



Collaborative practices of knowledge work in IT projects

Ermal Hetemi^{a,b}, Olga Pushkina^c, Vedran Zerjav^{c,*}

^a Department of Organisation and Entrepreneurship, School of Business and Economics, Linnaeus University, Kalmar, Sweden

^b Department of Industrial Economics and Management, KTH Royal Institute of Technology, Stockholm, Sweden

^c Bartlett School of Sustainable Construction, University College London, UK

ARTICLE INFO

Keywords:

Knowledge work
Collaborative practices
Dialogic process
Process view
IT industry

ABSTRACT

While projects in the Information Technology (IT) domain have been studied extensively, not much is known about the practices of knowledge work that is needed for IT projects to be brought together and enacted as temporary organisational structures. Building on the knowledge-as-practice perspective, we set out to explore collaborative work, which occurs through dialogic practices across knowledge domains in IT projects. Drawing upon multiple case study research in the IT industry, we run a qualitative analysis based on semi-structured interviews with the management level staff of six IT organisations. Based on the insights on IT projects in the six case organisations that varied in size and the degree of knowledge structure we develop a practice-based understanding of the collaborative practices of knowledge work. We identify three main practices of knowledge work in IT projects: *a) expressing differences*, *b) co-creation*, and *c) mutual alignment*, directing domain expert knowledge work at the collective level and towards shared project objectives. The practices emerged in the form of collaboration and as a function of cross-domain multi-disciplinary teams' alignment in IT projects. We offer novel insights into the essential role of the dialogue in collaborative knowledge work practices in IT projects, and their respective parent organisations.

1. Introduction

It has been widely accepted that in the face of increased business volatility and the need for flexibility and speed, more and more organisations and industries organise their business and operational activity through projects (Newell & Edelman, 2008; Lundin et al., 2015; Hue-mann, 2022). Business outcomes in project organisations are based on teams in different domains of expert knowledge being able to collaborate, share meaning and develop new ideas that move the practices of the core business ahead (Martinsuo & Geraldi, 2020; Nisula et al., 2022). But as organising practices become increasingly entangled with information technologies (Yoo et al., 2012; Baralou & Tsoukas, 2015), the complexity of firms' core business increases and so does the importance of collaboration across knowledge domains in projects (cf. Whyte 2019). The key challenge for project teams is establishing collaborative practices, providing the structuring needed for project teams to operate across knowledge domains (Majchrzak et al., 2012), while at the same time allowing innovation and exploration to thrive in specialist teams (Vedel & Kokshagina, 2021; Nisula et al., 2022). Existing research focusing on knowledge in project organisations stressed that the

temporary nature of projects hinders attempts to create, capture, share, and reuse knowledge across project teams and to the permanent organisation (Bakker et al., 2011; Pemsel & Müller, 2012; Nisula et al., 2022). Such challenges are particularly prominent in projects that are characterized by their novelty, technology-specific knowledge dependence, domain diversity, uncertainty, and time pressures (see Parolia et al. 2011, Jiang et al. 2014, Vermerris et al. 2014, Ko & Kirsch 2017). A good example of such a setting can be found in the information technology (IT) industry where both explicit and codifiable knowledge as well as tacit and team-embedded knowledge are needed to enable project practices across knowledge domains (Ko & Kirsch, 2017; Boden et al., 2012; Burga et al., 2022). As a result, there is a need for an analytical approach that acknowledges the complex practices of collaborative alignment and the boundary work across multi-disciplinary teams in IT project settings (Bechky, 2003; Carlile, 2004; Boden et al., 2012).

To address the complex social and interactive aspects of knowledge, a distinct stream of research approached the phenomenon of knowledge in organisations from a *practice and process* perspective (Cook and Brown, 1999; Orlikowski, 2002; Nicolini et al., 2012). But while a

* Corresponding author.

E-mail address: v.zerjav@ucl.ac.uk (V. Zerjav).

<https://doi.org/10.1016/j.ijproman.2022.10.004>

Received 12 October 2021; Received in revised form 6 October 2022; Accepted 13 October 2022

Available online 28 October 2022

0263-7863/© 2022 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

stream of practice studies has focused on IT firms as a permanent setting (Orlikowski, 2002; Newell et al., 2009; Boden et al., 2012), there has been a paucity of work looking at project-related temporary settings.

To contribute to an understanding of this context, in the present paper, we are interested in the *knowledge work* in IT projects. We view project-based knowledge work embedded in collaborative work practices across disciplinary domains whereby project members make sense of the problematic situations they are facing (cf. Majchrzak et al. 2012) and act on them. They do so by engaging in practices of social interaction mediated by the use of technologies and tools, directing expert work at the collective level toward shared project objectives (Ewenstein & Whyte, 2009; Barley, 2015). In this context, cross-domain collaboration and knowledge work practices in projects are inseparable from each other (Majchrzak et al., 2012; Ben-Menahem et al., 2016), and form the core of project organising. We in particular draw from the work on *dialogic practices* as semi structures that set the rules of conversation, including, for instance, “discussing sources of knowledge, encouraging knowledge emergence, shifting perspectives, keeping knowledge indeterminate with possible revising given new information,” (Jarvenpaa & Majchrzak 2008, p. 263).

We distinguish between *knowledge work practices* and *knowledge management* as we want to emphasise a practice-based understanding of knowledge and its activities in projects. Along these lines we focus on professionals that are ‘characterized by an emphasis on theoretical knowledge, creativity and use of analytical and social skills’ (Newell et al., 2009, p. 24) as opposed to explicit strategies, tools and practices applied by management that seek to make knowledge a resource for the organisation (for further discussion on the issue see Newell, 2015).

To position our argument in this paper, we posit that discussing knowledge work through a process and practice perspective helps understand cross-domain team collaboration and the structuring of dialogical interactions through an iterative search between detailed and summary-level knowledge in IT projects. At the same time, we focus on collaborative knowledge work practices as a set of observable and situated activities that form a pattern with an analytical emphasis on their temporality and locality (see Feldman & Orlikowski 2011). By adopting a practice perspective (Cook & Brown, 1999; Orlikowski, 2002; Nicolini, 2012), we are interested in the dynamic nature of the dialogic process, participation and efforts of project teams, and the coordination of activities supporting knowledge work and sharing in IT projects. To this end, we seek to contribute to emerging research on knowledge work practices in projects (e.g., Hartmann & Dorée 2015, Mahura & Birolo 2021); the governing of knowledge work (Pemsel et al., 2016, 2018); and more broadly to studies related to knowledge work and sharing across-domain teams in IT projects. In line with these open issues, we focus on and ask the following research question: *What knowledge work practices do project practitioners engage in to collaborate in IT projects?*

Our approach is informed by recent calls in project studies (e.g., Brunet et al. 2021, Song et al. 2022) to incorporate contextual approaches, and particularly practice or process views to further our understanding of knowledge work and project governing. To this end, our study draws on research on interactive knowledge work across disciplinary team boundaries (Majchrzak et al., 2012; Baralou & Tsoukas, 2015; Ben-Menahem et al., 2016) and research on knowledge work in IT projects (Boden et al., 2012; Burga et al., 2022). To address the research question, we develop a qualitative multiple case study research design, capturing rich empirical insights across six international IT firms involving a set of interviewees representing diverse aspects of projects being implemented. We explore and compare patterns of knowledge work practices in IT projects across six firms, involving a set of interviewees representing diverse aspects of knowledge work in their projects. Based on the in-depth multiple case insights, in this paper, we develop a practice-based view, offering novel insights on the essential role of the dialogue and collaborative practices when IT project teams work across diverse knowledge domains.

Following this introduction, the research paper is organised in the

following way: first, literature on knowledge work and dialogic practices is reviewed and critically discussed in the project management context. Then, we discuss our research design, case selection choices and data analysis followed by research findings in line with the analytical approach. We conclude with a discussion of the paper’s research contribution, its limitations, and suggestions for future research on knowledge work in IT projects, and general project-based organisations.

2. Knowledge work, dialogic practices and IT projects

Extant literature on technological innovation for the management of knowledge can be divided along the lines of contrast between the epistemology of knowledge as a possession as opposed to knowledge as practice (Cook & Brown, 1999) and their applications that have been portrayed as the *product vs. process knowledge work* (see Newell 2015, Hetemi et al. 2022). While both approaches problematize the fundamental shifts in the interrelation between knowledge and technology, they do so from different positions. The product knowledge work assumes knowledge can be developed, retained and shared in an explicit, abstract and codified form while process knowledge work acknowledges the importance of the social context, embeddedness and shared meanings in understanding the phenomena associated to knowledge work (Newell et al., 2009; Grabher and König, 2020).

2.1. Knowledge work and dialogic practices

So far, the vast majority of research has taken the perspective of knowledge as possession, primarily developing a structuralist perspective on the management of knowledge underpinned by its technological infrastructure. This stream views knowledge essentially as a hierarchy of levels distinguishing between data, information, knowledge, and wisdom (cf. Rowley 2007, Newell et al. 2009). It also assumes that knowledge resides with the individual and can be transferred and shared although it is ‘sticky’ (e.g., Nonaka 2007). This view also suggests that it is the conversion from tacit to explicit types of knowledge with the help of technology that can resolve problems related to the management of knowledge work (cf. Newell et al. 2009). However, the perspective of knowledge as a product and its derivatives such as the Knowledge Management systems approach is not without its critics, in particular concerning its reductionist approach and a failure to capture the intricacies of the socio-technical and relational phenomenon of knowledge development, share, use and reuse in organisations (Newell, 2015).

To address these shortcomings, a research stream focusing on knowledge as a social practice has emerged intending to recognize and explain the interactive and situational nature of knowledge also labelled as *knowing-as-practice* (Orlikowski, 2002; Feldman & Orlikowski, 2011). In this view, knowledge or knowing is “an ongoing social accomplishment, constituted and reconstituted in everyday practice” (Orlikowski, 2002, p. 252) and the relationship between knowledge accumulation, its transfer and organisational performance is understood as socially constructed and politically contested (see Marabelli & Newell 2014, Newell 2015). The practice perspective on knowledge work draws attention to the materiality of social activity and material properties of information technology (see Orlikowski & Barley 2001, among others).

The practice perspective also recognizes that in organisational settings knowledge is not merely transferred from one team to another, it requires team members to continuously transform and integrate their knowledge with others across the boundaries (Carlile, 2002; Majchrzak et al., 2012; Ben-Menahem et al., 2016). This occurs through ‘traversing’ the knowledge across the existing cognitive and organisational boundaries underpinning the specialized project team members – through deep knowledge externalization and transformation (cf. Bechky 2003, Carlile 2004, Majchrzak et al. 2012). Along those lines, Jarvenpaa & Majchrzak (2008) argued for the need to engage in *dialogic practices* to help bridge across diverse specialist teams, where team members engage

with assumptions of other specialities according to “semi-structures that describe the rules of conversation.” Some of these rules include: discussing sources of knowledge, encouraging knowledge emergence, comparing multiple perspectives, and keeping knowledge indeterminant to be repeatedly revised in response to new information (for discussion see [Jarvenpaa & Majchrzak, 2008](#)).

