TECHNOLOGY FOR KNOWLEDGE WORK: A RELATIONAL PERSPECTIVE

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Abstract

In this research in progress paper, we consider how two major trends drive digitalization. First, software product management focuses on fast and iterative development where users are involved in the design phase of products through product managers. Second, there is a push toward applying AI in knowledge domains. We show how these trends intensify the need to focus on relations between IS development and use. Through an interpretative case study of digitalization, drawing on ethnographic methods, we investigate key relations and how they compound into constellations of relations. We discuss key constellations of relations, how the data flow between constellations of relations functions, and how we can zoom in and out to understand relations—allowing for a reposition of IS development for AI, both theoretically and practically.

Keywords: Constellations of relations, AI, software product management, knowledge work, empirical, case study, ethnographic.

1 Introduction

Two significant trends characterize digitalization efforts in current knowledge-intensive organizations. First, software product management in information systems (IS) development (ISD) puts a premium on fast, iterative, and continuous development (Dennehy & Conboy, 2019; Fitzgerald & Stol, 2017). Roles such as product managers and product owners represent the user domain within development teams (Tkalich et al., 2022). Second, organizations seek to apply artificial intelligence (AI) in supporting knowledge work (Berente et al., 2021).

This research in progress paper considers how software product management and AI intensify the need to cross the boundaries between ISD and IS use (van den Broek et al., 2021). People in both ISD and IS use communities, respectively, build relationships with technology and other people both within their community and externally (Bailey et al., 2022). The internal relationships are more numerous than the external relationships and thus create boundaries towards other communities (Bailey et al., 2022). These boundaries must be crossed because developing, implementing, and using AI in knowledge-intensive areas challenge key software product management assumptions in several ways (Waardenburg & Huysman, 2022).

First, software product management focuses on mutual learning between developers and domain experts in the design phase, using prototyping, minimum viable products, and agile practices. Designated roles, such as product managers and product owners, must undertake a wide range of responsibilities, covering the usability, viability, and feasibility perspectives of software products, seeking to enable developers to understand domain experts' interests, and domain experts to learn how technology functions (Springer & Miler, 2022). Having designated roles for this is challenging because of the depth and diversity of the knowledge required to perform the work of the experts (van den Broek et al., 2021).

A second challenge concerns the use of output-based performance metrics. In software product management, speed is measured by lead time in development (time elapsed between a requirement being formulated and a feature in production). Key-results define objective measures to assess how a product works (e.g., how much a new feature is used). Furthermore, AI performance generally focuses on assessing its ability to produce the correct output for a given input (Lebovitz et al., 2022). However, these metrics do not sufficiently capture how AI works in the production of knowledge, and using the wrong metrics for AI can lead to real-world harm, as the metrics themselves are merely proxies for the underlying latent quantities (Thomas & Uminsky, 2022).

A third challenge is that AI has some key characteristics that sets it apart from traditional software products (Berente et al., 2021): *i*) autonomy, acting without human intervention, *ii*) learning, improving through data and experience, and *iii*) inscrutability, being unintelligible to multiple audiences. Recent research on developing and implementing AI argues that there is a need to focus on the practices for developing and implementing AI in knowledge production, highlighting the interdependence between developers and user experts, and the dialectic nature of their interaction (van den Broek et al., 2021). Taken further, this requires not only foregrounding the experts and developers separately, but blurring the boundaries between ISD and IS use, by developing new shared practices, allowing knowledge sharing, and co-creation across the boundaries of the communities (Waardenburg & Huysman, 2022).

Motivated by the need for new approaches for developing AI-enabled technology for knowledge work, thus necessitating new perspectives on the relationships that cross the boundaries between ISD and IS use, we pose the following research question:

How are constellations of relations influencing ISD in knowledge work?

To answer this research question, we report findings from a case study investigating the development and use of digital technology in maritime survey work. Maritime survey work is a very specific form of knowledge work through experts which, despite considerable efforts to automate it (Hanseth et al., 1996) remains a major challenge to automate. Notwithstanding, the case organization actively pursues initiatives to digitalize this work, including using AI to support expert knowledge work.

