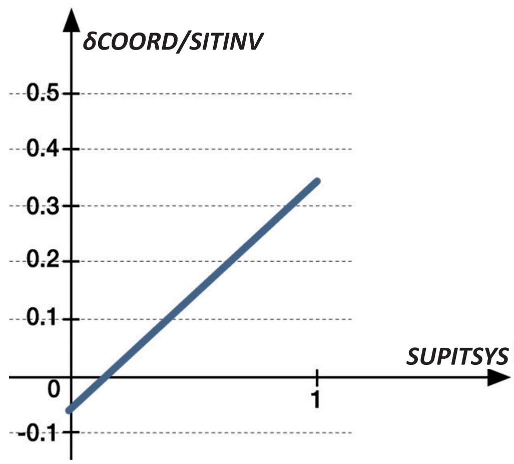

Fig. 2. Interaction effects for the two hypotheses (H2)

Tab. 4. Regression analysis

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.691	0.216		12.448	0.000
BITINV	b_1 = -0.068	0.089	-0.065	-0.770	0.442
SITINV	b_2 = 0.073	0.093	0.066	0.787	0.432
BUYITSYS	b_3 = -0.465	0.235	-0.134	-1.977	0.050
SUPITSYS	b_4 = 0.151	0.254	0.041	0.594	0.553
BUYITSYS×SITINV	b_5 = 0,402	0.162	0.188	2.475	0.014
SUPITSYS×BITINV	b_6 = 0.406	0.168	0.181	2.416	0.017
SUPIND	b_7 = 0.684	0.220	0.218	3.105	0.002
OPER	b_8 = 0.250	0.076	0.235	3.302	0.001
LNITCOOP	b_9 = 0.047	0.134	0.024	0.350	0.727
PRODCOMP	b_{10} = 0.192	0.071	0.191	2.725	0.007

Note: dependent variable: COORD.

These two aspects are addressed in the discussion of the following two subsections concluding this paper.

The primary goal of this research was to offer new theoretical insights into the inter-organisational electronic exchange of strategic information, as well as to find new explanatory factors and drivers for this information sharing. An interesting observation we found is that the direct effects of the supplier's investments in the IOS and the buyer's investment in the IOS are not statistically significant. It may be attributed to the specific nature of the IOS investments, i.e., they become beneficial only when both sides contribute to the IOS investment projects equally. Due to the high specificity of the IOS investments, especially when it comes to customized IOSs, specific investments made unilaterally become a too risky option. That is explained by high switching costs which in turn originate from a high risk of opportunism from the non-investing party. Our modelling results substantiate that point. Neither the buyer's nor the supplier's investments made unilaterally may contribute to the electronic strategic collaboration. However, from a theoretical standpoint, the goal of any specific investment type is to contribute to the growth of value and to reduce costs. We see that the impact of the unilaterally made IOS investments becomes statistically significant (Tab. 4) in case of mutual investments in the IOS when reciprocity is established. Our results demonstrate that the IOS ownership mechanism can have a significant impact on the relationship "IOS specific investments – strategic electronic coordination" by eliminating the threat of the opportunistic behaviour.

The fact that one of the companies in the dyad owns and controls the IOS normally describes the situation when this firm initiates the IOS project and, therefore, makes significant investments in the IOS, i.e., pays for hardware and software, spends time on searching and contracting potential software vendors, and trains personnel. The other party of the IOS investments basically has to adjust their IT system to the one established by the company who made the essential IOS investment (the one owning and controlling the system). In such a case, both sides of the IOS project may find themselves in a "win-win" situation where, first, the supplier does not bear any risk of losing significant funds invested in the IOS in case the relationships are prematurely terminated. In the meantime, the buyer is not afraid to lose the invested funds because the supplier has very little incentive to behave opportunistically (the buyer owns the IOS and can use the supplier's sensitive strategic information for its purposes, which can easily prevent the supplier from using the IOS). There may be situations when the same IOS is shared with other suppliers, so the risk of "locked-in" situation is then reduced to the minimum.

The described mutually beneficial situation might become motivating for sharing strategic information. It may also be a solution to the "information exchange paradox" (Bogers, 2011), when both parties in the dyad understand the importance and the value that information exchange brings to the table; however, they choose not to share the information due to fear of the information being inappropriately used by other companies for their economic gains.

