Received 5 March 2022
Revised 11 June 2022
26 July 2022
1 September 2022
Accepted 11 September 2022

The whereabouts of interorganizational learning: a maritime case study

Bjarne Pareliussen, Marte Fanneløb Giskeødegård and Vilmar Æsøy
Faculty of Engineering, IHB, Norwegian University of Science and Technology, Ålesund, Norway

Abstract

Purpose – This paper aims to present the results from a case study that investigated interorganizational learning in a buyer and seller relationship in the context of the maritime industry. This examination emphasized unraveling how the buyer and seller in the case study interacted and transferred knowledge when using a new business model that relied on servitization. Furthermore, this paper also addresses and discusses work practices, and the relationship between intra- and interorganizational learning.

Design/methodology/approach – A case study entailing the introduction of digital technology and a new business model into the maritime industry was used as an empirical example of interorganizational learning. The case study was conducted over a period of over one year and focused on a buyer of freight ships and a seller of servitized technology used on the ships. The organizations involved were the ships, the shipowner's office and the ship engine supplier. The primary data acquisition methods comprised semi-structured interviews and observations.

Findings – The case identified interorganizational learning within the organizations at the individual, group and organizational levels, but only a few learning signs could be viewed as bidirectional interorganizational learning that can create knowledge and competitive advantages for the organizations. This is explained by the interorganizational learning context and the organizations' motivation for learning at a strategic level.

Originality/value – This paper addresses an identified need for empirical studies on how interorganizational learning unfolds within organizations and connects to intraorganizational learning. Interorganizational learning studies often examine partnerships and joint ventures, in which partners have entered into these relationships with learning as a specific goal. By choosing a case in which interorganizational collaboration is anchored in operational matters, the study demonstrates the importance of motivation and agenda when entering into partnerships, concerning how inter- and intraorganizational learning develops within organizations. Furthermore, approaching these levels from an interrelated and practice-oriented perspective challenges established success criteria for interorganizational learning.

Keywords Interorganizational learning, Learning, Organizational change, Working practices, Maritime organizations

Paper type Case study

Introduction

This article investigates the implementation of digital technology and the subsequent change in business model within a maritime context in Norway. The maritime industry is

The Learning Organization
Vol. 29 No. 6, 2022
pp. 670-687
Emerald Publishing Limited
0969-6474
DOI 10.1108/TLO-11-2021-0129

developing technology for greener energy and is experiencing demands for innovation and change. As digital technologies have been known to impact and stimulate learning processes at different levels (Belinski, Peixe, Frederico, & Garza-Reyes, 2020; Ingvaldsen, 2015), as well as alter relational ties between organizations (Selnes & Sallis, 2003), this paper presents a case study to unravel and discuss further how technology-induced organizational change impacts intra- and interorganizational learning.

The introduction of digital technologies is a research context often used to illustrate how organizational learning can aid organizations (Belinski *et al.*, 2020; Ingvaldsen, 2015; Tortorella, Vergara, Garza-Reyes, & Sawhney, 2020). For instance, digital technologies can elicit added connectivity, information sharing and new business opportunities to organizations that can make the necessary adaptations to harvest these possibilities. Recently, discussions about interorganizational learning have become increasingly important, adding new dimensions to the theoretical foundations of organizational learning. Interorganizational learning focuses on how organizations can learn from each other and collaborate in dyadic relationships, networks, partnerships and supply chains.

Intraorganizational learning refers to learning within organizations using a process involving the individual and the collective (Popova-Nowak & Cseh, 2015), in which learning ideally takes place at different levels. Interorganizational learning in this context is defined as knowledge transfer from one organization to another or between organizations, or creation of new knowledge as a result of mutual knowledge exchange (Rupčić, 2021).

Interorganizational learning often has been studied within organizations that actively seek partners for collaboration. In these situations, learning from each other is the main driver for entering into such relationships, as it is thought to increase competitiveness (Anand, Kringelum, Madsen, & Selivanovskikh, 2021; Rajala, 2018). A central question is whether positive effects in such relationships are transferrable to other contexts, considering that interorganizational learning processes depend on the type of relationship and types of organizations (Rupčić, 2021). Organizations in a joint venture that actively look for collaborations and opportunities will have motivations and possibilities that differ from organizations entering into collaborations in which learning is less emphasized as a motivator (Inkpen & Crossan, 1995). This paper demonstrates interorganizational learning in a context that focused on two ships' operations. Understanding the motivation for the partner organizations to collaborate can be a key issue in understanding how learning within and between these organizations unfolds.

For example, Peronard (2021) argued that learning requirements depend on service networks' interactive complexity. Peronard's (2021) typology demonstrated that service networks with loose couplings and linear interactions can manage with passive learning, viewed as learning from seminars, consultants and printed materials. Networks with tight couplings or complex interactions require active learning, e.g. learning by observing competitors. Lane and Lubatkin (1998) demonstrated that these definitions of *passive, active* and *interactive* learning are different ways in which interorganizational learning can occur. Interactive learning is the most effective and allows firms to learn the more complex aspects of knowledge, i.e. the "how and why" knowledge, from other firms (Lane & Lubatkin, 1998). Interactive learning necessarily will require a close and dedicated commitment from both parties.

This paper's case study focused on a shipowner operating two advanced ships using a novel maritime industry business model that uses performance-based contracts as the basis for operation. These contracts transform the onboard technology supplier into a service provider, delivering services closely related to the shipowner's core business, which is the operation and maintenance of ships. The case study lasted for a year, comprising interviews

and observations, and focused on the work processes on board the ships, at the shipowner's office, and at the supplier's office. Such a study can be instrumental in describing learning at different levels within the organizations and observing the effects of organizations learning from each other or together. Analyzing these effects of digital technology and business models can benefit the industry and contribute to discourse on intraorganizational and interorganizational learning.

