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Digitalization of the buyer-seller relationship in the steel industry

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Digitalization of the buyer–seller relationship in the steel industry

Abstract

Purpose

The purpose of this research is to cast light on the nature of the digitalization process that occurs when digital technologies are adopted in buyer–seller relationships.

Design/methodology/approach

The study features a case study from the steel processing industry.

Findings

The present research builds on and extends the interaction approach to the context of buyer–seller relationship digitalization process. The study explicates the interrelated elements of digital infrastructure, digital communication, and degree of digitalization of the buyer-seller relationship.

Research limitations/implications

The study aims at theoretical generalization and thus produces conceptual understanding that is to some extent applicable to various contexts. The generalization of the empirical insights to other process-focused industries is to some extent possible. However, further research in versatile empirical contexts is needed to validate the results.

Practical implications

For managers, the study presents a success case of digital technologies use for improving a buyer–seller relationship.

Originality/value

The originality of the present research is in the way it depicts how a buyer–seller relationship is gradually digitalized in successive digital technology adoptions, that is, a virtuous cycle of

digitalization, that creates and alters the digital infrastructure and digital communication processes between the buyer and the seller resulting in different outcomes (degrees of digitalization in the buyer–seller relationship).

Keywords: buyer–seller relationships, business relationships, digital technologies, digital tools, information technology, steel industry, case study

Introduction

In the US, digital transactions are up to 90% caused by B2B e-commerce (Lilien, 2016). Use of digital technologies or more broadly harnessing technology is one of the key research areas in business marketing (Cortez and Johnston, 2017). Megatrend of digitalization has altered also buyer–seller relationships. Buyer–seller relationships, under different theoretical concepts such as relationships, channels, and supply chains, have been, and continue to be, one of the central areas of research in industrial marketing (Reid and Plank, 2000; Hussain et al., 2020). Several scholars have researched how different digital technologies and tools alter and influence different aspects of buyer-seller relationships (Mathews and Wilson, 1974; Stern and Kaufmann, 1985; Salo, 2012; Salo and Wendelin, 2013).

Mathews and Wilson (1974) focus on electronic data processing (EDP) systems and how those alter the nature of the buying task and relationship. Stern and Kaufmann (1985) discuss the benefits of adopting EDI (Electronic Data Interchange) system. Salo (2012) focus specifically on the steel industry and show how mobile technologies enable faster order taking and transparent relationship. In addition, Salo and Wendelin (2013) in the steel and heavy truck production industry depict over-time how digital tools influence the existing bonds and create new ones namely digital bonds in the studied relationships. The authors of previously mentioned studies overlooked the processual aspect

of digitalization i.e. how over-time digitalization occurs as a holistic phenomenon due to several adoptions of different digital tools.

Thus, the following research question is put forward: How are buyer–seller relationships digitalized, and what kind of process is the digitalization of buyer–seller relationships? This research contributes to buyer-seller relationships and especially to the IMP discussion. Within that domain of research specific focus is set to the interaction process and interaction framework (Håkansson and Snehota, 1995).

As a contribution, this research shows that buyer–seller relationships in the steel industry are digitalized over time through successful investments and adaptations conducted within the buyer–seller relationship. These investments and adaptations are preceded by antecedents, inhibitors and accelerants to those decisions. Eventually, investments in different types of digital technologies enable to solve managerial problems, such as order taking, while forming digital infrastructure and enabling digital communication between the buyer and the seller. Gradually, when several digital infrastructure investment projects are successfully conducted, the virtuous cycle of digitalization emerges (where buyer–seller relationships become increasingly digital). The opposite (i.e., the vicious cycle) is also a possibility in which digitalization might be stopped, and then even reversed, and ultimately, the buyer–seller relationship might be terminated (Alajoutsijärvi *et al.*, 2002).

This research is structured as follows: First, a literature review is conducted. Second, the research methodology is detailed. Third, a case study is conducted and analyzed. Fourth, results and conclusions are presented.

Literature review

Interaction approach to buyer–seller relationships

In the industrial marketing domain, a prominent school of thought is Industrial Marketing and Purchasing (IMP). Within that group, the interaction framework (Håkansson, 1982; Håkansson and Snehota, 1995) comprises an extensively applied conceptual tool for analyzing buyer–seller relationships (Metcalf *et al.*, 1992; Möller and Wilson, 1989, 1995; Baraldi and Nadin, 2006). The interaction framework is widely adopted and amended (Johanson and Mattsson, 1987; Möller and Wilson, 1989, 1995; Håkansson and Snehota, 1995). It has been used also to study the structure and process of digitalization of the buyer–seller relationship within the steel industry (Salo, 2006, 2007). As the framework (Håkansson and Snehota 1995) enables detailed analysis of both structural and processual aspects of buyer-seller relationships the framework provides support for the focal study. Håkansson and Snehota (1995) identified the following structural elements: continuity (time), complexity (e.g., contact patterns), symmetry (power balance or imbalance), and informality (e.g., legal contracts or verbal). Processual elements include adaptation (e.g., modification of the resource or process), cooperation and conflict (e.g., reciprocal or mutual interests), social interaction, and routinization. It should be noted here that this study adopted and revised the idea of relational outcomes and their influence to the relationship from Möller and Wilson (1995).

Digitalization of the buyer–seller relationship

Several seminal contributions have highlighted the importance of studying the impacts of digital technologies on buyer–seller relationships (Appendix 1), although these studies did not directly focus on the impacts. Based on a literature review, 29 studies were identified, which focused on buyer–seller relationships and digitalization efforts. Of those studies, 16 were empirically grounded, during the period from 1985 to 2019, and examined buyer–seller relationships, and how digital technologies have influenced relationships (Appendix 2). In addition, 13 theoretical-analytical studies were

identified during the period from 1989 to 2019. Numerous empirical studies used a survey where either the buyer or the seller responded to survey questions on behalf of the whole buyer–seller relationship, and the dyadic survey method was largely ignored.