Notably, the values of the coefficients describing the two interaction effects (Tab. 2) are rather similar, and both are considerably higher than zero. It makes the slope of the two interaction effects appear steep (Fig. 1 and 2). This quality remarkably substantiates what prompts the companies to exchange their sensitive strategic information. These two effects, in other words, explain the conditions that increase the willingness to share information via an IOS. Interestingly, the effect of BITINV on COORD is negative, all the while the results prove this correlation to be not statistically significant (Tab. 2). From the buyer's viewpoint, this fact merely points to the value of knowing who owns the IOS, since this knowledge becomes a determinant in the buyer's decision whether to get involved in the coordination with a particular supplier or not.

It should also be noted that the theoretical implications are limited to the five different IOS ownership structures implicated in the used questionnaire. Nowadays, companies often use cloud solution to share information with their partners. These new approaches can be cheap and time-effective, although they may bear certain kinds of risks. The cloud solutions have not been considered in our model because the data for this research was collected in 2006 when these solutions were at an early stage of their development.

Some remarks are necessary regarding the control variables. The impact of OPER, PRODCOMP, and SUPIND on COORD is positive as expected and statistically significant. The impact of LNIT-COOP on COORD is not statistically significant. In section 1.2, we point out that many researchers examine the duration of the prior relationships as a variable and find that it has no impact on cooperation.

The modelling results underline the importance of the ownership mechanism of an IOS. Managers who make decisions regarding the information that can and should be shared with partners are likely to benefit from avoiding the overly sceptical attitude to the information exchange and, thereby, the cautious behaviour when the hostage situation is observed in the dyad. It means that if the reciprocal investments are made in an IOS, and afterward certain managerial decisions block the flow of the strategic information between the firms (due to the fear of the other party's opportunism), then a negative impact on the dyad's collaboration goals, and by extension, the supply chain performance are to be expected in the long run. In such a case, the potential gains of a company striving to protect itself from the other firms' opportunism (i.e., sensitive information disclosure to the third parties or competing agents) may be lower than the potential benefits from the extensive sharing of various information within the dyad.

The results of the presented modelling prompt neither the buyer nor the supplier to share all their strategic information with each other. The IOS ownership is only one out of many antecedents of the strategic information exchange. To decide regarding the types of information to be exchanged with a specific partner, the broader perspective of various business aspects and market conditions should be contemplated. Our research model shows that the product complexity has a significant impact on the strategic collaboration. We may assume that for the products of a rather low complexity level, the significance of the examined hypotheses may be annihilated. Therefore, when it comes to the decision-making about the types of information to be exchanged, the managers should always conduct a multi-criteria analysis of the supply chain and the market conditions (where the IOS ownership is one of many factors).

One of the presented research limitations is the focus on the Norwegian companies. The IOS ownership structures may have a different impact on the coordination in different cultural environments in various countries.

Also, in this paper, we have collected the data from the buyer's perspective. We could expect a result that is possibly diverging from the one obtained here if the same questions regarding the IT-specific investments were directed to the suppliers.

Our research concentrates exclusively on the dyadic relationship. Much more complex models, structures, and results could have been obtained if three or more actors were included in the analysis. That, however, may pose a problem due to the lack of relevant scientific frameworks as well as the issues regarding data collection.

In this research, the CFA has suggested including only three items in the construct of "Strategic electronic coordination". It appears obvious that the scope of information to be potentially exchanged in real dyadic relationships may turn out to be much broader than that specified by the three items in our model. In the future research, more items describing the strategic electronic coordination may be suggested to provide a more precise description of the phenomenon in question.

In our results, the R-square characteristic of our model has a moderate value. Had more antecedents (i.e., independent variable) been identified and included into consideration, a higher value of R-square may have been expected.

New forms of the IOS collaboration, such as cloud solutions, have not been considered in this model. Elaborating such an analysis as the one presented in this paper with these modern approaches would require formulating and testing new hypotheses, updating the questionnaire for the data collection purposes, and most importantly, exploring the theoretical foundations for the new results that may be expected.

Literature

Afuah, A. (2003). Redefining firm boundaries in the face of the Internet: Are firms really shrinking? *Academy of Management Review*, *28*(1), 34-53. doi: 10.5465/AMR.2003.8925207

Ahmadjian, C., & Oxley, J. (2005). Using hostages to support exchange: Dependence balancing and partial equity stakes in Japanese automotive supply relationships. *Journal of Law, Economics, and Organization*, *22*(1), 213-233. doi: 10.1093/jleo/ewj003

Allen, D. K., Colligan, D., Finnie, A., & Kern, T. (2000). Trust, power and interorganizational information systems: the case of the electronic trading community TransLease. *Information Systems Journal*, *10*(1), 21-40. doi: 10.1046/j.1365-2575.2000.00078.x

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research*, 396-402. doi: 10.2307/3150783