Knowledge can flow only if specialist team members are aware of each other’s deep knowledge such as project members’ domain or diverse disciplinary practices, knowledge background, and framing. To this end, concrete and epistemic (i.e., fluid and incomplete) boundary objects have been broadly suggested to help make these disciplinary differences clearer and to facilitate knowledge work and cross-domain team collaboration ([Ewenstein & Whyte, 2009](#); [Nicolini et al., 2012](#); [Barley, 2015](#)). Boundary objects motivate and allow project participants to collaborate across different types of boundaries. They constitute the fundamental infrastructure of the activity ([Nicolini et al., 2012](#)). Furthermore, [Ewenstein & Whyte \(2009\)](#) articulated the difference between concrete boundary objects – such as products, prototypes, sketches, notes or drawings useful for negotiations and coordination– and epistemic boundary objects – which are fluid in nature and include, for example, metaphors, conversational interaction that continuously evolve to meet the needs of knowledge work ([Ewenstein & Whyte, 2009](#); [Majchrzak et al., 2012](#)).

More recently an alternative view known as the ‘transcend’ view to knowledge work in cross-domain team collaboration has been promoted. In this view, the nature of the dialogic process is based on similar generative practices but seeks to downplay boundaries and transcend knowledge differences instead (cf. [Majchrzak et al. 2012](#), [Bruns 2013](#)).

The distinction between traverse and transcend views to knowledge sharing is that in the latter “knowledge differences are not first clarified with deep-knowledge dialogue and then bridged through negotiation” ([Majchrzak et al., 2012](#), p. 964). Not every cross-domain team effort requires issues to be considered thoroughly, and thus deep knowledge sharing among each team member is externalised. Instead, project team members focus on minimizing the differences – and somewhat shortcut deep knowledge dialogue, and experience sharing, and still achieve knowledge integration, sharing and reuse. Yet, knowledge work and sharing are challenging to achieve because people are naturally suspicious of others’ knowledge. According to [Majchrzak et al. \(2014\)](#), individuals only share and reuse knowledge if they cannot come up with their own solution. For organisations and projects alike, the key challenge is how the diverse specialist teams coordinate and share knowledge to achieve the project objectives. To ground this question, in the next section knowledge work practices at the project level are discussed, blending insights from project studies.

2.2. Knowledge work in IT projects

Studies on projects and project organising have shown a similar pattern to that observed in research on organisational knowledge in general management and technological innovation literature. Most existing literature on projects that discussed the management of knowledge has done so from the structuralist perspective and using the view that “predominantly sees knowledge produced at one location and consumed at another location,” almost intact ([Hartmann & Dorée, 2015](#)). Here, knowledge is treated as a management instrument to achieve specific goals, rather than as a complex phenomenon that occurs in projects and needs to be contextualized and properly understood.

As a result, approaches such as post-project evaluation and Customer Relationship Management (CRM) databases are promoted to retain, share, and reuse knowledge accumulated within specific projects ([Newell et al., 2006](#); [Park et al., 2017](#)). Such approaches are problematic in project organisations because they fail to account for the temporary nature of project organisations where (a) employees are usually pulled out of the projects as soon as their work is done and do not have an opportunity to fully contribute to the project evaluation process ([Bakker](#)

[et al., 2011](#)), (b) the difficulty in establishing organisational practices for knowledge work when faced with pressing deadlines for project completion and (c) the difficulty of transforming such knowledge across different, contexts, situations and localities ([Swan et al., 2010](#); [Hetemi et al., 2022](#)).

The above knowledge work challenges and the related problems are particularly critical in IT projects and generally in the IT industry, which imply a high level of interdependence among the projects and their fragmented project team members ([Ebert & Man, 2008](#); [Ko & Kirsch, 2017](#)). A typical IT project setting comprises three components: hardware, infrastructure software and application software ([Ebert & Man, 2008](#); [Ko & Kirsch, 2017](#)). Given that the IT project work exhibits several specific attributes (e.g., ambiguous, volatile and uncertain work conditions, technology intensive and tightly coupled production systems); agile management approaches have been relatively widespread because of their adaptive characteristics and rapid iterations allowing for more proactive and responsive approaches ([Burga et al., 2022](#)). Besides, the IT industry also involves customer and vendor interaction for knowledge integration and sharing, stressing close collaboration, and feedback for dynamic organising ([Yoo et al., 2012](#)). Hence, the IT project teams are often fragmented into several professional domains– such as software engineers, testers, support teams, and customer-facing teams, which sets knowledge boundaries, interrupting a seamless knowledge flow ([Carli, 2002](#); [Bresnen et al., 2004](#); [Newell et al., 2009](#)). These added layers of complexity in IT projects underpinning diverse logics of action (i.e., business and technical) and the project knowledge work paradox of knowledge boundaries being both a challenge and necessity of knowledge-based organisations ([Bresnen et al., 2004](#); [Bakker et al., 2011](#)) have recently led researchers to focus on practices of knowledge work.

[Winter et al., \(2006\)](#) suggested that focusing on understanding practices in projects would allow for more relevance to practitioners, highlighting “the need for new research concerning the developing practice” ([Winter et al., \(2006\)](#), p. 638). More recently, building on organisational information processing theory [Burga et al. \(2022\)](#) explored how accountability in the project is understood in the context of agile practices in IT projects, calling for further research into knowledge mobility across teams and IT projects. Similarly, [Zaman et al. \(2019\)](#) through a survey-based sample bring forth project members’ interaction and the value of social and political skills in complex software projects. [Imam & Zaheer \(2021\)](#) examine the role of knowledge sharing, cohesion and trust among the teams in an IT project context and [Mahura and Birollo \(2021\)](#) focus on formal and informal knowledge transfer practices within PBOs. These studies are tangential to efforts to acknowledge that dialogic practices enable knowledge integration, sharing and reuse among cross-domain teams, and help project organisational actors’ sense-making (cf. [Majchrzak et al. 2005, 2012, Jarvenpaa & Majchrzak, 2008](#)).

While the discussion on the practice-vs-possession perspectives on knowledge can be seen in mutually exclusive terms with the two perspectives counter imposed upon each other, it can also be seen in a way where knowing (practice) and knowledge (possession) are mutually constituted and recursively related drawing on [Nicolini’s \(2012\)](#) remark of ‘to transfer is to transform’ and ‘to adopt is to adapt’. Thus, we view the practice of mutual constitution of knowledge in projects with the starting point that only by complementing the product (know what) knowledge with the process (know-how) knowledge, understanding its enabling context and the resulting dialogic processes can the knowledge work be meaningfully understood and discussed (for further discussion see [Hetemi et al. 2022](#)). Similar can be said about the practices of knowledge work in projects, which are closely interrelated and some see the former as part of the latter ([Foss et al., 2010](#), [Stock et al., 2021](#); [Nisula et al., 2022](#)). However, knowledge sharing does not automatically lead to knowledge reuse and in contrast to knowledge sharing, which focuses on knowledge mobility or flow, knowledge reuse is mainly concerned with knowledge transformation.

Despite the increasing effort directed to study knowledge work in IT projects (see Zahedi et al. 2016, Ko & Kirsch 2017), more needs to be done to unveil the dialogic process and the actual knowledge work in practice as there is a lack of understanding of how knowing is attained in IT project practice (Boden et al., 2012). Further, we need to know how knowledge work is resourced and iteratively reproduced. By anchoring the study in the knowledge-as-practice stream of work (Orlikowski, 2002; Nicolini et al., 2012), we seek to provide an understanding and explain how the knowledge work practices are interactively (re)produced in IT projects. To this end, we next discuss the empirical research we undertook to address the research question of this study.

3. Methodology

3.1. Research design

To understand the knowledge work practices in IT projects, the second author of the paper conducted an interview-based inductive qualitative study involving several IT organisations operating internationally. We wanted a research design that would achieve sufficient familiarity with the practices of knowledge work embedded in their project and organisational contexts, but at the same time retain a comparative perspective across several organisations. We consider the project practices to be comparable as they were conducted within the IT industry context to provide meaningful insights, and generate recommendations that are closer to the actuality of the project and, therefore, applicable to practice (cf. Chiasson & Davidson, 2005). For this reason, we chose the multiple case study design comprising several selected IT organisations (Eisenhardt & Graebner, 2007). The main advantage of this methodological strategy is that it enhances the robustness and broader analytical generalisability through theoretical elaboration while allowing us to explore complex contextual idiosyncrasies (Flyvbjerg, 2006; Ketokivi & Choi, 2014). The IT organisations selected for this research operated in various markets, focused on different products and are different in size, yet most of them use similar project management methodologies and databases for the management of knowledge.

The theoretical sampling had two stages to ensure that firms with the most insightful knowledge work practices were selected for more detailed research and analysis. 13 firms were sampled for diversity during the first stage (Eisenhardt, 1989). To disguise the real names of the firms all firms were given pseudonyms from Greek mythology. The second author then conducted pilot interviews with one to two people from each firm to gain information about broader knowledge management practices within the firms (see Table 1).

Based on this initial set of exploratory interviews, the six most relevant firms were selected for further research in the next stage, see Table 1. These six firms were purposefully sampled for diversity in their size, geographical location, and industry segments, in a way that was combined with access to knowledgeable informants. Out of the six firms, three were small and medium enterprises (SMEs) and three were large firms. Three firms had headquarters in Eastern Europe and three had headquarters in North America. Two of the six firms had offices in a single country, while the rest had at least one office located outside of the country hosting the firm's headquarters.

The six firms represented five different segments of the IT industry: telecommunications, search optimisation, education technology (EdTech), advertising technology (AdTech), and information verification (data checks). Most importantly, the sample included two firms with somewhat nascent knowledge work practices, two with present albeit uneven inter-project knowledge work practices, and two firms with the most advanced inter-project knowledge work practices see Table 2. Finally, the easiness of access to key informants and their readiness to talk openly about the practices of their firm were taken into account whilst deciding on inclusion criteria for the focused firm sample.

Table 1
Information on the firms.