Digitalization of the buyer–seller relationship in the steel industry

The steel industry has been one of the key focus areas of industrial marketing and the IMP group (Johanson, 1966; Håkansson *et al.*, 1976; Walter *et al.*, 2001; Penttinen and Palmer, 2007; Salo and Wendelin, 2013, Frick *et al.*, 2020). Within the context of the steel industry, several studies that partly shed light on the digitalization of buyer–seller relationships have emerged since the early 2000s (Chan and Swatman, 2000; Foster, 2005; Salo, 2006). In a similar vein as Vlosky *et al.* (1994), but in the context of the steel industry, Chan and Swatman (2000) identified the drivers of the implementation of the electronic data interchange (EDI) system in the Australian steel industry case and discussed the future possibilities of internet-based commerce. Foster (2005) examined case studies' websites and especially the extranet, similar to Vlosky *et al.* (2000). Foster (2005) focused on the value creation perspective and found that the buyer and the seller in the steel industry must gain value from use of the extranet to succeed in its relational usage. Salo (2006) provided a literature review on basic features and types of digitized buyer–seller relationships, and a case study, and a catalog of items (antecedents, accelerants, and inhibitors) that influence the buyer–seller relationship, specifically digital technology adoption and the relationship to digitization outcomes. In addition to looking at the items and digital technology adoption later, Salo (2007) focused on the order-to-delivery process. With the help of a steel industry case study, Salo (2007) showed how internet technologies and enterprise resource planning (ERP) systems can be utilized in a buyer–seller relationship to redesign work routines to eliminate extra manual work and speed up the order-to-delivery process. Instead of looking only at singular digital technologies, Cripps *et al.* (2009) illustrated, with Australian and Finnish steel industry case studies, how the level of IT sophistication (simple vs. complex digital technologies) and tie strength in the relationship influence the use of digital technology. Strong tie

relationships use relationship-specific digital technologies while loose tie relationships use plug-and-play solutions. Examining the coordination process of a buyer–seller relationship, Salo (2012) illustrated with an in-depth case study how mobile technology use can be aligned with internal coordination efforts and relational coordination efforts. As a result, a mobile technology usage grid in a buyer–seller relationship is provided. In buyer–seller relationships, the bonding process has also been of interest since the early work of Håkansson (1982) and Hammarkvist *et al.* (1982). By focusing on this domain of buyer–seller relationships, using a longitudinal and comparative case study in the steel and truck production industries, Salo and Wendelin (2013) showed how IT impacts the bonding process and identified the emergence, formation, and strengthening of a digital bond.

Methodology

Case study

This study utilizes a case study research method to shed light on the digitalization of buyer–seller relationships. This approach is based on qualitative research and it is used to understand relatively poorly understood phenomena (Eisenhardt, 1989), such as digitalization of a buyer–seller relationship. Thus, a case study method is appropriate, and it has been previously employed to understand buyer–seller relationships (Blois, 1999; Helgesen, 2007). A single case study approach was utilized to enable rich description and more nuanced theoretical development (Easton, 1995; Yin, 1994). The case was selected from a group of pre-selected cases based on the availability of public data, well-known digitalization efforts, and access to the cases (Marshall and Rossman, 1989). The unit of analysis is the interactions forming the buyer–seller relationship (Benbasat *et al.*, 1987).

Data collection

In total, 11 qualitative in-depth interviews were conducted (Arksey and Knight, 1999) which covered 90% of the active individuals, that is, the key informants of the buyer–seller relationship in focus.

Key informants, managers and other important employees, were identified and interviewed (Kumar *et al.*, 1993) as they are the most knowledgeable about the events that have unfolded during digitalization in the case study since the 1970s to early 2019. This process eliminates common bias that occurs when research focuses on senior or elite managers only (Ellis and Ybema, 2010). Appendix 3 shows the details of the key informants.

Data analysis

Overall, the data set consists of 11 semi-structured interviews, which were audio-taped and transcribed. This resulted in approximately 204 pages of transcribed text. The aim for the interviews was to cover the general characteristics of the buyer–seller relationship and then information technology use in the relationship, digitalization. Thus, the authors employed the so-called “grand tour” approach (Arksey and Knight, 1999). Then, the authors asked more detailed questions, and respondents were asked to recall the different phases and events of digitalization in as much detail as possible. Qualitative data analysis (Miles and Huberman, 1984; Lee, 1999) guided by research questions and abductive logic (Dubois and Gadde, 2002) was employed. Abductive logic is a process in which theoretical insights into digitalization of the buyer–seller relationship and empirical understanding of the process evolve simultaneously. Content analysis was initiated by reading the transcribed interviews first for a holistic view, and then more detailed analysis. The unit of analysis is a case study, but at the company level, the focus was individuals and their experiences within digitalization of the buyer–seller relationship either from the buyer’s or the seller’s viewpoint. Based on the detailed analysis, the authors identified all the interviewees’ statements that focused on the buyer–seller relationship and digitalization. They were contrasted with the views of corresponding interviewees from the other side of the buyer–seller relationship. This way, the authors could compare the views held on the progress of digitalization. Thus, understanding of digitalization of the buyer–seller relationship emerged gradually, and evolved as new empirical insights were gained, and theoretical insights were refined and adjusted accordingly (Dubois and Gadde, 2002; Yin, 1994). This

type of content analysis has enabled researchers to achieve deep understanding of the process of digitalization and its unfolding acts, episodes, and events (Holmlund, 2004). In the content analysis process, the authors also used secondary materials, such as popular press articles about the companies, internal documents and newsletters, and video materials, to triangulate the different types of data sets (Denzin, 1978) and gain more complete insights.

A case study from the steel industry

Background

Steel mill (SM) was established as a government owned company in the 1960s and it became one of the largest suppliers of hardened steel qualities in the Nordic region. In 2014 it was bought by a bigger steel mill operating in Europe. Family business owned steel engineering company (SEC) was established in the 1960s and origins of the company are in the construction industry and HPAC business (heating, plumbing, and air conditioning) while focus is now mainly on specialized steel solutions. The case study examined in this research is the relationship between a steel mill (SM) who is the seller and a steel engineering company (SEC) who is the buyer, that was initiated in the 1970s. Today, SM is a large European steel mill while SEC remains family owned.