This investigation adopted a practice-oriented perspective; therefore, the research questions grounding this study were structured to assess the impact of both technology and new business models on learning processes and work practices. Building on this, the research questions comprising this study include:

RQ1. How do changes in buyer–seller relationships due to new business models and new technology influence the actors' learning processes?

RQ2. How can studying changes in work practices contribute to understanding the relationship between intra- and interorganizational learning?

The paper is structured by first presenting the theoretical foundation for analyzing organizational and interorganizational learning used in the case study. The method for gathering the empirical data then is presented, followed by the case study results in two parts: first, the description of the case and the situation in which interorganizational learning took place, and second, the results of the individual interviews. A discussion of key findings follows. The paper concludes with how this case study can increase understanding of intra- and interorganizational learning, as well as contribute to the maritime industry's use of digital technology and servitization as a business model.

Theoretical background

Work practice and learning within and between organizations

Using intra- and interorganizational learning as analytical frameworks to explain the successes and failures of organizations' adaptation to technology and business models is not straightforward. Intraorganizational learning's complexity starts with the concept of learning, originally thought of as an individual learning process (Crossan, Lane, White, & Djurfeldt, 1995). It is now used in a broader context at the individual, group. and organizational levels. A strategy for linking learning and technology entails understanding work practices as manifested evidence of learning. Adopting such a practice-oriented perspective on learning and work has methodological and theoretical implications. According to Barley (2020), the organization will change from the ground up if new technology changes workers' roles and relationships, leading to organizational change, as workers' actions elicit new interactions with other workers, altering social structures. Understanding the intricate and interrelated processes of change at different organizational levels is imperative. Advocating for an emphasis on practices also entails taking an epistemological stance on how to understand knowledge creation and learning. Therefore, the following theoretical discussion includes an introduction to academic debates on the different levels of organizational learning, what is required to focus on work practice, and how to understand learning and knowledge as phenomena.

Levels of learning

The first level of intraorganizational learning is individual-level learning, which refers to learning that each individual organizational member does. At this level, learning is explained using common theories, e.g. cognitive or experimental learning. The second

intraorganizational level refers to the group or collective level. Groups can be defined formally within an organization structure, or they can emerge in an organization. Here, the focus is on learning as a collective process. Learning at the group level can happen in communities of practice, which Brown and Duguid (1991) exemplified as the mutual knowledge-creation that takes place in the interactional space where one learns to become a community member instead of understanding learning as a transfer of knowledge. Learning at the organizational level can be defined as learning done by the organization, implemented by systems, and influenced by or influencing organizational structures, procedures and systems (Crossan *et al.*, 1995). It also has been described as "encoding inferences from history into routines that guide behavior" (Levitt & March, 1988, p. 320), highlighting that learning at the organizational level is independent of the organization's individual members.

However, theories with different epistemological foundations and even paradigms are necessary to explain how learning occurs at various organizational levels (Crossan *et al.*, 1995; Popova-Nowak & Cseh, 2015). This makes intraorganizational learning a challenging concept to use as a research framework and for comparing findings from different studies (Crossan, Maurer, & White, 2011).

One approach to grasping the difference between intra- and interorganizational learning is to understand them as learning at different levels, in which interorganizational learning is presented as a fourth level (Crossan *et al.*, 1995). The authors recognized the growing research area of organizations learning in networks and partnerships, and viewed this as the fourth level of organizational learning. In this context, *interorganizational learning* is defined as "learning between organizations at predominantly the individual, group, or organizational level" (Crossan *et al.*, 1995, p. 346). This definition views the interorganizational level as a source or origin of learning that can occur at intraorganizational learning levels. A challenge with this definition is understanding what this fourth level means concretely, i.e. is it a fourth level separate from the other three, or does it stimulate the other three, but is difficult to single out as a separate dimension?

Linking interorganizational learning to intraorganizational learning and the typology of learning at different levels has become scarce in the organizational learning debate (Anand *et al.*, 2021). Interorganizational learning has been studied as a concept on its own, separate from intraorganizational learning, often focusing on the possibilities of gaining a competitive advantage by establishing relationships for learning. Important research themes in interorganizational learning have included assimilation of new knowledge (exploration) or using existing knowledge (exploitation) (March, 1991). These terms were used in a study by Holmqvist (2004), in which interorganizational learning benefitted from combining the learning methods of exploration and exploitation. Interorganizational learning then can be viewed as either extension or internalization. *Extension* is viewed here as intraorganizational learning that generates interorganizational learning. However, *internalization* is the opposite, in which interorganizational learning generates intraorganizational learning. There also has been an emphasis on organizations' ability to learn from other organizations, i.e. their absorptive capabilities (Cohen & Levinthal, 1990; Lane & Lubatkin, 1998).

Questions also have been raised about the disadvantages of studying these concepts separately from each other. For instance, Choi, Jean, and Kim (2019) studied absorptive learning capacities within individual organizations and as a joint capability between business partners. Their findings indicate that an individual organization's learning capability and a partnership's joint learning capability affect innovation and should be studied together. Also, Hallikas, Karkkainen, and Lampela (2009) called for research on the definitions of *intraorganizational* and *interorganizational* learning, particularly regarding

learning that can happen only in networks because the learning depends on interactions between organizations. Several scholars have voiced the need for research to study how intraorganizational learning and interorganizational learning are related (Anand *et al.*, 2021; Larsson, Bengtsson, Henriksson, & Sparks, 1998; Mariotti, 2012). One approach to studying intra- and interorganizational learning is to focus on the work practices within individual organizations when they enter into partnerships and networks. According to theory, work practices will change because they are affected by inter- and intraorganizational learning.

Emphasis on practice

Barley and Kunda (2001) used the introduction of digital technologies as an example of how work practice will change. The consequences of introducing digital technologies include the creation and elimination of jobs, leading to work becoming enskilled, deskilled and reskilled. Using this example, Barley and Kunda (2001) pointed out that work is important in deciding how technology (or other environmental factors) can change an organizational structure. This can be explained by how changes at the macro-organizational level always are linked to changes in micro-organizational processes. Events, e.g. the introduction of new technology, in an organization's environment necessarily will generate, or fail to generate, a response from human actors who comprise the organization. To understand organizational change – and, thus, learning – we need to understand the processes that occur at the micro- and macro-levels. Therefore, work practices must be a central part of the analysis (Barley & Kunda, 2001).