2 From product management to relation building

Modern software product management relies on methods where small iterations of changes to a software product, with fast feedback, are a fundamental concept for developing technology (Beck et al., 2001). This ability to deliver fast and frequently enables shorter learning cycles, with a continuous potential for improving the software product (Poppendieck & Cusumano, 2012). With the enabling speed afforded by DevOps initiatives in the past decade or so, which seek to break down the "silo" mentality of development, deployment, and operations (Gall & Pigni, 2022), many organizations have been able to achieve thousands of iterations per week. However, a key goal of iterative development is to collect feedback, and so this approach assumes that relevant feedback can be collected through mechanisms embedded in the product, such as user activity and engagement measures, to guide further development (Olsson & Bosch, 2014). Further, many software development teams seek to deliver software faster and more frequently, thus leading to a high focus on improving developers' ability to deliver (Forsgren et al., 2021). However, the information and learning that inform further evolution of the software product come through the use, and conceptualization of the product in itself, often through roles such as product managers who seek to improve the product according to strategic goals and measures (Tkalich et al., 2022). This focus on developing technology through increasingly efficient delivery cycles assumes a deterministic approach to selecting the right features for the product. Using technology, however, is not deterministic, and the nature of technology is shaped by the relationship between the users and the technology in their context (Gregor et al., 2020).

Producing software for knowledge work has long been identified as a major challenge. Knowledge can be tacit (Polanyi 1966), social, and produced through negotiation (Star 1995), and emerges in practice (Orlikowski 2002). Briefly stated, the challenge lies in formulating with sufficient detail and standardization what goes into decisions so that it can be translated into data and software code. The aspiration to develop and use IS to support and improve knowledge work has been riddled with challenges, issues, and tensions (Huysman, 2004; Ruggles, 1998). A critical component for development is cooperation and alignment between different domain experts (Huysman, 2004). Such challenges are intensified with AI (Lebovitz et al., 2021, 2022). These challenges must be bridged by crossing the boundary between domain experts and developers, that is, how two knowledge domains of expert users and expert developers can co-create technology for knowledge work (Waardenburg & Huysman, 2022).

One way to approach this is to reconsider the relationship between software technology and users. Rather than viewing software technology (such as AI) as a product that affects users, we must revisit the relations that are changing with the introduction of technology, combined with the relations involved in producing the technology (Bailey et al., 2022). A *relational perspective* is necessary due to the unstable nature of digital technology and the way people and organizations interact with them. Four key concepts are important for constructing a relational perspective (Bailey et al., 2022): *1) Entities enacted in relations*, where entities such as technologies and people act *in relation to each other*. 2*) Relational functionality*, the potential of the relation *between the entities* to perform some function. *3) Constellations of relations,* there are compounded sets of relations creating boundaries towards other constellations. *4) Relational dynamics,* relations constantly transform through the introduction of new entities, new relations, and new applications of existing relations.

In order to understand the boundaries of experts and developers better, the *constellations of relations* are of particular interest, as they provide insight into the *composition* of the boundaries and potentially how those boundaries can be broken down. Moreover, the internal composition of relations can point to the shortcomings of product orientation and instead emphasize the co-constitution of technology and the various practices in which they emerge to perform knowledge work.

3 Case and Method

3.1 Case background

MarComp (real name suppressed for anonymity) is a leading service provider for the maritime industry with about 3,700 employees worldwide. One of the core services of MarComp is performing surveys of vessels and subsequent issuing of certificates; certification is necessary for compliance with national and international maritime regulations, allowing vessels to operate in international waters. Certificates are updated annually through surveys, with a more thorough survey every five years. Surveys are performed by highly trained surveyors (3, or 5 years of higher education), with an additional two years of training after starting at MarComp. MarComp employees approximately 1,000 surveorys.

A key aspect of MarComp’s strategy is to digitalize through new technologies such as AI and Machine Learning (ML) and an increased focus on data collection and analysis. To that end, various digitalization initiatives have also affected the surveyor's role over the years. Currently, MarComp is in the process of modernizing their survey support system called *Naval Application*. This system is used daily by surveyors to prepare, conduct, and report on surveys, which includes looking up vessel history, documenting findings, and issuing certificates. The current system is a Microsoft Windows application, launched in 2005, with multiple updates since.