Structural elements of the buyer–seller relationship

The buyer–seller relationship was initiated in the 1970s which characterizes well the first structural aspect, that is, continuity or time. The key contact persons for the relationship were the steel engineering company co-owners John (SEC) and Diana (SEC), who handled all business activities in relation to the steel mill. Diana (SEC) described the start of the relationship as follows: “The relationship was initiated in 1970 by first heating, piping and air conditioning (HPAC) deliveries and later on by steel construction.”

During the first decade or so, there were several repeat purchases of HPAC installations which were followed by machine assembly services and steel structures. However, continuity was questioned constantly by both parties during the first decade. Early on and even later, a maximum of 15 people worked in the buyer–seller relationship, and thus, the relationship was kept simple rather than complex. Communication and exchange patterns were straightforward from the start, and the relationship was asymmetric, as the steel mill was in a commanding position due to its role as a large buyer of subcontracting services. Machine assembly services were, at that time, a large part of the steel engineering company’s business, and according to Matt (SM), “Clearly, the steel mill had to alter its procurement style when they divested from the assembly business.” As for the final structural element (informality), the communication and style of doing business can be described as very informal. David (SM) described activities with the steel engineering company: “The starting point for activities with the steel engineering company has been that one can trust their word.” Luca (SEC) described the informality aspect as follows:

The main guidelines are in contracts, but there are still many personal contracts without written contract. For example, sometimes an order arrives later than or at the same time when the products should be ready, so many times your work is based on personal contracts... it is based on trust.

Maintaining a relationship for almost 50 years includes some employee turnover and changes in what is being offered to the market. Today, the relationship has evolved into a symmetric relationship as the steel engineering company has grown. Another distinguishing feature of the relationship is the intensive adoption of digital technologies. In the late 1960s, the steel mill invested in an IBM 360 series computer which was utilized in bookkeeping, according to Chuck, a steel mill retiree. Although the computer was not used in the relationship, its use shows how the steel mill seeks to utilize novel technologies. Dennis (SM) described that period: “In the 1980s, the steel mill was at the forefront of

IT development especially in the production area and later in system integration.” Lennart (SM) stated, “In the 1980s, the steel mill started to use IBM mainframe systems whose main goal was to reduce lead-times and increase delivery reliability.” Lennart (SM) also emphasized the increased complexity when investing in digital technologies: “When we in the steel mill have different systems, it increases the need for integration and maintenance.”

At a later point in time, in the early 2000s, the steel mill had a whopping 700 different information systems in place. In addition, focusing on the internal digital infrastructure by reducing lead-times, the steel mill also initiated measures to integrate with their key suppliers (supplying hardened steel plates), such as the steel engineering company. The first step in the creation of a specific digital infrastructure in the buyer–seller relationship was email, which was introduced in 1988. At first, it seemed, and later the fact emerged, that the electronic message system partly replaced mail and telephone use. Thus, a relational digital infrastructure emerged which is proposed here as a novel structural element missed by the IMP interaction approach (Håkansson and Snehota, 1995). However, not all technological innovations were perceived positively in the relationship. Diana (SEC) described the steel engineering company’s attitude toward new technology as follows: “We are not abruptly jumping into new systems.”

This quotation highlighted the attitude within the relationship, that is, seeking benefits from using different technologies instead of mere novelty. Diana, at the time of the interview was close to 70 years old and she established the SEC with her husband, and they have survived a war and during that time national slogan was close to “if it ain’t broke don’t fix it”. Hence, if new information system was acquired, it was acquired for a reason. Luca (SEC) stated that SEC and SM were, at that time, described as being at the forefront of digital technology adoption in the steel workshop activities. He said:

The old system was Unix based and dated to 1980, and in practice, you can receive a lot of load situation information and work orders from that system which you then manually transfer into other systems to get a more accurate picture.

For offer accountants, we built some assisting software based on Access, but still today [when the interview was conducted], all we have is scattered pieces.

Use of Unix (internal operating system for both SM and SEC) and Microsoft Access (database system for both SM and SEC) further strengthened the created digital infrastructure and simplified the coordination of the relationship. In addition to Unix and Access, EDI was utilized to transmit standardized information in the relationship. Lennart (SM) stated, “We have had EDI connections with large volume customers over twenty years now [since the late 1980s].” According to Dennis (SM):

We have two types of EDI partners, direct connections and Anilinker-based connections. Anilinker is a company providing intermediary services for different actors; for example, small workshops or customers can use the Anilinker interface to make orders.

Another digital technology adopted was the internet, especially the extranet. The SM electronic business manager, at that time of the interview, gave a statement in the national newspaper with title “Transactions over the Internet are only the first phase of electronic commerce.” Philip (SEC) emphasized additional developments in the use of digital technology and strengthening of the digital infrastructure: “SEC invested in CAD software which assisted in the drawing and planning of steel objects. Software assisting in administrative routines, e.g., project management and work planning software was also acquired.”

When these technologies were employed, transparency increased considerably in the relationship. The internet provides a connection between companies that is also secure (similar to private networks used before the public internet), but that connection must be used for some purpose, as Philip (SEC) emphasized in relation to ERP utilization: “We have made a quite thorough pre-examination about ERP investment. If we have a new system, we could have direct connections to the network and have our software updated from there to our production machines.”

As the internet enabled an easy and cheap connection without EDI, ERP systems were used in a relational way via the internet, and SEC decided to adopt an ERP system. Especially useful was the automated pricing functionality where the steel plates hardened by SEC were automatically priced with rules set jointly by SM and SEC. Another relational infrastructure investment was the adoption of a mobile system within the SEC factory that enables them to produce steel hardness reports on the factory floor and submit them on the go to SM, steel mill then knows to sell more of the hardened steel plates when there is free capacity. In addition to increasing lead-time transparency, the last paper-based element of the buyer–seller relationship (i.e., the steel hardness report) was eliminated. Not all the digital technologies adopted were as successful at first, such as email and ERP. Stephen (SM) said, “When the digital infrastructure was built, e.g., the production control system, we did not take into account that subcontractors and customers have their own systems.” These problems were taken care of later as suggested by Lennart (SEC): “We are building additional layers [ERP] to integrate systems.”

To summarize, both parties of the relationship invested in internal digital technologies first and then used the technologies in a jointly agreed fashion in a relational way to improve specific pain points, such as eliminating paper-based steel hardness reports. In addition to pricing hardened steel plates, welding design software was transferred via the internet.