A starting point for understanding work practice and organizational learning can be found in Argyris and Schön's (1974) early work. Their theories on action explain the difference between how individuals perform actions (*theory-in-use*) and how we explain them to others (*espoused theory*). These two contrasting theories set up a foundation for discussing what it means for organizations when practical, tacit actions differ from explicit, spoken descriptions of the same actions. Argyris and Schön (1974) emphasized that the outspoken and explicit espoused theory can be changed and adapted easily when challenged. However, for an individual to change their actions, they need to change the theories in use that govern their actions. This requires that the individual reflect on the governing factors, action strategies and consequences of the actions. According to Argyris and Schön (1978), these actions' consequences often are unintentional. The discussion of consequences of theories-in-use and espoused theory also can be found at the group level and in communities of practice.

Communities of practice and theoretical peripheral participation were put forth as theoretical explanations of situated learning in a study of several practical-work cases (Lave & Wenger, 1991). Since then, they have gained popularity, becoming a natural part of the vocabulary in education, management and social sciences (Barton & Tusting, 2005). Brown and Duguid (1991) proposed a unified theory on work, learning and innovation, highlighting how intertwined organizational learning is with work practice. Brown and Duguid (1991) emphasized how knowledge of work is divided into explicit and tacit knowledge, and how this is connected to learning and innovation. The three features of work practice that the authors highlight – narration, collaboration and social construction – are taken from the work of Julian Orr (1986, 1990). Narration is an essential work feature that workers use to make sense of complex experiences and accumulate "wisdom" among workers and within an organization. This aspect of collaboration points to the fact that work is a more communal process, not an individual one. Therefore, both individual and collective learning are inseparable from work practice, and accumulated insight is constructed and shared socially among workers in their communities. This explains how work, learning and

innovation occur in communities. Brown and Duguid (1991) connected learning in communities to learning within organizations as a community of communities that share knowledge among them. Brown and Duguid (1991) also recognized the difficulties in achieving this shared knowledge in "real" organizations, in which knowledge is viewed as more of a commodity. The commodification of knowledge is a major aspect of how knowledge is created and shared within organizations. It has been described as a battle between the epistemology of possession and the epistemology of practice, in which the former views knowledge as something that people possess, while the latter views knowledge as action (Ribeiro, 2013).

The battle between these epistemologies explains some of the difficulties that organizations face in facilitating organizational learning and integrating it into structures and management systems. Suppose that "new" knowledge and learning occur in communities as a shared communal process or construction: in that case, it becomes difficult to incorporate or even acknowledge the learning in organizations' written explicit regulative systems, i.e. the possibility of an organization harvesting from this type of learning without acknowledging the need for changes in the written and explicit systems is limited. An interesting perspective on intraorganizational learning and harvesting knowledge from the individual and group levels can be found in Orr (1995). In the case presented, service technicians were given portable radios to use for professional discussions and to enhance their collective learning. In the beginning, the organization recognized that radios were used to increase learning at the group level. It was not something that the organization should use for cost reduction or as a control mechanism. The radios led to an increase in work satisfaction and learning among the service technicians. Eventually, management decided to use the radios as an excuse to downsize the number of technicians on staff, and the company switched to cheaper radios with limited functionality. These changes at the organizational level conflicted with work practice and diminished the radios' benefits. This example demonstrates that intraorganizational learning's benefits might exist on one organizational level, but not necessarily on all levels.

This challenge for organizations to understand learning and shared knowledge can be explained by returning to Argyris and Schön (1978) theories on single-loop and double-loop learning. These theories have been influential in organizational learning because they were first published (Smith, 2001). In short, single-loop learning responds to problems by following governing variables, e.g. rigid, written, regulative systems. Double-loop learning responds to problems by questioning these governing variables. Argyris (1982) argued that double-loop learning is necessary if practitioners and organizations are to make informed decisions in rapidly changing circumstances.

A logical extension to the discussion of double-loop learning is the concept of deutero learning, or simply learning to learn (Argyris & Schön, 1978; Schön, 1975). Argyris and Schön used the term "deutero learning" to describe how organizations can learn how to use single-loop and double-loop learning. The concept of deutero learning also has been used to describe interorganizational learning processes. Mariotti (2012) used three deutero learning processes to define interorganizational learning: learning to collaborate; learning to share knowledge; and learning to create interorganizational knowledge. By determining these three deutero processes, Mariotti (2012) described interorganizational learning as several processes in which the success of one process depends on the other processes' results. This points toward interorganizational learning as a slow and complex endeavor.

Several scholars have recognized interorganizational learning's added complexity compared with organizational learning. For example, Holmqvist (2009) connected the "slow" rate of interorganizational learning to how interorganizational decisions are usually a result

of "bargaining" between partners – not an analytical process. A consequence is that interorganizational learning's efficacy largely will depend on the involved organizations' relationships and how their collaboration is regulated. Therefore, interorganizational learning between organizations in an *ad hoc* relationship likely will take time because few mechanisms facilitate the decision process. The absence of mechanisms that aid decisions can shift the focus toward potential gains for individual organizations, rather than creation of mutual learning and shared profit.

The present study investigated how the introduction of technology and business models instigate intra- and interorganizational learning. The aforementioned discussions demonstrated that we need a better understanding of the interdependent relationship between intraorganizational and interorganizational learning processes. This study aims to address this gap. Emphasizing work practices provides a theoretical framework that necessarily also will be a methodological guide. The next section discusses the study's methodological choices and reflections.