We have been engaged with MarComp for several years, aiming to provide research-based advice on how to improve their IS development processes, preparing for the transformation and automation that is aimed for with the introduction of AI.

3.2 Research design, data collection, and analysis

To study the constellation of relations, we chose an interpretative case study (Walsham, 1995), allowing us to enter the world of surveyors and developers by drawing on ethnographic methods (see Figure 1). The nature of the research was exploratory without a predefined hypothesis (Oates, 2006) to be able to engage iteratively with literature and the observations, and develop a deep understanding, and challenge any assumptions that might underpin the development of new technology. We used different methods to collect data (see Table 1), including ethnographic observations, including photographs taken during field work, semi-structured interviews, and archival documents, to develop a deep understanding of the MarComp's context.

Data source	Description	Details
Semi-structured interviews	Semi-structured interviews with four software developers, three surveyors, and two interviews with the software implementation manager.	9 interviews, 105 transcribed pages
Observations	Field notes and pictures from "shadowing" seven surveyors. Field notes were captured during observation, and reflections were written immediately afterward	82 hours of observation, 59 pages of field notes.
Photographs	Pictures from "shadowing" seven surveyors, showing the surveyors in their environment	200 pictures
Documents	PowerPoints describing the software project and a project charter provided by MarComp	30 slides

Table 1. Data Sources

Figure 1 Surveyor using Naval Application onboard a ship

The interview data were analyzed using Nvivo and coded descriptively (Saldana, 2012) by the lead author. We approached the data using a grounded theory approach and iteratively moved through various stages of *coding*, *concepts*, and *categories* (Qureshi & Ünlü, 2020). The iterations were accompanied by literature searches on the identified concepts and categories by the first and second authors. Memoing and discussion relating to the discovered concepts between the researchers ensured the soundness and validity of the concepts and categories. We followed a similar process with the photographs through *open viewing* (Jewitt & Leeuwen, 2000). As the theme of relations appeared, we performed *selective coding* (Qureshi & Ünlü, 2020) and *structured* analysis of the pictures (Jewitt & Leeuwen, 2000) by visually mapping out the different entities involved, for example, developers and how they interacted (relations) with other entities such as surveyors (see Figure 2). We developed an ecosystem perspective on the constellations of relations (Adomavicius et al., 2008). Initial findings from the ethnographic study were presented back to MarComp, spurring great interest from the development organization as it gave them new insight into how surveyors work. By engaging with a rich empirical data set (notes, documents, photographs, interviews), we sought to avoid the "creeping conservatism" narrowing qualitative IS research (Monteiro et al., 2022). Further, all authors engaged in discussions, mapping the various initial findings to relevant theories and concepts to understand how the findings relate to contemporary literature on automation, work, and AI.