Processual elements of the buyer–seller relationship

Usually early on in the buyer–seller relationship, adaptations, that is, modification of resources or processes, to fit other companies' ways of doing business are needed. This also happened in the studied relationship. The steel mill provided special arrangements with SEC, as Diana (SEC) described:

A couple of years ago, we received permission to buy steel plates directly from the mill. Before that, the steel was distributed to the wholesaler in central Europe, and from there, it was transported back to our facilities. We had to pay annual financial assurances when we bought directly, and after a couple of years, SM notified us that assurances were not needed since they owed more than we did, most of the time.

In addition to adaptations by SM, SEC adapted their behaviors. Diana (SEC) described SEC's adaptations:

“The submerged arc welding tower is clearly a relationship-specific investment...

In general, I can say that we do not acquire machines that are only used in a relationship with one party.”

At the core of the nearly 50-year-old relationship is cooperation. Both parties have invested financially and by adapting their processes. Still, the relationship is not without conflicts. When new people are introduced, especially by the steel mill, they created new rules and closely followed them. Conflicts arose, but they were solved. Matt (SM) stated, “I have not seen any real conflicts within the SM-SEC business relationship.” David (SM) said, more strongly, “When there are problems, we do it together and ponder how to go about, and we don't ask how much it costs but how to move forward. We both trust each other, and if needed, we will share costs.”

Diana's (SEC) communications early on were mainly completed using mail, the phone, and the fax machine, but some steel mill visits were included. These early years built up trust and social contacts between the parties. Diana (SEC) said, "It is nice to know with whom you are doing business."

While looking backward, at that time the accumulation of common understanding and social bonds were initiated. Robert (SEC) who stated, "Every Christmas, either we or steel mill hosts a dinner." David (SM) had a similar view of the social aspects of the relationship: "The buyer-seller relationship is characterized by hard work, and relationships are maintained on various levels as we maintain the relationship in our free time, too. Sometimes, we dine and have a sauna."

Besides the social interaction that occurs in the relationships also the processes are learned and repeated and eventually routinization occurs. In the period from the 1970s to the 1990s, Diana (SEC) organized administrative routines, such as billing, making offers, bookkeeping, and salaries with some help from her assistant. John (SEC) was more active in the "real" work of making and doing things for the customer. He could be described as a handyman, with multiple skills ranging from welding to industrial engineering capabilities. John was also in frequent personal contact with many operations-level colleagues at the steel mill, including David and several purchasing managers. Diana (SEC) described John's activities as follows: "John was at steel mill all the time, and he was in contact with work supervisors, buyers, and sellers who are negotiating constantly."

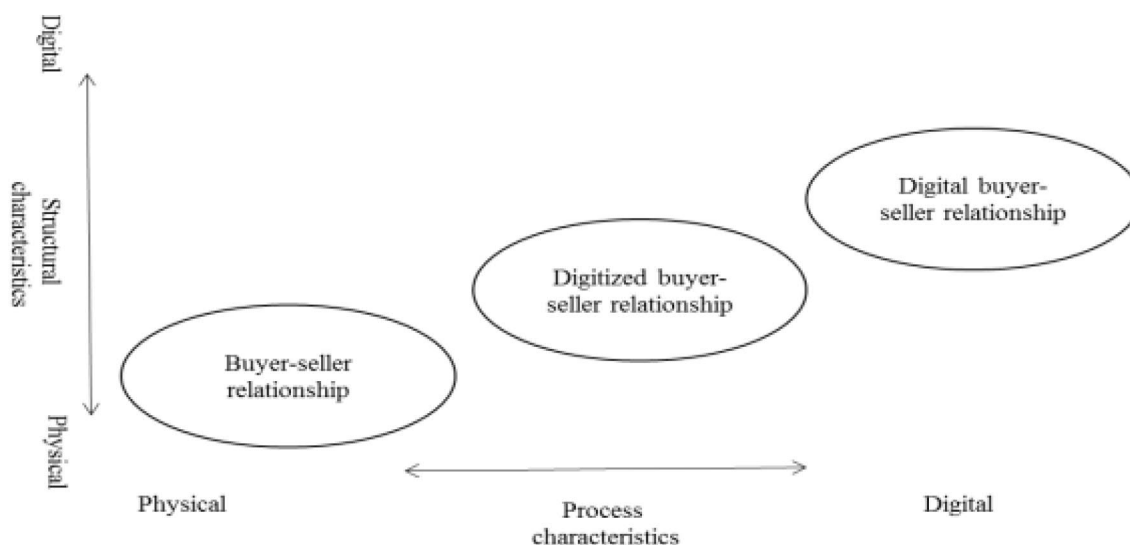
As digital technologies (email, EDI, ERP, welding burnouts, and mobile) were adopted successfully, and the digital infrastructure was reinforced, it also gave birth to digital communication between the parties. As routine acts and events in the relationship were identified, and both parties wanted to improve the relationship, digital communication partly replaced social communication and paper-based transactions in many places. Manual work done by Diana (SEC) was reduced, as digital technologies started to help or do the whole bookkeeping or pricing of steel plates. In addition, order taking was done via an extranet and EDI systems, while the mobile system was, at first, used for steel hardness reports. As a result, over time a digital infrastructure was created, and more importantly,

that infrastructure was utilized for relational communication and transactions. It is not uncommon to invest in a customer relationship management (CRM) system on either side, but the system is not used or fully used as salespeople do not fill in the customer information.

Findings

It was shown in the steel industry buyer–seller relationship that digital infrastructure was created over time and strengthened with the successful adoption of several digital technologies. More importantly, these digital technologies were employed to increase the efficiency and effectiveness of the relationship in form of digital communication. Thus, from the 1970s to 2019, the relationship evolved from the traditional buyer–seller relationship when manually inputting orders and sending faxes was the norm for conducting business into an almost fully digital buyer–seller relationship where only the steel plates and structures are in physical form. Attempt to capture this type of digital transformation is presented in Figure 1 which provides a abducted view of the degrees of digitalization of the buyer–seller relationship.