Name	N of employees	N of people interviewed	The roles of people interviewed	Profile
Gaia	85000+	6	Product Manager, Programme Manager, Management Solutions Consultant, Head Developer	Search engine
Ananke	100+	4	Project Manager, Developer, Tech Support Manager	Text msg services
Metis	200+	3	Business Development Director, Deputy CEO (CTO), 3D Developer	EdTech
Caerus	1200+	6	Knowledge and Development Specialist, 2 Senior Account Managers, Product Marketing Manager/ Team Leader, Software Engineer, Customer Care Lead Engineer	Telecom
Poros	150+	5	Director of Engineering, Senior Account Manager, Head of Global Marketing, Project Manager	Data checks
Ioke	400+	5	Key Account Manager, Director of International Partner Development, Project Manager, Software Engineer	AdTech

3.2. Data collection

Empirical data collection was conducted by the second author (hereafter referred to as the researcher) between May and August 2018 and its main purpose was to uncover the knowledge work practices as they occur in their organisations and differ from practices in other organisations. The unit of analysis was set to the knowledge work practices as they are reported in their respective organisational settings and compared with accounts from other organisations. To this end, the purpose of our multiple case study design is to go beyond the project cases, and contribute to our understanding of knowledge practices (see Stake, 2006, p. 8). Besides, following practice theory with a flat ontology, we acknowledge that practices encompass multiple levels of the organisation and often enrol actors beyond the boundaries of the organisation for which reason we did not specifically want to capture operation, project execution or strategic organisational levels but chose to include representatives of the different domains in the interviews, some related to projects and others to the organisational functions.

Between three and six informants from each of the six firms were interviewed. The sample was mostly consistent across all cases with at least one interviewee with project management responsibilities, one with technical responsibilities, and another in a customer-facing role. Not all firms had dedicated project manager roles; in these cases, other interviewees were asked about the project management practices of the firm (this usually had to do with the size of the organisation). Similarly, not all firms had dedicated roles for knowledge managers. Although three to six people from each firm are a small sample, it was sufficient for looking at firms' knowledge practices from different angles and was helpful in intensively investigating several cases in a constrained time frame.

Semi-structured interviews (Silverman, 2015) were chosen as a primary data collection method for the study allowing insights into various aspects of knowledge practices. Twenty-nine 20–40 min semi-structured interviews were conducted in total. In addition to the semi-structured interviews that presented the basis of the study, follow up emails, messages, and social media feed studies were also used to contextualise

Table 2
A brief description of the firms.

Pseudo-nym	Firm description	Approaches to organising <i>(How are project members selected and how familiar were they with each other)</i>	Knowledge work and practices of sharing
Gaia	Gaia is a publicly-traded firm that specialises in online search optimisation and online productivity applications.	Sophisticated organisational routines with a certain degree of flexibility for each department and team to create their organisational routines to mimic the start-up culture within the larger organisation. <i>(Some individuals worked on previous projects)</i>	Depends on the team, but the culture, in general, is very knowledge-oriented, and a philosophy of learning from each other is widely accepted, albeit in contradiction with a strong drive for innovation and constant artisan creation of new tools and techniques within individual departments and teams.
Ananke	Telecommunications firm specialising in application to peer messaging services. The firm has recently undergone a merger.	Somewhat chaos, lack of order in organisational routines since the merger. <i>(Several pairings of individuals knew each other)</i>	Depends on the department. Some type of knowledge reuse is present, but it is not encouraged from above; instead, employees initiate knowledge work themselves. Much knowledge is tacit, and there is a particular difficulty with transforming it into explicit knowledge.
Metis	Initially, an educational publishing house turned into an EdTech firm, that has developed a software suite for K-12 education.	Lack of established organisational routines, and reliance on individuals to fulfil their tasks rather independently. <i>(None worked together previously)</i>	Depends on the team. Reuse is initiated by the individuals, rather than established and encouraged by the management. Most of the knowledge is with the employees, which presents difficulties due to the high level of work rotation.
Caerus	Global telecommunications firm specialising in application-to-peer messaging services.	The firm is growing fast, and organising is fluid. Actions are taken to establish more sophisticated organisational routines. <i>(Several pairings of individuals knew each other)</i>	Low level of organised project-to-project knowledge sharing is low. The level of project-to-project knowledge reuse is even more underwhelming. This has not been a priority until now, but the dialogic processes which will help to establish these knowledge work practices in the future are being developed currently.
Poros	A data collecting and analysing firm. Positive,	Well established and well-designed organisational	The high degree of project-to-project knowledge sharing

Table 2 (continued)

Pseudo-nym	Firm description	Approaches to organising <i>(How are project members selected and how familiar were they with each other)</i>	Knowledge work and practices of sharing
	tight-knit startup/small firm culture.	routines across all departments that make a positive contribution both to firm culture and knowledge sharing across project teams. <i>(Several pairings of individuals knew each other)</i>	and reuse, that was part of the firm's organisational routines.
Ioke	A family-owned AdTech firm specialising in online advertising bidding.	Medium level of maturity of organisational routines. Due to the high pace of the AdTech industry, the development of organisational routines is overlooked in favour of accommodating industry changes. <i>(Some individuals worked on previous projects)</i>	The tools and recognition of the importance of this practice are in place, but it is not enforced or encouraged, with the firm being very forward-looking and discarding previous projects as outdated.

and complement the interview data whenever possible. The diversity of the data sources helped to provide a richer account of the knowledge work practices in line with good practices of case study research (see [Martinsuo & Huemann 2021](#)). Indeed, the value of the case studies was the understanding of the context-dependent knowledge ([Flyvbjerg, 2006](#)).

Interviews started with general questions about the firm: the size of the firm, the industry segments where it operates, and the interviewee's role within the firm. Interviewees were then asked to talk about the firm culture and relationships between employees. The questions about general knowledge-related practices of the firm and knowledge work practices followed later. Interviews concluded with questions about knowledge work between various project teams and functions within the firm. The list of interview questions is available in the [Appendix 1](#). All interviews were audio-recorded. Most interesting interviews were fully transcribed, while only relevant parts of the rest of the interviews were transcribed.

Following [Sandberg \(2005\)](#), we sought to achieve validity in the data collection and analysis process. Communicative validity was sought by the researcher making sure that there was a common understanding around the topics being discussed – i.e., knowledge work, sharing and reuse. The researcher did this by establishing prior contact with the organisation and conducting a preliminary exploratory interview to establish common ground for the topics being explored as well as to establish interest by the informants in the research. The interview guide contained a selection of possible follow-up questions to enable reflection on the topic in real time as well as to seek informants to elaborate on specific examples of practices they were referring to, thus establishing pragmatic validity. The emerging findings were being discussed continuously between the second and third author during the data collection process, to establish tensions and contrast emerging findings across the case firms and within them, contributing to both pragmatic and transgressive validity.

3.3. Data analysis

Data were analysed in two stages. During the first stage, the data from the initial sample of 13 firms were examined guided by basic thematic analysis principles to identify the most relevant themes, single out the most interesting firms, and improve interview questions and techniques. Interview data analysis overlapped with data collection so that the sample and the interview technique could be adjusted where

necessary (Eisenhardt, 1989). For example, the questions about firms' inter-project knowledge work practices were altered after the first 6 interviews (see questions 13, 14, and 15 in the Appendix 1). The questions were rephrased to be more direct, which helped to get clearer and more comparable answers. The interview notes were examined for the presence of information about firms' practices related to knowledge work. The researcher has also looked out for the unexpected knowledge management practices. Reference to existing literature was especially

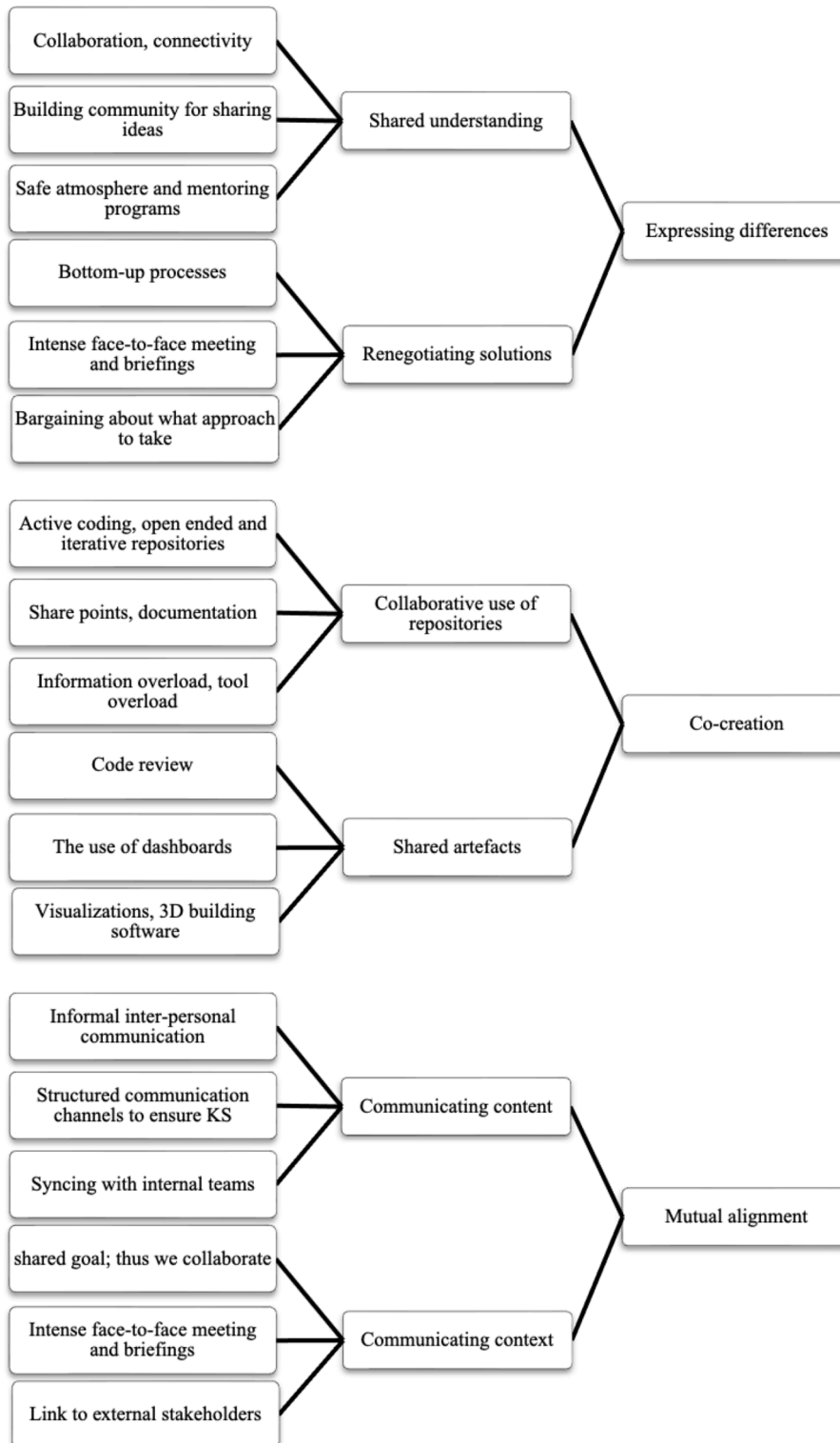


Fig. 1. The data structure, codes, themes, and emergent categories.

useful while looking for common themes in the data collected leading to aggregated theoretical dimensions, which were used in the following stage of data analysis. This began with interview transcriptions and analysis of selected firms. An example interview transcript can be found in the Appendix 2.