Bensaou, M., & Anderson, E. (1999). Buyer-supplier relations in industrial markets: when do buyers risk making idiosyncratic investments? *Organization Science*, *10*(4), 460-481. doi: 10.1287/orsc.10.4.460

Blut, M., Evanschitzky, H., Backhaus, C., Rudd, J., & Marck, M. (2016). Securing business-to-business relationships: the impact of switching costs. *Industrial Marketing Management*, *52*, 82-90. doi: 10.1016/j.indmarman.2015.05.010

Bogers, M. (2011). The open innovation paradox: knowledge sharing and protection in R&D collaborations. *European Journal of Innovation Management*, *14*(1), 93-117. doi: 10.1108/14601061111104715

Burnham, T. A., Frels, J. K., & Mahajan, V. (2003). Consumer switching costs: A typology, antecedents, and consequences. *Journal of the Academy of Marketing Science*, *31*(2), 109-126. doi: 10.1177/0092070302250897

Buvik, A., & John, G. (2000). When does vertical coordination improve industrial purchasing relationships? *Journal of Marketing*, *64*(4), 52-64. doi: 10.1509/jmkg.64.4.52.18075

Choon Tan, K., Kannan, V. R., Hsu, C. C., & Keong Leong, G. (2010). Supply chain information and relational alignments: mediators of EDI on firm performance. *International Journal of Physical Distribution & Logistics Management*, *40*(5), 377-394. doi: 10.1108/09600031011052831

Deutsch, M. (1962). Cooperation and trust: Some theoretical notes. In M. R. Jones (Ed.), *Nebraska Symposium on Motivation* (pp. 275-319). Lincoln, USA: University of Nebraska Press.

Dorsch, M. J., Carlson, L., Raymond, M. A., & Ranson, R. (2001). Customer equity management and strategic choices for sales managers. *Journal of Personal Selling & Sales Management*, *21*(2), 157-166. doi: 10.1080/08853134.2001.10754266

Geiger, I., Durand, A., Saab, S., Kleinaltenkamp, M., Baxter, R., & Lee, Y. (2012). The bonding effects of relationship value and switching costs in industrial buyer–seller relationships: An investigation into role differences. *Industrial Marketing Management*, *41*(1), 82-93. doi: 10.1016/j.indmarman.2011.11.013

Gemser, G., & Wijnberg, N. M. (2001). Effects of reputational sanctions on the competitive imitation of design innovations. *Organization Studies*, *22*(4), 563-591. doi: 10.1177/0170840601224002

Han, K., Kauffman, R. J., & Nault, B. R. (2008). Relative importance, specific investment and ownership in interorganizational systems. *Information Technology and Management*, *9*(3), 181-200. doi: 10.1007/s10799-008-0039-9

Hannås, G. (2007). V*ertical electronic coordination and specific IT investments in business-to-business relationships* [Ph.D. dissertation]. Molde, Norway: Molde University College.

Hart, O., & Moore, J. (1990). Property Rights and the Nature of the Firm. *Journal of Political Economy*, *98*(6), 1119-1158. doi: 10.1086/261729

Heide, J. B., & John, G. (1992). Do norms matter in marketing relationships? *The Journal of Marketing*, *58*(2), 32-44. doi: 10.2307/1252040

Heide, J. B., & John, G. (1990). Alliances in industrial purchasing: The determinants of joint action in buyer-supplier relationships. *Journal of Marketing Research*, *27*(1), 24-36. doi: 10.2307/3172548

Heide, J. B., & Miner, A. S. (1992). The shadow of the future: Effects of anticipated interaction and frequency of contact on buyer-seller cooperation. *Academy of Management Journal*, *35*(2), 265-291. doi: 10.2307/256374

Hunt, S. D., Sparkman Jr., R. D., & Wilcox, J. B. (1982). The pretest in survey research: Issues and preliminary findings. *Journal of Marketing Research*, *19*(2), 269-273. doi: 10.2307/3151627

Ibbott, C. J., & O'Keefe, R. M. (2004). Trust, planning and benefits in a global interorganizational system. *Information Systems Journal*, *14*(2), 131-152. doi: 10.1111/j.1365-2575.2004.00167.x

Johnston, H. R., & Vitale, M. R. (1988). Creating competitive advantage with interorganizational information systems. *MIS Quarterly*, *12*(2), 153-165. doi: 10.2307/248839

Joshi, A. W., & Stump, R. L. (1999). The contingent effect of specific asset investments on joint action in manufacturer-supplier relationships: An empirical test of the moderating role of reciprocal asset investments, uncertainty, and trust. *Journal of the Academy of Marketing Science*, *27*(3), 291-305. doi: 10.1177/0092070399273001