Figure 1: Degree of digitalization of the buyer–seller relationship



For illustrative purposes, the Y-axis presents the combined structural characteristics (continuity, complexity, symmetry, informality, and digital infrastructure) of the buyer–seller relationships. The X-axis presents the process characteristics (adaptation, cooperation and conflict, social interaction, routinization, and digital communication). The Z-axis can be thought of as the degree of digitalization or progress in digitalization, which is the outcome of one-time and accumulated digitalization efforts (i.e., successful or unsuccessful adoption of digital technologies).

In responding to the first part of the research question, how are buyer–seller relationships digitalized?, Figure 1 presents the outcomes of the digitalization in a specific point of time, that is, as a snapshot; a process model is developed to depict the digitalization process that occurs over time. Table 1 is an attempt to generalize and capture different types of characteristics that change in a buyer–seller relationship individually or in tandem due to adoption and use of digital technologies, which causes at the end different ideal types of buyer–seller relationships to emerge.

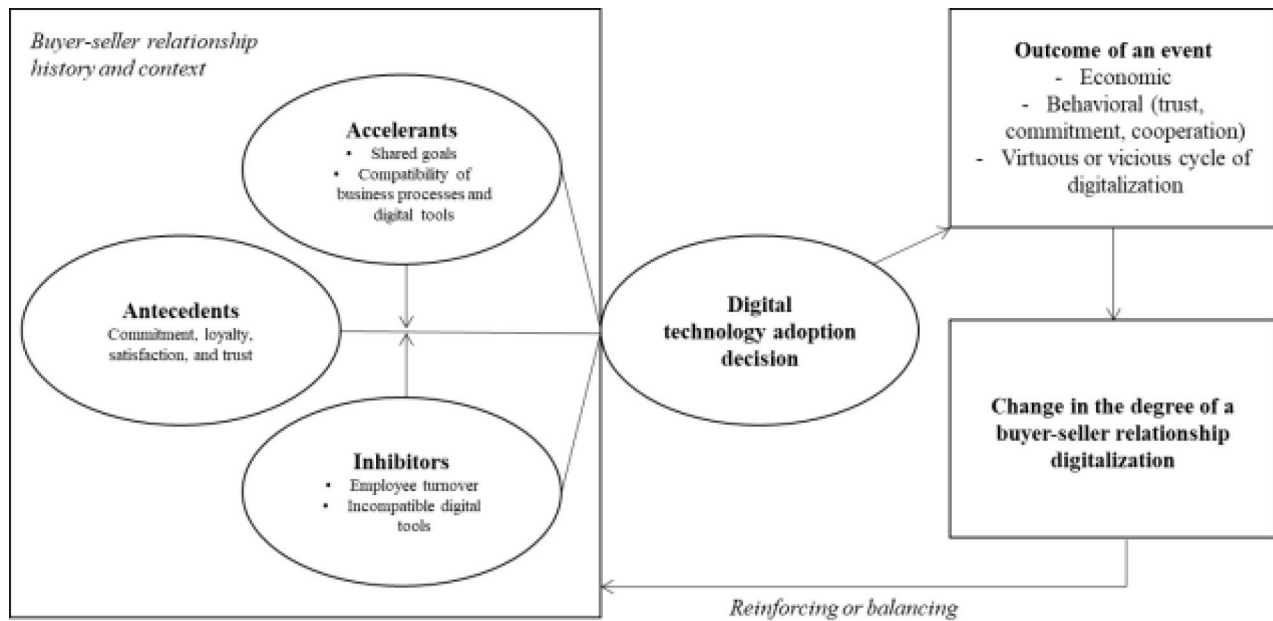
Table 1: Characteristics of the degrees of digitalization of the buyer–seller relationship

Characteristics	Business relationship	Digitized business relationship	Digital business relationship
<i>Product and service exchange</i>	Physical with some electronic brochures	Product or service might be digitized but some or main part of exchange is still physical	Product or service is (almost) fully digitized if digitization is possible
<i>Information exchange</i>	Verbal	Digitized – verbal	Digital (on rare occasions, personal meetings occur)
<i>Amount (quantity and quality) of personal communication</i>	Personal communication is the main communication method	Some two-way digitized communication forms are used	Most of the communication is based on two-way digitized communication (some strategically meaningful meetings occur physically)
<i>Actors</i>	Physical	Moderately digitized	Digitized or digital

<i>Business-related activities (e.g., buying and selling)</i>	Physical, based on personal meetings, exchange, and communications	Partly digitized, increased amount of impersonal contact	Digital, rarely personal communication or exchange
<i>Flexibility</i>	Is at high levels as digitized routines do not hinder flexibility	Optimal, as structure as well as organizations are used to digitized and physical contacts and processes	Is at low levels as routines and digital structure bring in rigidity
<i>Digital bonds</i>	None	Some	Several
<i>Structure</i>	Traditional	Partly digitized	Digital
<i>Outcomes of the current state of the business relationship</i>	Flexible but costly to maintain	Optimal, as high level of effectiveness and efficiency is gained while business relationship has remained its basic flexibility	Rigid, as also routines are digitalized and are difficult identify or change; R&D type of innovation creation is not fostered

Figure 2 is an attempt to answers the latter part of the research question (i.e., what kind of process is the digitalization of the buyer–seller relationship?) by presenting how history and context (antecedents, accelerants, and inhibitors) of the buyer–seller relationship influence the decision to adopt digital technology. In the studied relationship long-term relationship, trust and mutual goals acted as antecedents and even accelerants to digitalization efforts. Also, success in the digitalization i.e. economic outcomes (Möller and Wilson, 1995) has increased digitalization (i.e. virtuous cycle). In some cases and situations, elements or characteristics of a relationship are inhibiting digitalization such as lack of commitment, organizational changes and lack of top management support). It is also important to note that qualitative changes in the studied steel industry buyer-seller relationship are observable. We can see that cooperation and commitment to the relationship have increased due to the economic success but these in general are contingent to the success or failure.