In accord with Eisenhardt’s (1989) multiple-case study method, individual case histories were created for each firm. The histories described culture, attitude, employee engagement, and firm’s practices or lack of them in each firm (see Table 2). Within-case and cross-case analyses followed the write-up of the individual case histories. Following the case study work, during the first-order analysis, the case history was continuously revisited where we (i.e., the second and third authors) gave insights about the primary studies, bringing on board the first author with the research and social context. In line with the purpose of practice studies (Orlikowski, 2002; Nicolini et al., 2012), we scrutinised the subject of knowledge work by drawing on the researcher’s observation notes. This close perspective throughout the data collection periods helped the analysis to understand how the project teams organised their activities. Also, we follow the practice of qualitative inquiry and have had each important finding confirmed through at least three (often more) instances in data and assured that key meanings are not being overlooked (see Stake, 2006). Each important follow up email and message were used to confirm the interpretations, reassuring that the analysis is supported by the data gathered and not easily misinterpreted.

Further, the within-case analysis focused on the culture of the firm and its knowledge practices. When a reasonably comprehensive understanding of practices within each case organisation was established, the cross-case analysis was commenced. Charts and tables were used to identify similar themes across different cases. For reasons of brevity, we provide an excerpt of the cross-case analysis as supplementary material, see the Appendix 3. At the end of the second stage of this detailed data analysis, we worked with and created the augmented data structure, see Fig. 1. Here the first order codes are direct codes from NVivo. The identification of themes across cases provided a focus for a further consulting with the data and the identification of the key knowledge work practices, their boundaries, constraints and actors, which are finally presented in this paper as the three practices: a) expressing differences, b) co-creation, and c) mutual alignment. Finally, the discussion of the cross-case comparison was following the dimensions of firm size, approach to knowledge work (formal or structured, and/ or informal), and front and back-office considerations and roles related to knowledge work. From the detailed case analyses and their comparison, we identified three practices. We discuss them in the following section.

4. Findings: collaborative knowledge work practices in IT projects

We explored the dialogic process and the collaborative practices that project members engaged in to share knowledge in IT projects. We identified three dominant practices in which the project team members engaged, leading to knowledge work and sharing in and across IT projects: a) expressing differences, b) co-creation, and c) mutual alignment. In our view, these practices provided the scaffolding – the way to make heterogeneous meanings across the teams clearer (Bechky, 2003). It is important to note that these interactive practices emerge as a function of the cross-domain project team collaborative work. In Table 3, we summarise the findings, the practices that the project teams used and their influence on the project process and the knowledge work dialogic process. We next elaborate on the identified practices.

4.1. Practice 1: expressing differences and renegotiating solutions

The first practice that project teams in the sample firms engaged in was to *express differences* and create a shared understanding, in which the project team members were able to communicate their viewpoints

Table 3
Identified practices and their influence on the project process and the dialogic process.

Practice	Influence on project process	Influence on knowledge work dialogic process
<i>Expressing differences</i> (The project teams bring forward their viewpoints and different thoughts as to potential solutions; at times through energetic discussions, but without blaming and ‘us’ and ‘them’ discussions)	Openly and quickly discussing their viewpoints helps to create a safe atmosphere for sharing several ideas for the suggested solutions. Surfacing potential conflicting ideas initially kept the project teams’ attention on the shared goal and the needed collaboration.	Expressing differences helped the project team to directly a) engage in process knowledge work; b) allow for multiple solutions to the problems; c) depersonalize project work, avoid focusing on interpersonal differences; d) attempt to externalize the knowledge in action, making it easier for collective problem solving and solutions to emerge
<i>Co-creation</i> (The project teams iteratively engage with shared artefacts underlining their differences and elaborating on the use of repositories, fostering creative ideas)	The project team iteratively reviews and adds to their solutions, keeping the project team’s attention on shared project tasks rather than on any specific tasks and individual ideas. The open-source repositories were used as meeting points for discussing shared ideas. Many shared objects, such as dashboards were used to bridge differences across the project teams.	Iterative engagement with each-others work helped a) the project team members to learn; b) it reduced the need to add the much-needed explanations extensively; c) resurface differences around ongoing problems; d) through the use of objects, e.g., 3D software, dashboards and visualizations helped bridging each other’s specialized knowledge
<i>Mutual alignment</i> (The project teams maintain dialogue about the potential and alternative solutions. They keep open communication on their daily work, and finally communicate their solutions to the external stakeholders)	Communication channels kept project teams informed and continuously engaged toward the shared (collective) goal. It provided project team members with contextualized understanding and a sense of progress. After that, the team changes focus to external alignment – mapping and informing the stakeholders of the solutions.	Continued co-creation and shifted evaluation brought the existing solutions a) forward, b) situated their work in context, c) tailored collective solutions were achieved, and d) probed their viability in the eyes of the external stakeholders

and renegotiate solutions. For example, one of the interviewees uttered: “Of course, if there are two or three teams involved then it kind of gets lost in translation so you need a week or two to bring the different teams together and inquire: where do we stand with something, is it done or is it not done? So, one gets lost in translation between different teams and it’s a kind of a pain point because we have a huge number of teams.” (Caerus, Senior Account Manager, August 2018). Collaboration, connectivity, and freedom to experiment were the main advantages of the more informal approaches to knowledge work. An excellent example of this practice is illustrated with Gaia and its informal knowledge work approach, creating a safe atmosphere to express or voice discrepancies without querying or critiquing ‘others’ (cf. Majchrzak et al. 2012). As one of the interviewees put it: “Different teams have different cultures, different ways of understanding and sharing knowledge, at Gaia we do not have a universal approach.” (Gaia, Programme Manager, June 2018).

Within this firm, a flexible corporate-wide knowledge management policy focused on building a community for sharing ideas. Easiness to

connect and collaborate with other employees of the firm was reported. It motivated employees to work with and invent new ways to manage knowledge work. Firm-wide practices such as mentoring, and corporate citizenship were the backbone of Gaia's approach to knowledge work. However, it was up to the team members to come up with the best way to manage knowledge within and across the project teams. Voicing different perspectives among the team members helped engage with new initiatives. For example, Gaia's Management Solutions Consultant has shared a story of how her team created a new website to share information about their projects with other teams: *"We decided to create a micro-website, the internal one, where we also post some information about the team, also training materials [and] some menus of services."* (Gaia, Management Solutions Consultant, July 2018). The creation of the new database was a bottom-up process without any push from the management and it really started without domination or confrontation among the project teams.

Within all six firms and in almost all their projects reported on, we observed that expressing differences, creating a shared understanding took place at the project initiation. Yet, the voicing of differences differed slightly across the firms. For instance, at Gaia and – to a lesser extent – Poros voicing involved overlapping and adding to and confronting each other's arguments in good spirit. The comments and suggestions were not criticized further but taken at face value. or replicated. By contrast Ioke, Caerus, Metis, and Ananke employed more structured methods of articulating differences in ideas which involved in-depth elaboration and challenging of the parties involved. While there was still the focus on collaboration – it was less about ideation through fostering connectivity and flexibility, and more about the logical argument, setting core team assumptions and understandings at the centre of discussion at project initiation. Yet on several occasions, it was also considered time-consuming by introducing delays, re-evaluation, and slowing down the knowledge generation processes. In those cases, the emphasis was on creating focus rather than on fostering a culture of shared understanding. For instance, a respondent highlighted: *"We did have kind of a SCRUM before, but mostly for weekly, daily meetings and for kind of planning. However, we moved away from that because it was too much time-consuming."* (Caerus, Senior Account Manager, August 2018). Similarly, another respondent noted: *"If we [look] back, at the time we spent much more time on informing and arguing with everyone about everything; we lose two or three hours per day just on having a lot of meetings and sometimes it's really unrelated to someone's work"* (Metis, Business Development Director, July 2018).

The practice of creating a shared understanding through surfacing differences in project team perspectives helped the team members to set 'their heads in the right direction' at the project outset. Although all case firms in the sample and the project teams foster a culture of innovation; there was a distinction and different emphasis when it came to perspective-shifting and the requirement for in-depth discussion and efforts to surface differences. On the one hand, collaboration and flexibility were deemed important for creating a safe working environment and acknowledging different viewpoints was considered promising for stimulating a creative mindset. On the other hand, understanding each other's viewpoints through in-depth discussion, negotiation, and dialogue for establishing common ground was considered necessary for enabling project teams' focus.

4.2. Practice 2: co-creation through the collaborative use of repositories and shared artefacts

Co-creation through the collaborative use of repositories and shared artefacts is the second practice that we observed. Through this practice, the project teams elaborate artefacts underpinning the voiced differences. Our informants, in general, reported the use of artefacts such as project plans, dashboards, documentation or repositories, as well as codes as useful for co-creating knowledge work and sharing meaning across the project teams and their specialized members (product

manager, developers, and customer representatives).

Many of the respondent developers who took part in our research study sounded surprised when asked whether they share knowledge across projects and how. It seemed natural for developers to share and reuse a code from previous projects and to ask for help with coding from people who work on other similar projects. While developers did not prefer any project official project documentation technique, they used sourced codes and active coding – writing, an insight of that software code was a type of documentation. Supplemented by the bug tracking database, code becomes a rich – albeit not always easy to decode – knowledge source. The view of the code as both a product, a document, and a type of explicit knowledge has been shared by many of the developers and technical employees of the case firms. A developer from Ananke has pointed out that coding and testing the code is naturally an iterative and heavily documented process. She said:

"We do not solve this problem [of sharing and reusing knowledge] by having meetings or milestones, instead, being software engineers, we solve this problem through code review; You just need to make comments in the code and not overcomplicate the code, so people do not have questions later" (Ananke, Software Developer, June 2018).

Similarly, a 3D developer from Metis said that everything that has ever been created by 3D developers for the firm, including all the steps that lead to a final product, was recorded within the 3D building software.

"3D developers can open the 3D project of any person because there is a common database. ... You can open a 3D scene with a lion created by someone else and look at it, take a texture from there" (Metis, 3D Developer, July 2018).