Kembro, J., Selviaridis, K., & Näslund, D. (2014). Theoretical perspectives on information sharing in supply chains: a systematic literature review and conceptual framework. *Supply Chain Management: An International Journal*, *19*(5/6), 609-625. doi: 10.1108/SCM-12-2013-0460

Kim, K. K., Park, S. H., Ryoo, S. Y., & Park, S.K. (2010). Interorganizational cooperation in buyer-supplier relationships: Both perspectives. *Journal of Business Research*, *63*(8), 863-869. doi: 10.1016/j.jbusres.2009.04.028

Klein, R., Rai, A., & Straub, D. W. (2007). Competitive and cooperative positioning in supply chain logistics relationships. *Decision Sciences*, *38*(4), 611-646. doi: 10.1111/j.1540-5915.2007.00172.x

Levinthal, D. A., & Fichman, M. (1988). Dynamics of interorganizational attachments: Auditor-client relationships. *Administrative Science Quarterly*, *33*(3) 345-369. doi: 10.2307/2392713

Malone, T. W., Yates, J., & Benjamin, R. I. (1987). Electronic markets and electronic hierarchies. *Communications of the ACM*, *30*(6), 484-497. doi: 10.1145/214762.214766

Ménard, C., & Valceschini, E. (2005). New institutions for governing the agri-food industry. *European Review of Agricultural Economics*, *32*(3), 421-440. doi: 10.1093/eurrag/jbi013

Novak, S., & Eppinger, S. D. (2001). Sourcing by design: Product complexity and the supply chain. *Management Science*, *47*(1), 189-204. doi: 10.1287/mnsc.47.1.189.10662

Nyaga, G. N., Whipple, J. M., & Lynch, D. F. (2010). Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ? *Journal of Operations Management*, *28*(2), 101-114. doi: 10.1016/j.jom.2009.07.005

Porterfield, T. E., Bailey, J. P., & Evers, P. T. (2010). B2B eCommerce: an empirical investigation of information exchange and firm performance. *International Journal of Physical Distribution & Logistics Management*, *40*(6), 435-455. doi: 10.1108/09600031011062182

Premkumar, G. P. (2000). Interorganization systems and supply chain management. *Information Systems Management*, *17*(3), 1-14. doi: 10.1201/1078/43192.17.3.20000601/31241.8

Saeed, K. A., Malhotra, M. K., & Grover, V. (2005). Examining the impact of interorganizational systems on process efficiency and sourcing leverage in buyer–supplier dyads. *Decision Sciences*, *36*(3), 365-396. doi: 10.1111/j.1540-5414.2005.00077.x

Sahaym, A., Steensma, H. K., & Schilling, M. A. (2007). The influence of information technology on the use of loosely coupled organizational forms: An industry-level analysis. *Organization Science*, *18*(5), 865-880. doi: 10.1287/orsc.1070.0285

Schoonhoven, C. B. (1981). Problems with contingency theory: testing assumptions hidden within the language of contingency "theory". *Administrative Science Quarterly*, *26*(3), 349-377.

Skjoett-Larsen, T. (2000). European logistics beyond 2000. *International Journal of Physical Distribution & Logistics Management*, *30*(5), 377-387. doi: 10.1108/09600030010336144

Stevens, J. P. (1992). *Applied multivariate statistics for the social sciences*. Hillsdale, USA: Erlbaum.

Stump, R. L. (1995). Antecedents of purchasing concentration: A transaction cost explanation. *Journal of Business Research*, *34*(2), 145-157. doi: 10.1016/0148-2963(94)00114-T

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly*, *28*(1), 45-73.

Vijayasarathy, L. R. (2010). Supply integration: an investigation of its multi-dimensionality and relational antecedents. *International Journal of Production Economics*, *124*(2), 489-505. doi: 10.1016/j.ijpe.2010.01.010

Wathne, K. H., & Heide, J. B. (2000). Opportunism in interfirm relationships: forms, outcomes, and solutions. *Journal of Marketing*, *64*(4), 36-51. doi: 10.1509/jmkg.64.4.36.18070

Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *The American Economic Review*, *73*(4), 519-540.

Williamson, O.E. (1985). *The Economic Institutions of Capitalism*. New York, USA: Free Press.

Zaheer, A., & Venkatraman, N. (1995). Relational governance as an interorganizational strategy: An empirical test of the role of trust in economic exchange. *Strategic Management Journal*, *16*(5), 373-392. doi: 10.1002/smj.4250160504