Figure 2: Digitalization process of the buyer–seller relationship



In Figure 2 the decision to adopt digital technology and the subsequent use of the digital technology lead to creation of the digital infrastructure and digital bond. It also gives birth to relational digital communications. In some instances, the decision to adopt digital technology may include a decision to reduce digitalization in the relationship or the decision might be the dissolution of the relationship. Buyer–seller relationships evolve gradually, and several outcomes may emerge (Möller and Wilson, 1995). It should be highlighted that adding the outcomes of an event to our analysis from the dyadic interaction framework developed by Möller and Wilson (1995, p. 35.) is an enhancement to traditional IMP interaction framework. Nevertheless, the focus is here on the economic and behavioral outcomes in addition to the virtuous and vicious cycle of digitalization. Economic gains in our studied relationship come from the transactional efficiencies, as well as from the increased volume of hard steel plates sold, for example, while behavioral outcomes link to processual aspects of the buyer–seller relationship, for example. For instance, cooperation and social exchange might be influenced by digitalization when employees have less regular meetings and they might be socially distanced from each other. The degree of digitalization of the buyer–seller relationship links to Figure 1, while

reinforcing and balancing acts are feedback mechanisms linked to the history and context of the buyer–seller relationship.

Conclusion

This study set out to answer the following research question: How are buyer–seller relationships digitalized, and what kind of process is the digitalization of the buyer–seller relationship? A single in-depth case study from the steel processing industry was conducted to illustrate how structural and processual elements are in play when buyer–seller relationships are digitalized. This research builds on the interaction approach (IMP), especially Håkansson and Snehota (1995), and as a result, shows the digitalization process of the buyer–seller relationship in the steel industry by utilizing concepts such as digital infrastructure, digital communication, and degree of digitalization of the buyer–seller relationship (Figure 1) to depict the digitalization process. The digital infrastructure is a structural element added to the traditional buyer–seller relationship characteristics to reflect changes that have taken place after the megatrend of digitalization. It emerges when digital technologies are used in a relational way and over time. The digital infrastructure is strengthened with repeated investments in digital technologies. It enables digital communication, which is a processual element that is added to the traditional buyer–seller relationship characteristics to enable richer description of current buyer–seller relationships that are influenced by digital technologies. Digital communication replaces in some cases, but also enhances and intensifies other processual elements (specifically, face-to-face social interaction) of the relationship. Social interaction is more focused and intense when mundane work, such as sending documents via faxes, is now conducted over digital infrastructure such as the internet. Each episode and event in the buyer–seller relationship has an effect (i.e., outcome) for the buyer, the seller, and the relationship (Håkansson, 1982; Holmlund, 2004). Traditional outcomes are economic and behavioral (Möller and Wilson, 1995), but digitalization-specific outcomes (i.e., virtuous and vicious cycles of digitalization) are also identified (Figure 2). The virtuous cycle occurs

when companies can effectively and efficiently use information technology to speed up processes and yield the benefits of digitalization. The vicious cycle occurs when expectations of digitalization efforts are unmet. As buyer–seller relationships evolve over time, and can last decades, outcomes of digitalization efforts can be analyzed with a snapshot of the relationship. At any point in time, the buyer–seller relationship can be seen to belong to one of three types of ideal buyer–seller relationship types (Figure 1 and Table 1). This study contributes to the literature in the way it depicts how a buyer–seller relationship is digitalized gradually in successive adoption of digital technologies, that is, the virtuous cycle of digitalization, which create and alter the digital infrastructure and digital communication processes between the buyer and the seller, resulting in different outcomes (i.e., degrees of digitalization) in the buyer–seller relationships.

Managerial implications

For managers, the process of successfully using digital technologies in a buyer–seller relationship for organized digitalization is presented with the help of the case study. Similar to Ekman *et al.* (2015), this study finds that setting common goals that benefit both parties of the relationship is key to successful adoption of digital technology. In addition, the present research emphasized the importance of setting jointly agreed digital technology roadmaps for digitalization efforts as they ease the management of the relationship.

Current research also shows in rough form for managers how buyer-seller relationship can be digitalized. Quite commonly, first steps in the digitalization process are taken when information exchange in a relationship is digitalized by implementing relational information systems such as the Extranet (Spralls, Hunt and Wilcox, 2011) or extended ERP systems (Gupta et al., 2019) or mobile systems (Barata, Da Cunha and Stal, 2018). These are especially helpful to increase sales within the relationship as order taking and placing is easier. Then, due to creation of digital infrastructure and digital communication business relationship becomes more digitalized (Table 1). These investments into a relationship require trustful relationship where both parties are committed to further developing

the relationship. Existing trust, commitment and cooperation are common antecedents to the digitalization. When digital infrastructure is nurtured burden of repetitive work and redundant business process are eliminated. It is also important for managers to keep key people in the relationship as high employee turnover inhibits digitalization. Similarly, lack of managerial support is one of the inhibitors. If managers focus only on their daily tasks and ignore the developmental aspects of their work employees feel betrayed. Again, if both parties are using similar information systems i.e. digital technologies it accelerates digitalization (Figure 2). Another, step that can be taken relatively easily is digitalization of the product or service exchanged (Table 1). Perhaps not all the elements of the offering can be digitalized but parts of it e.g. service elements (Laudien, and Pesch, 2019). For example, when producing hardened steel plates and products testing reports can be digitalized and without those steel plates are worthless. In some cases it is also, relevant to streamline the interfacing business process e.g. meetings related to contracts or R&D to be conducted via Zoom, Microsoft Teams or Skype. These are especially flexible tools for smaller companies and the simpler the digital tool the faster the adoption and the use of the tool is. When different aspects of the buyer-seller relationship are digitalized the degree of digitalization within a relationship increases and creates organizational rigidity but also digital bonds that work as exist barriers. For managers it is important to be aware of the increased rigidity and organize informal events for the employees of both sides. Increased digitalization brings cost savings in form of less travel or more efficient sales process (Salo, 2012). However, as social exchange and communication is kept at bear minimum co-innovation occurs at lower levels. In order, the virtuous cycle of digitalization to occur managers at both sides should identify bottlenecks that are relevant and use different digital tools to increase the digitalization of the relationship. In the digitized business relationship, information exchange as well as offering are key elements that can be digitalized further. Also, business activities or process such as R&D meetings and other workshops could also be digitalized. Most difficult one would be the

digitalization of the actor i.e. how to move from physical work to e.g. platform enabled work where companies rarely own resources (e.g. Airbnb).