Sharing and reusing software code is an easier task than sharing and reusing more tacit types of knowledge such as building relationships with customers.

Similarly, the Management Solutions Consultant from Gaia has recalled that her previous team was very interested in creating dashboards: *"We were always keen [to learn] how to do dashboards"* (Gaia, Management Solutions Consultant, July 2018). Yet, the dashboards kept multiplying and it became difficult to keep them all up-to-date. However, it is always possible for the management of the firm to take control back. For example, Gaia has eventually restricted access to the dashboards: *"We are trying to restrict it as much as possible because otherwise, we [would] have too many different dashboards"* (Gaia, Management Solutions Consultant, July 2018). The restriction helped to ensure that all dashboards contained up-to-date and accurate information.

Collaboratively creating and iteratively improving repositories is one of the practices that seemed to be most appreciated and understood by the project teams, the firms, and their respondents. For example, an interviewee noted: *"Usually any documents we write we try to make them open to everyone at Gaia"* (Gaia, Product Manager, June 2018). Along similar lines, a respondent highlighted: *"[it's] also good for us to be synced with them in terms of what we use, how we approach and tackle problems, etc."* (Gaia, Management Solutions Consultant, July 2018). Further, Ioke has recently hired copywriters to proofread and organise its repository content. Similarly, Poros was reorganising its knowledge repository to make it more applicable to all its account managers. Not all of the firms that gravitated towards a more interactive knowledge work via technology adaptation. However, those that did not still recognise the importance of knowledge-creating and iteratively improving repositories and their codes as open-ended. For example, Ananke's Technical Support Manager said:

"Let's say that we do have a central point it's like an internet share point of documents that we have regarding different projects, but especially products related. Because lately, we do have broadened our product portfolio. So, we do have like a central position where we have all the documents regarding those products. Of course, on that internal website,

we do have also a list of the people who are product owners, who are in technical development or product marketing owners that can be reached if we have a certain more detailed question or we need a more detailed explanation regarding a certain product" (Ananke, Technical Support Manager, July 2018).

Nevertheless, the repositories at the time involved part of the expressed differences and concerns, thus instead of sharing useful knowledge and meaning produced confusion. There were several cases where respondents reported the fragmented information across various databases, chat logs, etc. As a management solution consultant noted:

"It can be very confusing indeed because it often happens that people tend to create a lot of documents. [Creating] more and more documents that everyone forgets about where they are and we just agree that at least at the project team level to aggregate everything and not set up too many databases for the same thing" (Gaia, Management Solutions Consultant, July 2018).

Another respondent pointed out the potential layers of complexity introduced by redundant information and spread tools: *"There are so many different layers or a kind of ambiguous information that one might cross when sharing information within the team"* (Gaia, Management Solutions Consultant, July 2018). Ioke's UK-based Key Account Manager has expressed a lack of satisfaction with the way knowledge repositories were maintained. Her team used a messaging tool: Slack, as the primary knowledge work tool and she complained that on some days she spent hours looking through the messages: *"If anything gets uploaded overnight, I would have to spend ... two hours in the morning just going through the chats between people and finding the articles or anything that has been changed"* (Ioke, Key Account Manager, June 2018). The challenge with the formal or structured approach to knowledge work was that there was a lack of support for new, innovative, and potentially better knowledge work approaches.

Moreover, the formal approaches to knowledge work can be extremely time consuming and require a large number of robust practices. Although this did not seem to concern the interviewees from Poros, interviewees from Ananke, Metis, and Caerus saw this as a disadvantage. The Business Development Director of Metis said that Metis did not have regular meetings because if they did, they *"would lose two or three hours per day just on having a lot of meetings"* (Metis, Business Development Director, July 2018).

In summary, knowledge work through co-creation via repositories and other artefacts was present in all six case firms' project-based work regardless of their size. Collaboratively creating repositories served as a way for project team members to effectively share their specialized knowledge. However, the discrepancy in the level of sophistication in knowledge work structures was rather high. Large and small firms faced different problems when it came to knowledge work and, thus, collaboratively creating and iteratively improving repositories. For smaller firms, lack of funds, time, and designated structures for this purpose, were the main reasons for the rather scarce co-creation practices. Conversely, larger firms were more prone to suffer from the overload of information and technology tools.

4.3. Practice 3: mutual alignment – communicating content and context

The third practice we refer to as *mutual alignment*– communicating content and context between project teams. It is an important practice and we observed that the project teams engaged with throughout their project work, and we encountered it in all six cases of firms and their project-based work. Early in the dialoguing process in the project, the project teams expressed several differences and viewpoints. To illustrate the communication of content the collaborative repositories helped with, yet given the different logics in action a growing understanding of the project work context needed to be communicated and thus mutual alignment, and collaborative know-how achieved. For instance,

according to Ioke's Key Account Manager, her primary way of gaining knowledge was via interacting with colleagues continuously, which was not a structured process. She shared her opinion that *"the continuous growth and changes introduced iteratively [prevented] things to be set in stone"* (Ioke, Key Account Manager, June 2018).

Due to the different logics in action, one of the most interesting findings of this research was the difference in the way back-offices and front-offices managed knowledge work, how they maintained open communication channels, and how they shared meaning between the project teams. This difference was the case for all six firms regardless of their size, and knowledge work (e.g., formal or informal approaches). That is, the division between the back-office technical side of the business and the customer-facing front-office or the business side was visible when looking at knowledge practices, particularly the means and approach to continuous work alignment. There were, in our view, three main reasons for these differences. Firstly, the back offices used standardised project management techniques, whereas the front offices did not. Secondly, the back-offices seemed to have the advantage of the software code being a form of documentation – a knowledge repository, which helped maintain an open communication channel. Lastly, the back-office departments and their teams had a stronger project orientation. The traces of more structured communication and knowledge work across different project teams were found in Gaia, Poros, and to some extent Ananke. For instance, Gaia's team of Management Solutions Consultants and Poros's Development team have compiled 'lessons learned' documents after the completion of the project.

Poros's emphasis on the processes and plans for action was a good illustration of the benefits of well-established project organisational practices for knowledge work. For example, Poros's engineering department and project teams followed the Scrum methodology by the book which helped establish regular meetings that help surface differences across the project teams. Scrum is a simple framework for effective team collaboration on complex products. Poros's Director of Engineering has explained the way workflow was organised in the programming department:

"We are using agile methodologies, Scrum mainly, there is a quite good rhythm that we follow. We are working in two weeks long sprints. We have sprint planning in the beginning. Before the spring lockdown happens, we estimate all the tasks, and we discuss this in detail, then we [try] to select the best [solution] which points to the future which has the most insensibility. Then we are trying to break down the work ... there should not be any task that needs to be done which is bigger than three days" (Poros, Director of Engineering, July 2018).

Technical teams in most of the analysed firms used standardised project management techniques such as Scrum and Kanban, which were less likely to be used by the front-office project team members. Kanban is a method for defining, managing and improving services that deliver knowledge work. Although the management of knowledge was usually not the primary reason firms introduced Scrum, it helped and ensured knowledge work and instilled knowledge practices. Short project intervals called sprints, a well-measured work rhythm, frequent team meetings, rating the difficulty of the tasks through planning, and other aspects of Scrum can be seen as covert facilitators of knowledge sharing. Since the methodology was initially launched for software development and is since predominantly marketed this way, software development departments and their teams were more likely to use it than customer-facing project team members. Software development members of five out of six firms, excluding Metis, used Scrum or some other type of agile project management methodology in their projects. Similar project management methodologies were used by some of the front-office departments of three firms – Caerus, Gaia, and to a lesser extent Poros. Yet, as an interviewee highlighted: *"Project in our world is a product development and if you are looking at the project as beginning and the end of something like feature development than it is a project. What we actually do there is this project management tool Gyro [a tool to manage cloud*

infrastructure] where you have an end goal let's say that it's to build up the image feature inside the WhatsApp application and there are concrete steps to achieve it" (Caerus, Product Marketing Manager/Team Lead, August 2018).

The back-office departments and the teams of the selected firms were indeed more project-oriented than the front office. For instance, the 3D Developer from Metis was surprised to be asked whether her work was project-based. "Yes, it is [project-based]. What other options are there?" (Metis, 3D Developer, July 2018). On the other end, account managers, technical support, and business development from the front office were more inclined to think of their work as a combination of functions rather than projects. For example, the Technical Support Manager from Ananke said that the workflow of her department "does not look like projects, because we always have some requests and they are quite similar to each other" (Ananke, Technical Support Manager, July 2018). Similarly, the Senior Manager from Caerus said that although her work revolved around projects to an extent, this was not the case for more junior employees.

Maintaining open communication through informal communication channels and interpersonal communication seemed more likely to bolster knowledge work practices, alleviating different understandings and decontextualization (i.e., different understanding from the work context of the project teams). To this end, one-to-one mentoring, a system in which one person from the team was assigned to mentor a newcomer, was common. The 3D Developer from Metis shared her experience of being trained as a new member of the team. The training seemed utterly bespoke and tailored specifically for her: "I was seated next to a colleague, and he explained everything to me. On his own initiative, he even prepared some lessons on the skills crucial for my project" (Metis, 3D Developer, July 2018). Moreover, the transformation of the local team understandings occurred when a project team member overruled cross teamwork. Another interviewee highlighted: "We also have every two weeks we sit together as a team, we agree on what we are going to do in the next two weeks. And we also have daily fifteen minutes of stand-ups we call it when we stand in a circle and we actually say what we did yesterday (he said tomorrow) and what we would like to do today" (Caerus, Product Marketing Lead, August 2018).

Further, status meetings and maintaining open communication through regular meetings were deemed appropriate.

"I am leading the team of product marketing managers, there are five of them. And what they actually do is when a specific feature of a product as we mentioned images sending over WhatsApp is produced, we communicate it to the relevant stakeholders. And how do we do it again over different tools whether it is some kind of internal newsletter whether it's communication through a SharePoint that we have in our internal intranet; [and] then when we communicate with internal stakeholders, we also inform our external stakeholders about what is going on" (Caerus, Product Marketing Lead, August 2018).

Along with the formal processes, additional supporting communication channels among the different teams were the technology infrastructure, as an interviewee noted it helped maintain communication open: "We have three or four different teams within my team working on different features but they often use the same infrastructure so every once in a while, someone may send out an email to the whole group reporting to have faced this problem with infrastructure. I would like to learn how to solve it and they will ride to a little dark and then if this is something that they can demo then we have a weekly half an hour slot which is book a meeting room" (Gaia, Product Manager, June 2018). Another interviewee highlighted along similar lines: "We also used email when we exchange specific databases even when we are trying to have everything online. All the communication channels have a segment of knowledge over Skype, for instance, we can send some important information. But the main focus is on two sites and that would be intranet as a share point and that would be Compliance [a tool from Atlas]" (Caerus, Product Marketing Manager/Team Lead, August 2018).