Method

An instrumental case study was chosen to investigate intra- and interorganizational learning in the maritime industry. The case study focused on two advanced ships operating in a freight route along the coast of Norway. The case study lasted from October 2019 to December 2020. In addition to the ship engineers, technical staff at the shipowner's office and the main engine supplier were included in the study.

An instrumental case study is bounded by time and place, allowing data to be gathered over time and in depth (Creswell & Poth, 2018; Stake, 1995). The data were acquired through semi-structured interviews and observations to establish the necessary in-depth understanding of the case (Creswell & Poth, 2018; Van Wynsberghe & Khan, 2007).

Three interview guides were developed to reflect the different organizations to which the informants belonged. The interview guides focused on ship operations and whether the work processes required to keep the ships running have changed since the introduction of the technology and business model. The interview guide for the ships' engineers was developed first and piloted by a ship engineer with knowledge of the relevant technology beforehand. The other interview guides comprised similar topics, but were developed further using information gathered from the interviews of the ship engineers and targeted for their respective organizations/positions. The questions in all three interview guides were intended to be open and allow the informants to answer the questions freely and use examples and stories. Observations also were used to observe the work processes and compare them with the information provided in the interviews.

The participants were selected based on how much they were involved with ship operations and whether they were able to observe any changes. On board the ships, the chief engineers were chosen because they have technical responsibilities on board and handle most of the communications with the shipowner and suppliers. From the supplier side, a technical advisor, service organizer and sales manager were interviewed. Information from service engineers was included in the observations, as well as informal discussions from yard stays. To represent the shipowner, two technical managers who were involved with these ships were interviewed.

One observation was conducted during a maintenance stay in a shipyard when the main engine was overhauled. The work involved ship engineers and participants from the shipowner and supplier. The observations lasted for 3 h and included work and informal situations, e.g. lunch breaks. Data were gathered primarily by taking notes. Observations also were made before and after interviews with the ship engineers. The interviews were

conducted during port calls, and service engineers usually were on board at the same time, which allowed for informal discussions on equipment and ship performance. Altogether, the ships were visited five times over a one-year period. A sales meeting between the supplier and a potential customer regarding the new business model also was observed. The meeting comprised technical discussions and contractual details on how this business model would compare with a traditional service agreement.

Several informants were contacted for additional information. Also, during this period, two major maintenance projects were taking place on these two ships: a regulatory five-year reclassification and replacement of the main propeller gear. Collecting data over time gave the study more opportunities for authenticity, with events happening by chance at the time of the interviews. This is particularly important considering the relatively few participants in this case study. An overview of the interviews and observations in the study is provided in Table 1.

The interviews were conducted in person, except for one technical manager, who was interviewed by phone. The interviews were recorded digitally and transcribed with the approval of the Norwegian Center for Research Data (NSD Ref. No. 575487).

The interviews were analyzed thematically using NVivo software. Thematic analysis was chosen to identify underlying themes and meanings in the data, as thematic analysis is flexible and direct, with no strict data collection method or specific theoretical foundation (Clarke & Braun, 2014). This made it easier to connect the results from the interview data analysis with the results from the other data collected in this case study.

The themes identified in the data analysis were as follows: traditional work; new digital work; teams; new possibilities; communication; technical problems; and business-related. These themes' content was analyzed further, and examples of learning were identified, divided into organizational levels, translated into English, and presented in the results section below.

Results

This case study's results are presented in two parts. The first part describes the case being studied, including information gathered on the technology, shipowner's business model, and the overall maritime industry in which the case is situated. The second part comprises the results from the interviews with the key personnel involved in this case study.

The case

When the data collection for this case study began in October 2019, the two five-year-old ships had been operating with the new business model for almost three years. During the first two years of operation, the vessels operated traditionally, with the shipowner responsible for maintenance, service and spare parts. The two vessels were constructed with advanced machinery and used liquid natural gas as fuel. They were the world's most environmentally friendly freight vessels when they were launched. The two ships are the only ones in the shipowner's fleet with this business model. Control of the fuel system and main engine largely is automatic and operated with an advanced control system. During the first years of operation, several costly technical issues with both ships led to the shipowner signing a new contract with the supplier to operate the ships with a new business model.

The background for introducing this business model includes advancements in digital technology that allow the supplier to monitor the operational performance of the equipment installed on the vessels. Digital sensors monitor the ships' engines and other vital equipment, i.e. the supplier can access operational data from the engines and identify when maintenance is needed using big data and artificial intelligence. This is known as predictive

Table 1.
Overview of interviews and observations

Interviews/observation	Location	Duration	No. of interviews	Experience in total	Experience these ships
Observation sales meeting	Office of potential new customer	2 h			
Observation yard stay Ship 1	Ship 1	1 h 30 m			
Observation yard stay Ship 2	Ship 2	3 h			
Observation service engineer visit Ship 1	Ship 1	50 m			
Interview chief engineer 1	Ship 1	34 m	1	30+	5
Interview chief engineer 2	Ship 1	28 m	1	10+	5
Interview chief engineer 3	Ship 2	19 m	1	8	4
Interview chief engineer 4	Ship 2	34 m	1	15	1
Ship engineer	Ship 1	46 m	2		
Supplier service coordinator	Video interview (COVID-19 restrictions)	52 m	1		5
Suppliers technical manager	Suppliers office	54 m	2		5
Sales manager	Video interview (COVID-19 restrictions)	1 h 34 m	2		5
Shipowners technical superintendent	Video interview (COVID-19 restrictions)	30 m	1	40	5
Shipowners technical superintendent	Shipowner's office	54 m	1	20	1

maintenance. A secondary effect is the possibility of introducing new business models, in which the supplier can use these data to offer new services to the shipowner.