Limitations and future research

A common limitation in any qualitative research, and especially in the single case study method, is the issue of generalization. The results are specific to the steel processing industry and similar process-focused industries, such as the chemical industry. Thus, further research with qualitative (i.e., case study-based) methods is needed in other empirical contexts to describe how buyer-seller relationships are digitalized, similarly or differently, from history to adoption and outcomes, as well as a survey instrument could be developed and tested to validate results across contexts.

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Appendix 1. Research highlighting the importance of studying the impacts of digitalization on buyer-seller relationships

Authors	Methods and data	Contribution
Mathews and Wilson (1974)	Conceptual and 15 interviews.	Suggests that electronic data processing (EDP) has an impact on industrial buying and buyer-seller relationships. Identifies a five stage model for EDP adoption. EDP usage depends on the associated buying task and stage of EDP adoption.
Mathews <i>et al.</i> (1977)	Conceptual.	Adopts seller perspective and describes how different systems linked parties together and shows which strategy is best used by a new seller to interfere a linked relationship.
Buzzell (1985)	Conceptual.	Computerization has impacted on the growth and profitability of companies as well as on economies of scale. In addition inter-organizational data links will be playing a greater role in marketing.
Backhaus (1986)	Conceptual.	Computer-to-computer dialogue will have an impact on buyers.
Wilson (1986)	Conceptual.	Discuss the state of the art studies in industrial marketing and pinpoints briefly to micro-computers and communication technology.

Wijnhove and Wassenaar (1990)	Conceptual and sample of 11 companies.	Focuses mainly on IT impact on an internal organization. Still notices that communication and inter-organizational systems increased cost savings and enabled better service.
Cunningham and Tynan (1993)	Conceptual and two companies.	Pinpoints that computer communications between organizations is relatively recent innovation. Electronic trading may alter personal understanding of each other's firm.
Steinfeld <i>et al.</i> (1995)	Conceptual and non-specified amount of case studies.	The inter-organizational network (the Internet is one) may support transactional markets or strengthen existing relationships. The latter view is taken in their study. Criticizes Malone <i>et al.</i> (1987, 1989) who favor the former view.
Stump and Sriram (1997)	Conceptual and sample of 277 companies.	IT deployment in purchasing may alter the nature of buyer-seller relationships, that is, foster the development of closer relationships.
Möller and Halinen (1999)	Conceptual.	Pinpoints the importance of studying the Internet's impact on business relationships and networks.
Reid and Plank (2000)	Conceptual and literature review of 2194 academic articles.	Notices the lack of research conducted into computers and technology in business markets area.

Appendix 2. Summary of the studies focusing directly on the impacts of digitalization on buyer-seller relationships

Authors	Sample/ Technology focus	Structure/ process focus	Major findings
Empirically grounded			
Stern and Kaufmann (1985)	Personal interviews. 16 companies with EDI.	Both are discussed. Describes changes in the structure of communication and coordination. Highlights EDI adaptation process and pinpoints performance benefits gained by using EDI.	Shows the role and impacts of the EDI. Illustrated some of the benefits of the EDI adoption and discussed the nature of power in the buyer-seller relationships.
Mohr (1990)	125 members of marketing channel of computers. E-mail.	Mainly describes communication and coordination process and how E-mail affects it.	Increased computerized communication (E-mail) is associated with higher levels of participation, coordination, and commitment. Also timeliness of communication is increased.
Vlosky <i>et al.</i> (1994)	173 home center retailers and 154 distributor intermediaries. EDI.	Both are discussed. Illustrates performance outcomes of EDI adoption and highlights the role of adaptations especially from seller's side.	Implementation of EDI is usually buyer initiated. The implementation phase is crucial. Key factors for successful adoption are communication, coordination, and planning.
Vlosky <i>et al.</i> (1997)	22 home center buyers and 102 wood	Both are discussed. Structure of relationship and	Relationship satisfaction gap concept was created. Perceptions of the both parties' impact on the degree of disconnection

	products suppliers. EDI and UPC.	parties give rise to satisfaction gap. Gap is narrowed by communication and coordination as well as with adaptation (e.g. financial investments, learning) processes.	between parties. Disruption is high if disconnection is wide but evidently after adoption relationship strength and satisfaction increases.
Wilson and Vlosky (1998)	13 home center retailers and 22 wood products suppliers. EDI and UPC.	Change process is discussed. Implementation process is an exercise of power.	The IOS implementation disrupts the relationships when buyers are pushing sellers to adopt technology. Buyers are gaining more than seller and authors suspect that in the future the benefit levels will rise.
Naudé <i>et al.</i> (2000)	89 large UK firms. EDI.	Both are discussed. EDI impacts on structure since adaptations have to make when aligning EDI. Coordination and communication occur more naturally.	Identifies various EDI benefits both in financial, strategic and behavioral level. EDI partners are locked to a relationship.
Vlosky <i>et al.</i> (2000)	56 companies from different industries engaged in the Extranet usage.	Both are studied. Technology brings a new facet to structure. Communication and exchange between parties is affected by the Extranet.	Defines the benefits of using the Extranet. Largest advantage is increased purchases/sales through electronic linkages. It also simplifies and reduces costs. The Extranet partners are perceived more positively than non-extranet ones.