In sum, the third and final practice of the dialogic process involved

intensive communication where the project team departmental differences (front- and back office) were observed. Thus, knowledge work across teams not only required the support of technology infrastructure but also being aware of the local transformation requiring excellent social skills in the intensive meetings. We also found people with an overview of cross-domain teams that worked actively and help maintain the communications channels open without the need to engage in a lengthy dialogue. They also facilitated the teams' contact and linked to external stakeholders' communication of prototype solutions. Indeed, crucial given that solutions were hard to develop across disciplinary teams and thus challenging to change. Besides, and despite ensuring a smooth transition of the dialogue from internal team dynamics to external stakeholders it gave support and advice to maintain the focus needed and continue the co-creation of knowledge work.

5. Discussion and conclusion

Project work and projects with diverse specialised expertise, involving cross-domain or multi-disciplinary teams are increasingly used to develop new products and processes (Bruns, 2013; Barley, 2015). However, sharing meaning and integrating knowledge across domains when faced with pressing deadlines and novel situations is highly challenging, requiring in-depth dialogue-based practices (Carlile, 2004; Jarvenpaa & Majchrzak, 2008; Majchrzak et al., 2012; Baralou & Tsoukas, 2015). Particularly challenging is the situation when project practices become entangled with information technologies, which introduces complex problematic situations related to knowledge work activities (Yoo et al., 2012; Whyte, 2019). Extant literature on collaboration and knowledge work in projects emphasises the need to move beyond the understanding of knowledge as formal structures and coordination mechanisms and understand knowledge work as a situated and evolving activity (see e.g., Majchrzak et al. 2012, Bruns 2013, Ben-Menahem et al. 2016). Guided by this call, our study aims to describe and explain how cross-domain project teams collaborate and engage in knowledge work practices within and across projects and in the IT industry.

5.1. Knowledge work practices and cross-domain collaboration in IT projects

Anchoring the study in the knowledge-as-practice perspective (Cook & Brown, 1999, Orlikowski 2002, Nicolini 2012), we explored the dialogic process, seeking to understand the project members' participation and efforts, and the coordination of activities supporting knowledge work in IT projects. We identified the practices of a) expressing differences, b) co-creation, and c) mutual alignment, which the cross-domain project teams in our case organisations engaged in for sharing knowledge and creating solutions for their IT projects. We next discuss the interplay of these practices in the context of the temporal dynamics of the project processes.

The practice of *expressing differences* we observed took place at the project outset when project members surfaced their different understanding of the problems and potential solutions. This often occurred through in-depth dialogue in face-to-face meetings where project teams needed to manage different members' knowledge perspectives. This enabled the project team to focus on in-depth discussions and negotiations across domains drawing on more structures necessary for knowledge sharing and transformation, which is broadly in line with the *traverse* view of knowledge integration (see Bechky 2003, Carlile 2004, Jarvenpaa & Majchrzak 2008). Similarly, several instances were reported of project members creating a collaborative working environment, acknowledging other members' perspectives and stimulating a creative mindset rather than challenging ideas. This suggests that in complex knowledge work in IT project settings, project members draw on informal and temporary structures of collaboration for knowledge work, broadly in line with the *transcend* view of knowledge integration

(Majchrzak et al., 2012; Ben-Menahem et al., 2016).

The second practice we identified in the interview accounts - *co-creation* - involved the collaborative use of repositories and shared artefacts that allow for the development of knowledge and its convergence (Yoo et al., 2012). The project team members were reported to iteratively work with epistemic and boundary project-related objects clarifying responsibilities, supporting emergent ideas, and renegotiating and resolving interdependent problems. Through this process the rather fluid understandings at the project outset are consolidated and clarified as project members would add and modify the content of the repository, allowing for a form of collective sense-making – an essential condition for knowledge work across domains (Bechky, 2003; Majchrzak et al., 2012). One example of this is when an account manager thought of the need for further details of the process guidelines in their project. Using an intranet share point the account manager created a new topic and added further documentation regarding the updated guidelines, but at the same time, asked for additional insights from the project teams. Less than a week after that, several project members added their ideas expanding the scope of the updated guidelines thus improving the project process. Over the next few days, more employees inquired for clarifications and helped shape the documents useful for the firm.

The above is an example of the co-creation of knowledge through the collaborative use of the repositories in line with the work on transactive memory systems (Jarvenpaa & Majchrzak, 2008; Choi et al., 2010; Majchrzak et al., 2014). The technology infrastructures allowed for sharing of work content dynamically, enabling the project team members further reflect with access to the available content (see Baralou & Tsoukas 2015). Our findings also illustrate that industry norms and regulations were incorporated into the platform through practices, procedures and role expectations (e.g., agile methodologies, Scrum, etc.), thus, facilitating the project members to consolidate knowledge work at the project level and reuse it (Hartmann & Dorée, 2015; Hetemi et al., 2022). Lastly, it was found that IT-based artefacts can be useful only if they reflect a sense of social bonds and human behaviours together and address the organisational complexity in organisations which supports prior studies in this domain (Eriksson et al., 2017; Nisula et al., 2022).

However, in instances where the content added to the repository and the discussion initiated was not sufficiently specified and defined, the result would be confusion created about the roles and the way forward instead of useful knowledge and meaning being shared. There were several instances where respondents, particularly from large firms reported the fragmented information across various databases, chat logs, etc. in their project work. That created new types of fault lines between project members in three knowledge dimensions: defining the product, building the product, and projecting the future (Yoo et al., 2012). As can be seen, at times the technology infrastructure mediating co-creation prompted an open problem space, reintroducing the very boundaries of the complementary knowledge that concerned central project activities (for more detailed discussion see Dougherty & Dunne 2012).

Finally, the practice of *mutual alignment* concerned intensive communication where the diverse logics of actions among the project team departmental routes (front- and back offices) were prominent. To this end, knowledge work across project teams at the project level not only required the support of technology infrastructure but also being aware of the local knowledge transformations, demanding excellent social skills in the intensive meetings. Moreover, communication between the project team members across the case firms was multimodal in that several members used face-to-face and technological infrastructure or tools mediated interaction. Similarly, it involved multiple project members' expertise, and different degrees of synchronization in the project context (Baralou & Tsoukas, 2015).

Apart from collaboration within their projects, the project members want to achieve alignment and communicate the context of their work to external team stakeholders (Majchrzak et al., 2005, 2012; Burga et al., 2022). They are doing so through sharing knowledge about the

situations, intentions, and embodied evolving actions interpreted by the individuals (see Majchrzak et al. 2005). It was clear from analysing the interviews that the practices are non-linear and mutually interdependent as they are a product of a continuous renegotiation of solutions and iteratively addressing emergent problems. The emergent nature of the practices and the tensions it created throughout the project implementation, required continuous collaborative work and alignment across the three main practices we discussed.

5.2. Implications for theory and practice

Knowledge, creativity and the use of analytical and social skills' across domains are core values of organisations, and are being increasingly discussed in the project management literature (Newell et al., 2009; Pemsel et al., 2016; Nisula et al., 2022). Particular attention is being paid to organisational knowledge, increasingly seen as a consequential activity grounded in everyday situated practice rather than abstracted from it, recorded and transferred. This shift in focus resulted in an emerging and growing research stream on *knowing-as-practice* to help reformulate and better understand the extant notions of knowledge (Orlikowski & Yates, 2002; Feldman & Orlikowski, 2011; Nicolini et al., 2012). This literature stream has paved the way for an understanding of knowledge work related to the dialogic processes and collaborative practices across domains and multi-disciplinary teams in project settings (see Jarvenpaa & Majchrzak 2008, Majchrzak et al. 2012, Baralou & Tsoukas 2015).

In this paper, we advance such a perspective on collaborative practices and knowledge work in IT projects. We primarily focus on IT projects as an exemplary setting for cross-domain knowledge work which organisations are undertaking to develop products, and processes and to implement change programmes. We broadly intended to contribute to the body of literature on knowledge in project organisations by exploring collaborative practices of knowledge work. Our findings highlight the collaborative practices that project members engaged in and the significance of collaborative shaping of information technology as means through which project members engaged in knowledge work.

The specific theoretical implications of this study are as follows. First, we showed that while knowledge work is deeply embedded in practices, many IT projects and their respective organisations rely primarily on fragmented knowledge as a decontextualised information product. We elaborate on the central practices implied in the interviews and the critical role of the dialogue in the knowledge work process that project members engaged with, and we show the key characteristics of these practices. The first aspect of our research supports existing findings from qualitative studies (Swan et al., 2010; Hartmann & Dorée, 2015), which argue for a contextual approach to knowledge and reaffirm the importance of knowledge governing and informal practices (Pemsel & Müller, 2012; Mahura & Birolo, 2021). While not entirely new, such an understanding is highly relevant for organisations both operating in the IT industry as well as more broadly. This message contrasts with the pure instrumentalist and detached approach to knowledge work (cf. Newell et al. 2009, Hartmann & Dorée 2015, Hetemi et al. 2022). Yet, noting that knowledge work practices are multi-dimensional, we are aware that the notion of embedded knowledge practices cannot be considered a sufficient theoretical contribution.

As our key contribution, we posit that the identified practices provided the *scaffolding* to make heterogeneous meanings across the project teams clearer (Bechky, 2003) and to achieve the collective shared project objective (Bruns, 2013; Ben-Menahem et al., 2016). These practices provided not only the needed focus throughout cross-domain project teamwork (Majchrzak et al., 2012), but also they appeared to create what Dougherty & Dunne (2012) refer to as the *creative mindset*. Thus, we found support for both the *traverse* and the *transcend* view of knowledge work.

Our study is an early attempt to develop an empirical understanding of the value of dialogue and collaborative practices (Jarvenpaa & Majchrzak, 2008; Majchrzak et al., 2012; Baralou & Tsoukas, 2015) in knowledge work in IT projects, demanding a balance between granting project-teams autonomy and embedding them in organisation-wide practices (Sydow et al., 2004). Although it is the responsibility of organisations to develop practices that ensure cross-domain project team and inter-project knowledge work, the practices need to become an inherent part of the governance. To this end, practitioners might benefit by harmonizing existing dialogic processes in IT projects, by allocating time for project teams to interact progressively and reflect on the reasons of effective and flawed activities (Bakker et al., 2011).