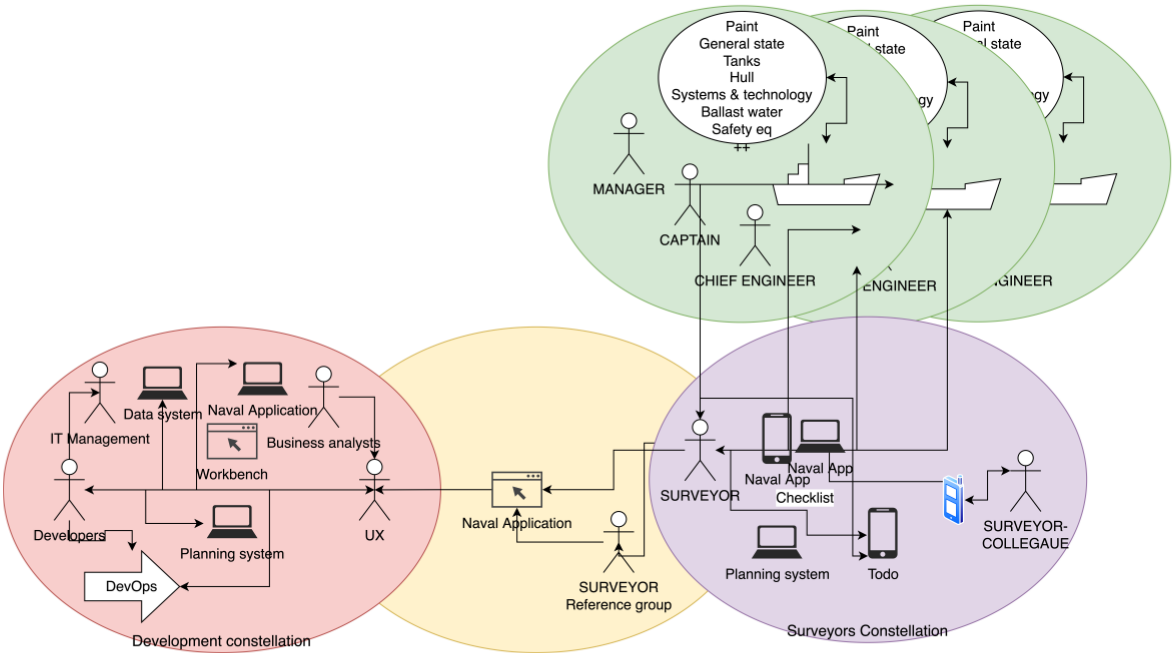

Figure 2 Visual mapping of constellations of relations

4 Findings

We now present the identified constellations of relations related to MarComp's surveyor operations and those observed in the developer organization, as well as how they interact with each other.

4.1 Surveyors' constellation of relations

MarComp surveyors establish and maintain a multitude of relations to perform their diagnostic functionality in the surveys efficiently and with high quality. Each survey visit constitutes a potential novel functional relation, depending on whether the surveyor has previously visited the type of vessel. Prior to a survey visit, surveyors always prepare the survey using the *Naval Application*, to access information about the current state of the vessel and previous conditions and findings. This data flow from the system to the surveyor is combined with the surveyor's prior tacit knowledge about the ship, crew, or operator.

At the ship, they note the general condition and "wear and tear" of the ship, as well as the general state of order onboard, to establish a diagnostic view of the vessel. *"I assess the paint, and if there is trash lying around; how they store materials; these factors decide how thorough I need to be."* These first impressions, combined with the data from the Naval Application, provide a set of initial ques for closer investigation. Further, surveyors engage in inquisitive conversations with the ship's crew to establish a general assessment that informs further diagnosis. Figure 3 captures the many relations, the Naval app, laptop, paper documents, and stakeholders who are involved. These relations represent different

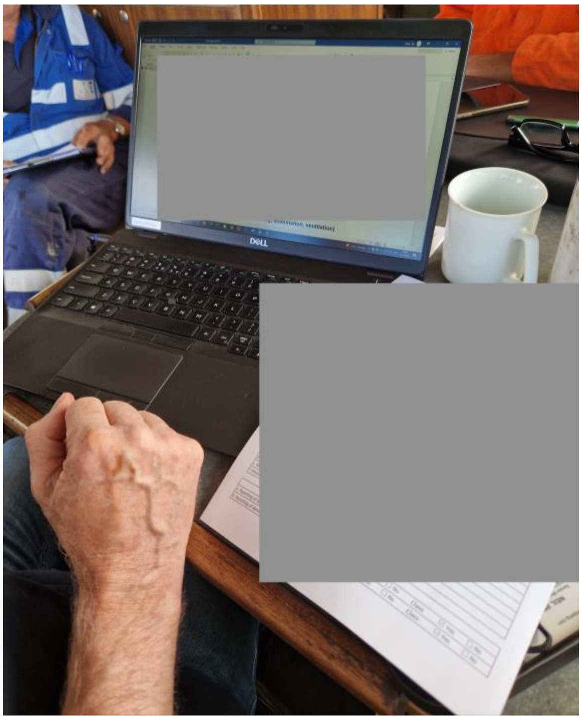

Figure 3. Surveyor working with Naval App, paper report, & ship crew

functions, allowing a surveyor to capture data. The value of these relations with ships and crew does not go unnoticed by the surveyors, as explained by one of the informants: *"We work in a way where different surveyors are responsible for their own customers."* Knowledge of each specific ship is relevant in order to know what data must be collected to properly assess the state of a vessel. The *Naval Application* is valuable when surveyors encounter things they do not know, such as a specific part of the vessel or specific regulations, which vary for each country ('flag').