This type of business model, often referred to as performance-based contracting (PBC), is well-known in aviation, in which the servitization of Rolls Royce™ airplane engines has been in use since the 1960s. In the present case, the shipowner pays a fixed hourly fee for use of the engine, and all spare parts, service, labor and training are included. The supplier also covers the cost of breakdowns and failures up to a specified value. This type of contract has been demonstrated in other business sectors to offer potential benefits for both the customer and supplier. Customers typically can benefit from increased efficiency, improved accountability, innovation, budget flexibility and cost-effectiveness, and the supplier can benefit from a steady fixed income (Grubic & Jennions, 2018; Selviaridis & Wynstra, 2015). The downside for suppliers is that they will be exposed to substantial economic risk (Hou & Neely, 2018; Ziaee Bigdeli, Bustinza, Vendrell-Herrero, & Baines, 2018). In our case, the increase in risk for the supplier is mitigated by using remote monitoring technology to avoid expensive repairs by identifying failures before they cause extensive damage.

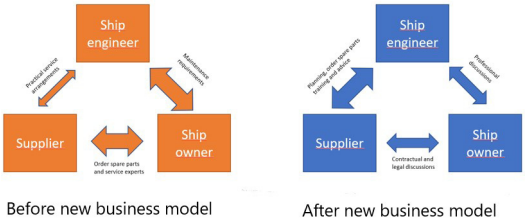
This business model elicits other important effects as well. Remote monitoring creates a communication channel between the supplier and ship engineer regarding equipment performance, which can be a source of new insights for both parties. Also, as shown in Figure 1, communication between a ship and its supplier traditionally goes through the shipowner, with limited direct communication between the ship and supplier. This restricts the relationship between these organizations to a customer–supplier type of relationship. However, with a PBC contract covering the cost of maintenance, spare parts and training, most of the communication can be executed directly between the ship and supplier, creating the possibility of a different type of relationship in which the focus can be on improving operations. As the arrow of the figure indicates, the frequency of direct interactions between supplier and ship has increased significantly.

Interviews

The empirical data from the interviews are presented here using the different organizational levels as a structure, which will make identifying examples of learning at the various levels easier.

Individual level

Over the past few decades, technological advancements have impacted ship engineers' work situation and learning methods. The use of automation and control software has transformed the work from traditional mechanical work to operating computers. "Everything is so much easier now. All the fumes and noise we endured in the engine room



Note: Size of arrows indicate the frequency of communications

Figure 1. Communication between ship, shipowner and supplier

are now removed. We do everything from here (the control room)," an experienced engineer noted. Engineers with more experience adopted a more pragmatic and hands-on approach toward learning. The younger engineers possessed higher levels of knowledge about advanced systems, with comparatively restricted levels of hands-on learning, and the experienced engineers were concerned about this lack of mechanical training and the fewer possibilities for hands-on learning in modern engine rooms. One of the senior ship engineers expressed doubts about younger ship engineers' abilities: "I'm not sure if they know where the valves they are remotely operating are physically located." Still, the advanced systems' advantages seem clear to the ship engineers, who are proud to work on this type of ship and learn through practical experience and attend the required advanced training courses.

The possibilities for learning in the PBC contract are essential for the ship engineers. Furthermore, the ability to acquire training beyond the required courses is important. One engineer stated, "I have taken the required courses for the gas system twice since I started, but this is the new contract – if we did not have it, nobody would tell us to go to courses. It would have to be the shipowner who decided it would be beneficial and pay for it. Now, if you need a hydraulics course, you just sign up for it." The number of training courses that the engineers take is also very individualized. One of the engineers said he was only taking the required courses to maintain his certification: "There is just too much going on at home to go to extra courses now."

Group level

The PBC contract with the supplier's service engineer has been a significant change for the ship engineers and their opportunities to learn by discussing issues and concerns directly with the supplier. One engineer noted, "If we have problems, we have a contact number, and they ask what our problem is: Is it the main engine? Bow thruster? Or winches? The only problem is that PBC does not include all the equipment on board. PBC is great for us engineers. It is 24/7. If you have a problem, they are obligated to help you."

A monthly status report is sent out to the ship engineers and shipowner that provides current operational trends in the machinery. Discussions sometimes are held between the shipowner and ship engineers on the execution of maintenance after a report is released. Still, the view generally is that it is a beneficial feature, as one of the engineers noted: "It is useful. We can identify many things out here, but they have access to more than we do and are much better at identifying a root cause of problems."

Maintenance and ordering of spare parts have changed substantially since the introduction of the PBC contract. Previously, the ship engineer and technical superintendent at the shipowner's office would discuss maintenance and when components needed changing. Also, the number of spare parts kept on board had been a question of economy vs contingency, but since PBC was introduced, the ship engineers order spare parts and services from the supplier directly with a written justification for needs, with the shipowner copied on the order. This makes a substantial difference in ship engineers' daily work. They now can use their knowledge and what they have learned to justify the need for service or spare parts. When asked whether the supplier ever rejected one of their orders, one of the engineers stated, "No, but we have never asked for something that wasn't justified either. This works really well, in my opinion."

The ship engineers viewed this remote interaction with monitoring personnel positively. As one engineer noted, "They never point any fingers. They are just focused on the operation of the machinery, the same as we are. If they spot something we have missed, it is good for everybody." All the interviewed engineers stated that more interaction with the

monitoring personnel was positive, as they could verify and discuss their observations and thoughts on the best way to operate the monitored machinery.

On the supplier side, the contact personnel described the introduction of PBC as a continuous learning process. One technical staff member said, "We need to think completely differently regarding PBC. We are not earning money by selling parts anymore." The supplier said that it has taken some time to adjust to this change in mindset from merely selling parts and services to being more involved with ship operations. One of the technical staff described it this way: "It is difficult to keep the customers that have a PBC contract separate from the ordinary customers, especially for the departments that have infrequent contact with the PBC customers." Also, the additional work for the supplier in a PBC contract has increased workloads for key personnel. However, the supplier does not view this extra work as entirely negative because they can learn more from their customers, but the increased interaction was not expected: "We expected an increase in communication and contact at the manager level, but not that the ship engineers should be that interested in contact with us," a PBC sales representative said.