5.3. Limitations and recommendations for future research

As with any research, this work has some limitations. The sample size could be argued as an obstacle to studying larger firms where there are potentially more discrepancies in knowledge work practices involving different departments and regional offices. However, we found that interviewing up to six people from larger firms, each one from a different department, was adequate to gain a relative saturation and sufficient understanding of the level of advancement of firms’ knowledge work practices. Another limitation was a relative lack of diversity in the seniority, and emphasis on the front-end related work which potentially led to biased data. Most of the interviewees from the four smaller firms were mid-senior to senior level, while the interviewees from the largest organisations – Gaia and Caerus – were in less senior roles.

Future research can address the above limitations through different conceptual angles and research designs. To this end, and since we found support for both the traverse and transcend view to knowledge work in cross-domain collaboration in IT projects, future studies can investigate the conditions in projects that make either traverse or transcend knowledge approach to cross-domain collaboration more appropriate than the other. Likewise, the integration knowledge view (exhibiting both traverse and transcend views) introducing different work activities that help induce focus and creativity is a good direction for future research. So is research on the conditions, in which the integrative view is the most appropriate angle to understand and manage knowledge work. Along those lines, we see research on temporal boundaries and practices in projects (e.g., Stjerne et al. 2019), and the underpinning temporal structuring literature particularly useful (see Orlikowski & Yates 2002). While the level of analysis in our research is set to IT projects within their respective firms, future research should explore complexities of knowledge work in multi-project and inter-organisational settings following recent debates in project scholarship in this domain (Martinsuo & Ahola, 2022). Recognizing the exploratory nature of our findings, future research could consider furthering our understanding through ethnographic and related research designs. We conclude by emphasising the importance of continuing to develop a solid understanding of project-based knowledge work and its practices as a key capability that organisations in public and private industries need to develop to thrive in their respective organisational ecosystems.

Appendix 1

Interview Questions

Background questions	1 Please describe the firm where you currently work, its size, industry, culture, and relationships between the employees. 2 What is your role in the firm, what are your day-to-day responsibilities?
Knowledge management practices (broad questions)	1 Do you share your views and ideas on work related subjects with your colleagues? 2 Is there a certain routine for this? Do you have a dedicated space, time to exchange your work-related ideas?
Knowledge management practices (specific questions)	1 Is there a database used by the firm to record information related to the projects? Do you/your colleagues use this database? 2 Do you find information from the database useful; do you reuse the knowledge shared there? 3 Do you think knowledge share is adequately presented and coded? 4 Is there a person within the firm who encourages you to share and reuse knowledge? Does this person do so by her/his own initiative, or this is her/his official responsibility?
Knowledge sharing and reuse incentives	1 Does senior management set an example of knowledge reuse; do they share knowledge with more junior employees? 2 Do employees/Does your project team/Do you find these incentives sufficient to abandon the competitive advantage of having knowledge others in the firm do not possess? 3 Do employees/Does your project team/Do you find these incentives adequate to search for the knowledge shared by others? 4 What would make employees/your project team/you more willing to share/reuse knowledge?
inter-project knowledge sharing and reuse	1 Can you say that your work is project oriented? 2 How do you record and share knowledge accumulated during projects? 3 Is project knowledge reused?

Appendix 2

Partial interview transcript, Example 1

Ioke, Key Account Manager	
Time	Quote
6:14	“The learning happens through interaction with people but I think it is not structured at all. I think with any of these tech firms, the growth kind of prevents things to be set in stone.... Ioke is a bit smaller and it is more like you are thrown in at a deep end. One month being here I would be sent to conferences even though I did not know anything about AdTech”
7:00	“A lot of the learning, additions or anything that you need to learn is communicated over [name of the communication tool] and because it is a messenger... our head office is in Canada, if anything gets uploaded overnight, I would have to spend ... two hours in the morning just going through the chats between people and finding the articles or anything that has been shared”
8:20	“Now we have [name of the knowledge depository] with all the things on it but it is very badly organised”

(continued on next page)

(continued)

Time	Quote
8:27	“AdTech as an industry changes every day, so there is a real need in this knowledge sharing because it is almost in real time”
12:34	“Very much the human side of [name of the knowledge depository] that is failing”
12:50	“My firm is 15 years old ... In 15 years, you have so much back log of old files, repetitive files, badly mapped things. And I think another that is a problem is that anyone can edit it, and nothing gets kind of signed off by a manager or a leader”
13:30	“I give you an example that was terrible. We have traffic volume limits to kind of select the websites we want to work with. So, we need the websites with a lot of volume ... The minimums are very important but every country has different minimums. I mean, the US has websites where like 5-6 billion people go a month, unique visitor will go. But then in England you will never find something that big, and neither you will in Germany or France ... But someone has gone into the page and changed the minimum volumes to the US standard, and then the team that has to approve my site kept rejecting it saying that, well it’s written in [name of the knowledge depository] ... You could easily mess up your workflow because you are junior person, you just put the things people told you for your market and you do not take into consideration other markets”
24:00	“When you grow and grow more, you need to corporealize, to be more corporate in the way you store knowledge, and be more structured”
33:20	Interviewer: “Do not you find there are too many tools?” Interviewee: “OMG a 110 % ... I think in a way it is fine if there are 100 different platforms. The problem is that they do not communicate with each other”

Partial interview transcript, Example 2

Time	Quote
Caerus, Product Marketing Manager, Team Lead	
1:30	“If [name of the messaging app] adds a feature that you can now send images, it is our goal to let you know as a user of [messaging app] that you can now send images. The culture is a bit of a transitioning from start-up to corporate mentality. As we are a firm that grew from a start-up opened in 2006 to a firm of 1500 people in 2018. We still have a lot of this start-up culture, but also, we are in this transition phase where we are trying to establish some corporate processes”.
4:20	“I am leading the team of product marketing managers, there are five of them. And what they actually do is when a specific feature of a product as we mentioned images sending over [name of the messaging app] is produced, we communicate it to the relevant stakeholders. And how do we do it again over different tools whether it is some kind of internal newsletter whether it’s communication through a [intranet] that we have in our internal intranet. And then when we communicate with internal stakeholders, we also inform our external stakeholders about what is going on. Whenever there is new feature, [name of the messaging app] is doing a bad job of promoting this because you do not know that you have a new feature and that’s where product marketing manager actually jumps in to makes sure that everybody that needs to have the right information gets the right information. And with that information we are tracking whether when we developed something and when we shared the news about it how widely used this option is.”
9:15	“There are different procedures here. When we are talking about what we are going to do as a form of knowledge sharing, we are doing these quarterly plans. We also have every two weeks we sit together as a team; we agree on what we are going to do in the next two weeks. And we also have on the daily basis fifteen minutes of stand-ups we call it when we stand in circle and we actually say what we did yesterday (he said tomorrow) and what we would like to do today. We also have this we call it “what do you think sessions”. Where we actually put down the list of topics that we think that would be interesting for the people. Then the people can vote for the topic and then when we have like five topics then members of my team present this thing to other teams like the rest of product development and maybe to market team or anybody who’s interested. It’s in a form of four-minute pitch where we have four minutes to explain what the idea is and ten minutes for questions. And then we go on to the next topic.”
12:40	“We use [name of knowledge depository] that’s one repository of documents and knowledge. The second one is [name of intranet], our intranet. So [name of knowledge depositories] is more like for development where they are sharing the knowledge and [name of intranet] is like the firm’s database for knowledge where we have you know how did we have some customer, some business proposal, some presentations. And of course, over email when we exchange specific databases even though we are trying to have everything online. All the communication channels have a segment of knowledge over [internet communication software] we can send some important information. But the main focus is on two sites and that would be intranet as a [name of intranet] and that would be [knowledge depository] as another tool”.
16:00	I mean again I cannot be objective here, because we track some stuff like how many people actually visit our [intranet] that I set up. So, people come there for two reasons first when they really need something and second because they need to go there. They do not have an option oftentimes. So yes, we are doing our best for them to easily find it and I think we did [found] a good solution. But again, we need to measure it more carefully, because we implemented it like two months ago or even three months ago. All the results are now good you know going up like this the usage and everything the comment, but we need more data to be able to answer this question”.
21:00	Interviewer: “Are the material incentives to share knowledge within the firm?” Interviewee: “No, so if you are talking about some kind of gamification stuff, if you are talking about [knowledge depository] they have these karmas where if you are contributing to content and you are like a big champion of [knowledge depository] we do not do that on [intranet]. We know that it is needed, we know that it is a key source of information for the firm, so we know that if you want to get to your goal that you need to use it and incentive is really not needed in this case it’s part of our everyday job and really, it’s not needed”.
27:00	Interviewee: “So let me start from my example. When we are working on a specific project, it is dealt by our internal tool called [tool name] and the other tool that we use now is [tool name]. So how would we actually break them down, there is always the size of the project. Okay let’s call it the project even though we are not specifically project oriented firm, we are a product-oriented firm. So, we do not deal that much with projects, but it is similar. Interviewer: “If you do not it’s also fine. That’s interesting”. Interviewee: “Project in our world is product development and if you are looking at project as beginning and the end of something like feature development than it is a project. What we actually do there is this project management tool [tool name] where you have an end goal let’s say that it’s to build up the image feature inside [messaging app] application and their steps to achieve it”.

Appendix 3

Excerpt(s) from the cross-case analysis on the IT firms projects (company and project size, front- and back office, etc.)

Small companies			Large companies		
Enablers	Company	Supporting quote	Enablers	Company	Supporting quote
1.Small size – easy communication	Poros Ananke Metis	“We have really excellent live systematic ways of keeping open lines of communication between the main teams that we work with” (Senior Account Manager, Poros)	1.Sophisticated organisational structure	Gaia Caerus	“We still have a lot of this start-up culture, but also we are in this transition phase where we are trying to establish some corporate processes” (Product Marketing Manager, Caerus).