		Organizational benefits are discussed.	
Carr and Smeltzer (2002)	175 mail surveys and 36 interviews with purchasing managers. Several technologies.	Focuses on communication process. Discusses IT usage and its relationship to information richness and frequency.	Notices the scant literature on the IT effect on buyer-supplier relationships. Trust is not increased by the IT, however the IT is applicable in frequent communication between partners.
Leek <i>et al.</i> (2003)	107 procurement managers. Several technologies.	Stresses the process of communication.	Describes the impact of the IT on various elements of the business relationship. Impersonal IT-based communication may become cornerstone of many new relationships. Range and depth of information exchange increases. The amount of face-to-face communication will decrease.
Hausman and Stock (2003)	Two large surveys with hospital managers. EDI.	Focuses on process adaptation and noted the importance of social interaction.	The factors affecting adoption and implementation seem to be different. Social influence plays a crucial role in the cooperative adoption of technologies like the case of the EDI.
Rao <i>et al.</i> (2003)	10 interviews with service companies. Internet.	Highlights communication and business performance increase.	The use of the Internet impacts little on trust and does not hinder personal forms of communication. Internet use is associated with improved business performance and satisfaction. Social bonds have to be created before technical bonds.
Deeter-Schmelz and	138 purchasing professionals	Focuses on communication and	The Internet plays a moderate role in the business relationships and if the

Kennedy (2004)	interviewed. Internet.	the role of information.	information exchange and the trust are in high level the role is even lesser.
MacDonald and Smith (2004)	102 industrial companies. Multiple.	Illustrates the adaptation and usage of systems.	Technology-mediated communication control costs while keeps personal touch. It also has positive effect on the trust and future purchase intentions.
Ryssel <i>et al.</i> (2004)	61 companies. Several technologies.	Both are discussed. Structure of organization influences IT deployment. Value creation process is enhanced.	IT deployment has diverse impacts on the atmosphere and value creation within the business relationship. Internal IT systems determine IT deployment within relationship.
Makkonen and Vuori (2014)	36 interviews in six focal companies forming 2 cases studied	Structure and process are discussed.	IT provides a strong foundation to act upon when enhancing buyer-seller relationships.
Falkenreck and Wagner (2017)	10 interviews and 3 focus groups with 10 individuals. Survey of 497 responses from Western Europe, 42 from Eastern Europe and 48 from China	Structural aspects were discussed.	Trust in the IoT data credibility is key issues to implantation.

Pagani and Pardo (2017)	Empirical research is limited to illustrative cases	ARA model utilized	Typology for digital systems is conceptualized.
Authors	Technology focus	Structure/Process	Major findings
Theoretical-Analytical perspectives			
Han and Wilson (1989)	Several technologies.	Stresses the role of structure.	Technology employed by a supplier and a customer leads to different organizational structures, behaviors, and the structure gives rise to different types of interactions.
Clemons <i>et al.</i> (1993)	IT.	Discusses the process of coordination and how IT lowers transaction risk associated with it.	The IT investments will be made with long-term suppliers because it takes time to recoup the investments and to learn. Human interaction needs to be managed since systems themselves do not create trust.
Bensaou and Venkatraman (1996)	IT.	Both are discussed. Information processing is discussed and respective capabilities are introduced.	Illustrates the role of IT-mediated inter-organizational relationships. Develops a model to explain inter-organizational coordination. Identifies IT facilitated and supported information processing capabilities as new sources of organizational capabilities.
Kumar and Dissel (1996)	IOS.	Stresses the role of conflict management as a process. Different IOS types cause different conflicts.	Discusses collaboration and conflict management within inter-organizational systems. Structurability of the relationship influences the degree of programmability of relationship.

Han (1997)	Several technologies.	Stresses the role of structure.	Almost identical to Han and Wilson (1989), however more emphasis is placed on technological matching i.e. if both parties have similar technologies it is beneficial for relationship.
Bello <i>et al.</i> (2002)	E-tools.	Both are discussed. Adaptations are needed to use e-tools. Six different activities are identified and e-tools are matched for each activity and possible performance outcomes are discussed.	Shows how software is linked to channel activities and how communication and transaction enhancements are possible.
Jap and Mohr (2002)	Web-technology.	Both are elaborated on. Different types of relationships from relational to transactional require different types of web-enabled technologies.	“B2B technologies... may undermine long-term business relationships”. Provides an overview of the fit between relationship orientation and employed web-technology. Technology can free up scarce human resources to do more value-added activities.
Schurr <i>et al.</i> (2002)	Web-technology.	Discusses the role of communication and information quality in the business relationship context.	Describes information quality in the web-based information systems. Identifies characteristics of information systems to moderate the influence of information quality on business relationships. Suggests future studies on the impact of information quality on trust.

Osmonbekow <i>et al.</i> (2002)	E-tools.	Both are discussed. Adaptations are needed to use e-tools. Discusses the changes to procurement brought about by electronic commerce and how both transactional and communicational tools exist in assisting internal and external activities.	Illustrates how adoption of the e-tools impacts on both the structure and processes of the buying center.
Easton and Araujo (2003)	IOS and virtual markets.	Mainly discusses structural issues on a macro level.	Authors raise a question of if more communication is necessarily better for relationships. They suggest that it even may lead to reduced levels of trust.
Boyd and Spekman (2004)	Internet.	Discusses value creation process and how the Internet impacts on it.	The impact of the Internet requires aligning its attributes with the economic and relational factors driving value creation. The Internet supports digital resource sharing.
Iyer (2004)	Internet, Intranet, and Extranet.	Discusses structures and purposes of electronic marketplaces and identifies private exchanges and the Extranets as a suitable form for business relationships.	Company and offering characteristics affect choices made regarding the adoption of particular type of IT.

Obal and Lancioni (2013)	Several	Ties together the special issue papers.	Provides general research agenda for the future.
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Appendix 3. List of interviewees

Steel industry buyer informant pseudonyms	Steel industry seller informant pseudonyms	Position of the interviewees	Type of contact	Duration	Transcribed pages
Matt		Purchasing manager	Telephone calls, E-mail correspondence, and interview	1h 40 minutes	17
Lennart		Business IT manager	Telephone calls and Interview	1h 30 minutes	25
Dennis		IT manager	Telephone calls, E-mail correspondence, and interview	1h 45 minutes	18
David		Technology advisor	Telephone calls, E-mail correspondence, interview, and plant tour	1h 49 minutes	21
Martin		Production planner	Telephone calls and Interview	1h 59 minutes	Interview together with Stephen, 30 pages
Stephen		Product manager	Telephone calls and Interview	1h 57 minutes	Interview together with Martin, 30 pages
	Robert	CEO	Telephone calls, E-mail correspondence,	2h 10 minutes	37

			plant visit, and interview		
	Luca	CIO	Telephone calls and interview	1h 45 minutes	23
	Diana	CFO	Telephone call and Interview	1h 55 minutes	20
	Philip	Production manager	Interview and plant tour	1h 30 minutes	13
	James	Production employee	Interview and plant tour	1h 10 minutes	13