Organizational level

The shipowner's technical managers were disappointed somewhat in the results from the remote monitoring. They had high expectations that this would benefit maintenance planning, but few practical benefits were observed. They believe the reason for this concerns the resources required for continuous monitoring of engine parameters. They receive reports in retrospect, but using the information for learning in daily operations is difficult. They said that the solution would be for the supplier to use more resources for monitoring and be more involved in day-to-day operations. The technical managers also commented on the technological solutions used on these vessels, including the use of liquid natural gas for fuel. They feel that the supplier should handle large maintenance operations. Thus, the technical management recognized the PBC's role and usefulness in these major maintenance operations, but questioned its usefulness in daily operations and maintenance. They concluded that managing the vessels is confusing and challenging when only part of the operation is covered under the PBC contract; therefore, they must keep track of all the maintenance on board, including what PBC covers.

According to the supplier, most of the daily communication takes place between the ship engineers and supplier. Contact with the shipowner's office occurs mostly during planning yard stays and when contract details need clarification. One of the technical advisors with the supplier stated: "We are much more involved with the operation and planning of larger maintenance work now than we normally do, and we are not really used to this." This was not viewed as unfavorable, and they also said they learned a lot from communicating with the ship and shipowner, which is helpful in other projects. During the first years of the contract, feedback from the customer to the supplier was very good, and the collaboration around solving technical issues was the focus for both organizations. However, the supplier said that several issues surfaced with the ships related to new technology and a quality problem in the yard where the ships were built.

After the PBC contract had been in service for some years, the shipowner filed some complaints concerning maintenance planning with PBC and synchronization of equipment maintenance outside of the PBC contract. One case entailed a major equipment failure that the PBC contract did not cover, which led to the ship being out of service for weeks. The supplier did not use this time well to perform maintenance due in the upcoming months. In response, the supplier set up a database mirror for the shipowner to use for planning equipment maintenance outside of the PBC contract.

Both vessels underwent a major maintenance program during the case study, including replacement of a troublesome main gear, which took a significant amount of planning between the shipowner and supplier. Although unexpected issues surfaced, they were resolved, and both parties viewed the program as a success. In the program's aftermath, the supplier arranged a workshop in which the shipowner, supplier and shipyard identified lessons learned and what could be improved for future yard stays. The technical superintendent stated, "I don't think this would have happened without the PBC agreement."

Discussion

This case study identified a turning point in the operation of these ships when the shipowner chose to introduce a new business model in response to reliability and cost issues, which entailed operating the ships with new technology. One choice available to the shipowner was to send the onboard personnel to training courses or hire more technical experts in the shipowner's office who could advise on operational issues. This would have been an example of single-loop learning to try and solve problems within their existing governing system (Argyris & Schön, 1978). The chosen solution included changing the business model, so that the supplier participates in the ship's operations and shares the operational risk for failure, an example of double-loop learning by changing the governing factors (Argyris & Schön, 1978). Not only were the imminent cost and reliability issues resolved, but the economic barriers between the organizations also were removed, setting a new stage for interorganizational learning. The shipowner's move also can be viewed as an example of choosing interactive learning over passive learning (Lane & Lubatkin, 1998). When the new business model let the supplier use its skills and knowledge to improve the ships' operations, a unique possibility for interactive learning arose, as they can work together to improve the ships' operations.

This case demonstrates that interorganizational collaboration is a driver of intraorganizational learning, as it provides incentives for increasing knowledge within organizations. Furthermore, the supplier's income is fixed per operational hour, thereby saving money by training ship engineers to perform more service work. The service engineers also can share their competence and knowledge freely without giving away knowledge to the detriment of their business activity.

Barley and Kunda (2001) advice, to focus on work practices and processes, proves essential to understanding the changes in action strategies and new knowledge from intra- and interorganizational learning. One of the changes in the work system occurred because the ship engineers had access to advanced training courses, which stimulated intraorganizational learning at the individual level, as well as intraorganizational learning at the group level, as the ship engineer could use newly acquired knowledge in discussions and through collaboration with the supplier's service engineers. The service engineers, in turn, had a new opportunity to discuss technology freely with the ship engineers without needing to charge for their services (which would have been a factor limiting their contact). From these interactions, the ship engineers could use the service engineers' specialized knowledge of the digital systems to assess what was necessary for their specific context. Simultaneously, these discussions with the ship engineers allowed the supplier's service engineers to learn more about how their systems functioned in specific contexts and better understand their application in practice. Such interactions among actors belonging to different formal organizations were signs of learning as a community (Brown & Duguid, 1991).

However, these communities spanned organizational, occupational and physical boundaries, creating complications for their role as learning catalysts. Following the theories of communities of practice, the three features of work practices that Orr (1990) highlights – narration, collaboration and social construction – are connected tightly to tacit knowledge that is challenging to share with organizations outside of the community (Ribeiro, 2013). When the community comprises members from different organizations, this becomes even more challenging. As a result, knowledge at the individual and group levels does not necessarily create learning at the organizational level. This seemed to be the case in this study, as the shipowner and supplier did not recognize the learning from ship engineers and service engineers that occurred at the organizational level. There are few indications that the combination of skills and knowledge was used to improve the organizations' formal systems and procedures. This study's examples of interorganizational learning are found primarily at the individual and group levels. The identified learning at the organizational level predominantly is practical and can be classified as single-loop learning (Argyris & Schön, 1978). For instance, the supplier mirroring the maintenance database of the shipowner to keep track of maintenance scheduled for equipment outside the contract can be viewed as single-loop learning.