(continued on next page)

- Eriksson, P. E., Leiringer, R., & Szentes, H. (2017). The role of co-creation in enhancing explorative and exploitative learning in project-based settings. *Project Management Journal*, 48(4), 22–38. <https://doi.org/10.1177/875697281704800403>
- Ewenstein, B., & Whyte, J. (2009). Knowledge practices in design: The role of visual representations as “Epistemic objects”. *Organization Studies*, 30(1), 7–30. <https://doi.org/10.1177/0170840608083014>
- Feldman, M. S., & Orlikowski, W. J. (2011). Theorizing practice and practicing theory. *Organization Science*, 22(5), 1240–1253. <https://doi.org/10.1287/orsc.1100.0612>
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245. Sage Publications/Sage CA: Thousand Oaks, CA.
- Foss, N. J., Husted, K., & Michailova, S. (2010). Governing knowledge sharing in organizations: Levels of analysis, governance mechanisms, and research directions. *Journal of Management Studies*, 47(3), 455–482.
- Grabher, G., & König, J. (2020). Disruption, embedded: A polanyian framing of the platform economy. *Sociologica*, 14(1), 95–118. <https://doi.org/10.6092/issn.1971-8853/10443>
- Hartmann, A., & Dorée, A. (2015). Learning between projects: More than sending messages in bottles. *International Journal of Project Management*, 33(2), 341–351. <https://doi.org/10.1016/j.ijproman.2014.07.006>
- Hetemi, E., Ordieres, J., & Nuur, C. (2022). Inter-organisational collaboration and knowledge-work: A contingency framework and evidence from a megaproject in Spain. *Knowledge Management Research & Practice*. <https://doi.org/10.1080/14778238.2022.2027827> Taylor & Francis.
- Huemann, M. (2022). Celebrating the power of projects and their management. *International Journal of Project Management*, 40(1), 1–3. <https://doi.org/10.1016/j.ijproman.2022.02.001>
- Imam, H., & Zaheer, M. K. (2021). Shared leadership and project success: The roles of knowledge sharing, cohesion and trust in the team. *International Journal of Project Management*, 39(5), 463–473. <https://doi.org/10.1016/j.ijproman.2021.02.006>
- Jarvenpaa, S. L., & Majchrzak, A. (2008). Knowledge collaboration among professionals protecting national security: Role of transactive memories in ego-centered knowledge networks. *Organization Science*, 19(2), 260–276. <https://doi.org/10.1287/orsc.1070.0315>
- Jiang, J., Chang, J., Chen, H. G., Wang, E., & Klein, G. (2014). Achieving IT program goals with integrative conflict management. *Journal of Management Information Systems*, 31(1), 79–106. <https://doi.org/10.2753/MIS0742-1222310104>
- Ketokivi, M., & Choi, T. (2014). Renaissance of case research as a scientific method. *Journal of Operations Management*, 32(5), 232–240.
- Ko, D. G., & Kirsch, L. J. (2017). The hybrid IT project manager: One foot each in the IT and business domains. *International Journal of Project Management*, 35(3), 307–319. <https://doi.org/10.1016/j.ijproman.2017.01.013> Elsevier Ltd, APM and IPMA.
- Lundin, R. A., Arvidsson, N., Brady, T., Ekstedt, E., Midler, C., & Sydow, J. (2015). *Managing and working in project society*. Cambridge University Press.
- Mahura, A., & Birolo, G. (2021). Organizational practices that enable and disable knowledge transfer: The case of a public sector project-based organization. *International Journal of Project Management*, 39(3), 270–281.
- Majchrzak, A., Malhotra, A., & John, R. (2005). Perceived individual collaboration know-how development through information technology-enabled contextualization: Evidence from distributed teams. *Information Systems Research*, 16(1), 9–27.
- Majchrzak, A., More, P. H. B., & Faraj, S. (2012). Transcending knowledge differences in cross-functional teams. *Organization Science*, 23(4), 951–970. <https://doi.org/10.1287/orsc.1110.0677>
- Majchrzak, A., Wagner, C., & Yates, D. (2014). The impact of shaping on knowledge reuse for organizational improvement with Wikis. *MIS Quarterly*, 37(2), 455–469.
- Marabelli, M., & Newell, S. (2014). Knowing, power and materiality: A critical review and reconceptualization of absorptive capacity. *International Journal of Management Reviews*, 16(4), 479–499. <https://doi.org/10.1111/ijmr.12031>
- Martinsuo, M., & Ahola, T. (2022). Multi-project management in inter-organizational contexts. *International Journal of Project Management*, 40, 813–826.
- Martinsuo, M., & Geraldi, J. (2020). Management of project portfolios: Relationships of project portfolios with their contexts. *International Journal of Project Management*. <https://doi.org/10.1016/j.ijproman.2020.02.002> Elsevier Ltd, (January).
- Martinsuo, M., & Huemann, M. (2021). Reporting case studies for making an impact. *International Journal of Project Management*, 39(8), 827–833. <https://doi.org/10.1016/j.ijproman.2021.11.005>
- Newell, S. (2015). Managing knowledge and managing knowledge work: What we know and what the future holds. *Journal of Information Technology*, 30(1), 1–17. <https://doi.org/10.1057/jit.2014.12>
- Newell, S., Bresnen, M., Edelman, L., Scarbrough, H., & Swan, J. (2006). Sharing knowledge across projects: Limits to ICT-led project review practices. *Management Learning*, 37(2), 167–185.
- Newell, S., & Edelman, L. F. (2008). Developing a dynamic project learning and cross-project learning capability: Synthesizing two perspectives. *Information Systems Journal*, 18(6), 567–591. <https://doi.org/10.1111/j.1365-2575.2007.00242.x>
- Newell, S., Robertson, M., Scarbrough, H., & Swan, J. (2009). *Managing knowledge work and innovation* (2nd ed.). Palgrave Macmillan.
- Nicolini, D. (2012). *Practice theory, work, and organization: An introduction*. Oxford University Press.
- Nicolini, D., Mengis, J., & Swan, J. (2012). Understanding the role of objects in cross-disciplinary collaboration. *Organization Science*, 23(3), 612–629. <https://doi.org/10.1287/orsc.1110.0664>
- Nisula, A. M., Blomqvist, K., Bergman, J. P., & Yrjölä, S. (2022). Organizing for knowledge creation in a strategic interorganizational innovation project. *International Journal of Project Management*, 40(April), 398–410. <https://doi.org/10.1016/j.ijproman.2022.03.011>
- Nonaka, I. (2007). The knowledge-creating Company. *Harvard Business Review*, July–August, 162–171.
- Orlikowski, W. J. (2002). Knowing in practice: Enacting a collective capability in distributed organizing. *Organization Science*, 13(3), 249–273.
- Orlikowski, W. J., & Barley, S. R. (2001). Technology and Institutions: What can research on information technology and research on organization learn from each other. *MIS Quarterly*, 25(2), 145–165.
- Orlikowski, W. J., & Yates, J. (2002). It's about time: Temporal structuring in organisations. *Organization Science*, 13(6), 684–700.
- Park, C. S., Kim, H. J., Park, H. T., Goh, J. H., & Pedro, A. (2017). BIM-based idea bank for managing value engineering ideas. *International Journal of Project Management*, 35(4), 699–713. <https://doi.org/10.1016/j.ijproman.2016.09.015> Elsevier Ltd, APM and IPMA.
- Parolia, N., Jiang, J. J., Klein, G., & Sheu, T. S. (2011). The contribution of resource interdependence to IT program performance: A social interdependence perspective. *International Journal of Project Management*, 29(3), 313–324. <https://doi.org/10.1016/j.ijproman.2010.03.004> International Project Management Association.
- Pemsel, S., & Müller, R. (2012). The governance of knowledge in project-based organizations. *International Journal of Project Management*, 30(8), 865–876.
- Pemsel, S., Müller, R., & Söderlund, J. (2016). Knowledge governance strategies in project-based organizations. *Long Range Planning*, 49(6), 648–660. <https://doi.org/10.1016/j.lrp.2016.01.001>
- Pemsel, S., Söderlund, J., & Wiewiora, A. (2018). Contextualising capability development: Configurations of knowledge governance mechanisms in project-based organizations. *Technology Analysis and Strategic Management*, 30(10), 1226–1245. <https://doi.org/10.1080/09537325.2018.1459538>
- Rowley, J. (2007). The wisdom hierarchy: Representations of the DIKW hierarchy. *Journal of Information Science*, 33(2), 163–180. <https://doi.org/10.1177/0165551506070706>
- Sandberg, J. (2005). How do we justify knowledge produced within interpretive approaches? *Organizational research methods*, 8, 41–68.
- Silverman, D. (2015). *Interpreting qualitative data*. Sage.
- Song, J., Song, L., Liu, H., Feng, Z., & Müller, R. (2022). Rethinking project governance: Incorporating contextual and practice-based views. *International Journal of Project Management*, 40(4), 332–346. <https://doi.org/10.1016/j.ijproman.2022.04.004> Elsevier Ltd.
- Stake, R. E. (2006). *Multiple case study analysis*. New York: The Guilford Press. ISBN 9781593852481.
- Stjerne, I. S., Söderlund, J., & Minbaeva, D. (2019). Crossing times: Temporal boundary-spanning practices in interorganizational projects. *International Journal of Project Management*, 37(2), 347–365. <https://doi.org/10.1016/j.ijproman.2018.09.004> Elsevier Ltd, APM and IPMA.
- Stock, G. N., Tsai, J. C.-A., Jiang, J. J., & Klein, G. (2021). Coping with uncertainty: Knowledge sharing in new product development projects. *International Journal of Project Management*, 39, 59–70.
- Swan, J., Scarbrough, H., & Newell, S. (2010). Why don't (or do) organizations learn from projects? *Management Learning*, 41(3), 325–344.
- Sydow, J., Lindkvist, L., & DeFillippi, R. (2004). Project-based organizations, embeddedness and repositories of knowledge: Editorial. *Organization Studies*, 25(9), 1475–1489.
- Vedel, J. B., & Kokshagina, O. (2021). How firms undertake organizational changes to shift to more-exploratory strategies: A process perspective. *Research Policy*, 50(1). <https://doi.org/10.1016/j.respol.2020.104118>
- Vermerris, A., Mockler, M., & Van Heck, E. (2014). No time to waste: The role of timing and complementarity of alignment practices in creating business value in IT projects. *European Journal of Information Systems*, 23(6), 629–654. <https://doi.org/10.1057/ejis.2013.11>
- Whyte, J. (2019). How digital information transforms project delivery models. *Project Management Journal*, 50(2), 177–194. <https://doi.org/10.1177/8756972818823304>
- Winter, M., Smith, C., Morris, P., & Cicmil, S. (2006). Directions for future research in project management: The main findings of a UK government-funded research network. *International Journal of Project Management*, 24, 638–649.
- Yoo, Y., Boland, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for innovation in the digitized world. *Organization Science*, 23(5), 1398–1408. <https://doi.org/10.1287/orsc.1120.0771>
- Zahedi, M., Shahin, M., & Ali Babar, M. (2016). A systematic review of knowledge sharing challenges and practices in global software development. *International Journal of Information Management*, 36(6), 995–1019. <https://doi.org/10.1016/j.ijinfomgt.2016.06.007> Elsevier Ltd.
- Zaman, U., Jabbar, Z., Nawaz, S., & Abbas, M. (2019). Understanding the soft side of software projects: An empirical study on the interactive effects of social skills and political skills on complexity – performance relationship. *International Journal of Project Management*, 37(3), 444–460. <https://doi.org/10.1016/j.ijproman.2019.01.015> Elsevier Ltd and Association for Project Management and the International Project Management Association Available at.