According to Argyris and Schön's (1974) theories of action, changing ship engineers and service engineers' actions through this new knowledge would require changing governing factors. The governing factors for ship engineers often are found at the organizational level, in which procedures, responsibilities and strategies are created and implemented. Therefore, from such an interpretation, learning at the individual and group levels is valuable to the organization only if it is identified, absorbed into the organizational systems and able to direct future actions. However, the case indicates that much of the learning that took place at the individual and group levels was not implemented at the organizational level. Still, it was critical for successful operations and benefited both organizations. This can be connected to the case presented in Orr (1995), in which intraorganizational learning at the individual and group levels was critical for the organization's successful operation. However, the learning's nature made it most valuable at the collective level, and taking steps to implement it at the organizational level could counteract it. Thus, one can argue that learning that occurs at the individual and group levels among organizational members can affect the organization's operations permanently and is crucial for its success, even if it is not implemented in the organizational systems.

Interorganizational collaboration can be viewed as internalization, from Holmqvist's (2004) perspective, as it primarily stimulates learning within the involved organizations. The learning catalyst was the outside organization's contribution; thus, the interorganizational aspect can be viewed as a fourth level of learning (Crossan *et al.*, 1995). Going back to the question of how to understand this fourth level, the case suggests that it needs to be viewed as a level that stimulates the other three and is difficult to single out as a separate dimension.

This case presents few signs of learning at the organizational level that can support the increased performance expected when using a PBC contract (Selviaridis & Wynstra, 2015). One explanation could be that individual and group learning were not recognized at the organizational level. This can be explained by Mariotti's (2012) deutero learning process, in which the organizations did not succeed during the last deutero learning process. The partners have learned to collaborate, e.g. learned to share knowledge, but they have not learned how to create interorganizational learning. Mariotti (2012) describes interorganizational learning as something that exists outside of the organizations and a learning process that goes beyond knowledge transfer. The last deutero process, learning to

create interorganizational learning, can be viewed as a learning process in which the organizations learn to take advantage of their common repertoire of experience and know-how. The final deutero process also can be viewed as learning that can happen only between organizations at the organizational level.

A different explanation for the lack of learning at the organizational level can be that interorganizational learning is a slow and complicated learning process (Holmqvist, 2009), i.e. the three years of operation were perhaps not enough to develop learning that involved the organizational level or learning that the organizations' management could recognize as strategic actions. This also can be linked to the contextual situation presented in this case study, in which the shipowner began a collaboration as a strategy to cut costs and reduce operational risk, i.e. its expectations of the collaboration's outcome limited its ability to learn, identify and use knowledge.

Conclusion

The literature on interorganizational learning often discusses the concept on its own, separate from intraorganizational learning. From such a perspective, the presented case would not be evaluated as successful necessarily. Few observable signs indicate bidirectional learning in the organizational systems, but when approaching this case with an emphasis on work practices and processes, it becomes evident that interorganizational collaboration stimulates intraorganizational learning at different levels, which is critical for operational success.

Furthermore, most intraorganizational learning presented in this case can be linked to interorganizational influences. As such, it can be understood and defined as interorganizational learning. Individual learning for the ship engineers primarily is viewed as the result of direct learning from courses that the suppliers provided. Also, members of both organizations gain skills and insights into the technology through increased contact and communication. Group learning is also a result of increased collaboration and collective activities that the new business model introduces. The case provides examples of learning at the organizational level, although these examples are less apparent.

These findings have implications for theoretical discussions on interorganizational learning. First, they imply a need to view the interdependent relationship between organizational levels. Second, other criteria for what comprises learning must be adopted. If work practice is viewed as mirroring manifested evidence of learning, this demonstrates the value of a practice-oriented approach to intra- and interorganizational learning. However, as mentioned in the theoretical section, choosing one perspective will elicit some questions and place others in the background.

Part of the explanations as to why bidirectional learning is less visible might be that the organizations entered into the collaboration with an emphasis on solving technical issues. This point also contributes to the current literature on interorganizational learning, as it suggests a wider reflection on the significance of the type of organizational collaboration. In the present case, interorganizational learning's potential was not an articulated motivational factor in choosing to enter into the collaboration. Nevertheless, the case indicates that this collaboration within both organizations stimulated intraorganizational learning. Suppose the organizations had entered the partnership with the intention of gaining a competitive advantage by collaborating. In that case, it is likely that capturing and implementing learning at the organizational level would be more prominent. It is also possible that learning at the organizational level will happen over time as the relationship matures.

Limitations and future research

A case study's strength is its ability to make in-depth investigations to study concrete processes regarding connections between work practices and learning. However, a significant limitation in a case study's design is the strong link to the particularity of the given time and place of the chosen setting. Because interorganizational learning has been demonstrated to be a complex and slow process, it also might be beneficial to adopt a longitudinal study to investigate the learning process. Another promising approach would be to use the lessons learned from intra- and interorganizational learning in other empirical contexts.

References

Anand, A., Kringelum, L. B., Madsen, C. Ø., & Selivanovskikh, L. (2021). Interorganizational learning: A bibliometric review and research agenda. *The Learning Organization*, *28*(2), 111–136, doi: 10.1108/TLO-02-2020-0023.

Argyris, C. (1982). *Reasoning, Learning, and Action: Individual and Organizational*, Jossey-Bass.

Argyris, C., & Schön, D. A. (1974). *Theory in Practice: Increasing Professional Effectiveness*, Jossey-Bass.

Argyris, C., & Schön, D. A. (1978). *Organizational Learning: A Theory of Action Perspective*, Addison-Wesley.

Barley, S. R. (2020). *Work and Technological Change*, USA: Oxford University Press.

Barley, S. R., & Kunda, G. (2001). Bringing work back in. *Organization Science*, *12*(1), 76–95, doi: 10.1287/orsc.12.1.76.10122.

Barton, D., & Tusting, K. (2005). *Beyond Communities of Practice: Language, Power, and Social Context*, Cambridge University Press.

Belinski, R., Peixe, A. M., Frederico, G. F., & Garza-Reyes, J. A. (2020). Organizational learning and industry 4.0: Findings from a systematic literature review and research agenda. *Benchmarking: An International Journal*, *27*(8), 2435–2457.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, *2*(1), 40–57.

Choi, K., Jean, R.-J. B., & Kim, D. (2019). The impacts of organizational learning capacities on relationship-specific innovations. *International Marketing Review*, *36*(6), 1042–1066, doi: 10.1108/IMR-07-2017-0130.

Clarke, V., & Braun, V. (2014). Thematic analysis. In T. Teo, (Ed.), *Encyclopedia of critical psychology*, pp. 1947–1952. Springer, doi: 10.1007/978-1-4614-5583-7_311

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, *35*(1), 128–152.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative Inquiry and Research Design Choosing among Five Approaches*, Sage.

Crossan, M. M., Maurer, C. C., & White, R. E. (2011). Reflections on the 2009 AMR decade award: Do we have a theory of organizational learning? *Academy of Management Review*, *36*(3), 446–460.

Crossan, M. M., Lane, H. W., White, R. E., & Djurfeldt, L. (1995). Organizational learning: Dimensions for a theory. *The International Journal of Organizational Analysis*, *3*(4), 337–360.

Grubic, T., & Jennions, I. (2018). Do outcome-based contracts exist? The investigation of power-by-the-hour and similar result-oriented cases. *International Journal of Production Economics*, *206*, 209–219, doi: 10.1016/j.ijpe.2018.10.004.

Hallikas, J., Karkkainen, H., & Lampela, H. (2009). Learning in networks: An exploration from an innovation perspective. *International Journal of Technology Management*, *45*(3/4), 229–243.

Holmqvist, M. (2004). Experiential learning processes of exploitation and exploration within and between organizations: An empirical study of product development. *Organization Science*, *15*(1), 70–81.

Holmqvist, M. (2009). Complicating the organization: A new prescription for the learning organization? *Management Learning*, *40*(3), 275–287.

Hou, J., & Neely, A. (2018). Investigating risks of outcome-based service contracts from a provider's perspective. *International Journal of Production Research*, *56*(6), 2103–2115, doi: 10.1080/00207543.2017.1319089.

Ingvaldsen, J. A. (2015). Organizational learning: Bringing the forces of production back in. *Organization Studies*, *36*(4), 423–444, doi: 10.1177/0170840614561567.

Inkpen, A. C., & Crossan, M. M. (1995). Believing is seeing: Joint ventures and organization learning. *Journal of Management Studies*, *32*(5), 595–618.

Lane, P. J., & Lubatkin, M. (1998). Relative absorptive capacity and interorganizational learning. *Strategic Management Journal*, *19*(5), 461–477.

Larsson, R., Bengtsson, L., Henriksson, K., & Sparks, J. (1998). The interorganizational learning dilemma: Collective knowledge development in strategic alliances. *Organization Science*, *9*(3), 285–305.

Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*, Cambridge University Press.

Levitt, B., & March, J. G. (1988). *Organizational Learning: Annual Review of Sociology*, *14*(1), 319–338.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, *2*(1), 71–87.

Mariotti, F. (2012). Exploring interorganizational learning: A review of the literature and future directions. *Knowledge and Process Management*, *19*(4), 215–221.

Orr, J. E. (1986). Narratives at work: Storytelling as cooperative diagnostic activity. *Proceedings of the 1986 ACM Conference on Computer-Supported Cooperative Work*.

Orr, J. E. (1990). Sharing knowledge, celebrating identity: Community memory in a service culture. In Middleton, D., Edwards, D., (Eds), *Collective remembering: Memory in society*, Sage. pp. 169–189.

Orr, J. E. (1995). Ethnography and organizational learning: In pursuit of learning at work. In *Organizational learning and technological change*, Springer, pp. 47–60.

Peronard, J.-P. (2021). Interorganizational learning: A strategic framework for service networks. *The Learning Organization*, *28*(2), 195–207, doi: 10.1108/TLO-01-2020-0002.

Popova-Nowak, I. V., & Cseh, M. (2015). The meaning of organizational learning: A meta-paradigm perspective. *Human Resource Development Review*, *14*(3), 299–331.

Rajala, A. (2018). Examining the effects of interorganizational learning on performance: A meta-analysis. *Journal of Business & Industrial Marketing*, 33(4), 33.

Ribeiro, R. (2013). Tacit knowledge management. *Phenomenology and the Cognitive Sciences*, *12*(2), 337–366.

Rupčić, N. (2021). Interorganizational learning: A context-dependent process. *The Learning Organization*, *28*(2), 222–232, doi: 10.1108/TLO-10-2020-0198.

Schön, D. A. (1975). Deutero-learning in organizations: Learning for. *Organizational Dynamics*, *4*(1), 2–16, doi: 10.1016/0090-2616(75)90001-7.

Selnes, F. & Sallis, J. (2003). Promoting relationship learning. *Journal of Marketing*, *67*(3), 80–95.

Selviaridis, K., & Wynstra, F. (2015). Performance-based contracting: A literature review and future research directions. *International Journal of Production Research*, *53*(12), 3505–3540, doi: 10.1080/00207543.2014.978031.

Smith, M. K. (2001). Chris argyris: Theories of action, double-loop learning and organizational learning. Encyclopedia of Informal Education.

Stake, R. E. (1995). *The art of case study research*, Sage.

Tortorella, G. L., Vergara, A. M. C., Garza-Reyes, J. A., & Sawhney, R. (2020). Organizational learning paths based upon industry 4.0 adoption: An empirical study with Brazilian manufacturers. *International Journal of Production Economics*, *219*, 284–294.

Van Wynsberghe, R., & Khan, S. (2007). Redefining case study. *International Journal of Qualitative Methods*, *6*(2), 80–94.

Ziaee Bigdeli, A., Bustinza, O. F., Vendrell-Herrero, F., & Baines, T. (2018). Network positioning and risk perception in servitization: Evidence from the UK road transport industry. *International Journal of Production Research*, *56*(6), 2169–2183, doi: 10.1080/00207543.2017.1341063.

Corresponding author
Bjarne Pareliussen can be contacted at: bjarne.pareliussen@ntnu.no