4.2 Developers' constellation of relations

Efficiency and corporate strategy are essential drivers that inform the IS developers' work. This is primarily related to the cost and overhead of maintaining the current software architecture of the Naval Application. However, contemporary software development practices and architecture are moving towards continuous delivery and web-based technology, as a software lead explained:

> *"We are here to serve the company and the strategy… we measure our success by looking at how we're able to promote this [technology] change and take us into a place where we can innovate better, have more development bandwidth, have faster time to market, you know, with the innovation and stuff like that."*

Thus, the relation to the product is vital for the developers, as they see the product as their *"reason d'être."* However, developers are focused on the product, rather than the users of their product and their relations, and how the product affects the users relations. Developers also explained challenges due to the many changes to the software architecture, as well as changes in the development approach and the relationship with other divisions of the company:

> *"Our entire application portfolio has been transformed, and our app needs to fit into the new regime. We are not so isolated as before, and this has taken significant time."*

A critical aspect of this is moving from the Microsoft Windows application towards a web-based platform allowing for continuous development. Such product-internal activities necessarily take time and focus away from any potential relation to the surveyors.

4.3 Inter-constellation relations

The relation between the surveyors constellation on the one hand, and the development constellation on the other, is weak from both sides, which is a barrier for effective data flow between these constellations. The main flow of data between the two constellations is through a group of approximately 50 surveyor representatives (a 'reference panel') and business analysts consolidating requirements proposed by these representatives. The reference panel engages in participatory events and techniques through workshops and structured test sessions, with prepared "scripts" explaining what users are expected to do and test. Surveyors do not, however, see themselves going beyond the scripts:

> *"We approach these tests the same way we approach the technology in our job. If we took too much ownership, we would define the answer. That is not our job. We approach the user tests the same way, we provide comments, and that's it."*

The flow of data through the product is considered necessary on the development side, where data about product use is collected by business analysts and user experience (UX) experts. Based on these data, developers infer (make assumptions about) the efficiency of the product and the surveyors' needs. One developer said:

> *"I think for this feature, as I said, the ingredients are there already. It is not so much to talk to the end users to ask them how to do it because it is more of a technical thing to take what we already have [and improve it].*"

We also observed that the dynamic relation building by the surveyors towards vessels and crew goes largely unnoticed by survey schedulers in the current planning strategy. Due to concerns for efficiency, survey assignments are often scheduled at short notice, frequently only one day ahead. In addition, planners lack knowledge of which surveyor are best suited to specific jobs, as one surveyor said: *"There are so many changes all the time, and I need to help the planner asses which surveyor could do the job."*

5 Discussion

In this research in progress paper, we consider two major trends in current digitalization; a software product management orientation (Springer & Miler, 2022; Tkalich et al., 2022) and a focus on implementing AI to support and automate knowledge work (Berente et al., 2021). These trends are, however, not necessarily well aligned and intensify the need to cross boundaries between developer and user communities (Waardenburg & Huysman, 2022). One way to do this is by focusing on the relations in play between these communities (Bailey et al., 2022). We therefore asked the question: *How are constellations of relations influencing ISD in knowledge work?*

Through an interpretative case study drawing on ethnographic methods, we report a number of preliminary findings of the digitalization of maritime surveyor work. First, we observe that there are distinct constellations of relations (Bailey et al., 2022) in the case (see Figure 2). One is the constellation of surveyors, their interactions with the software and technology delivered by developers, and their relations with vessels, crew, notebooks, and smartphones for taking photographs and notes. Likewise, developers have their functional relations within the development organization, where the functional flows depend on the strategy and interpretation of the strategy for the software organization, the internal relations within the software organization, the flow of data from business analysts and the reference panel of surveyors.

Second, by considering the data flow (Bailey et al., 2022), we find that the two constellations share a thin line of data flow between the competence domains, i.e., the data about the use of the technology is interpreted using the technology artifact itself, and they have very limited understanding of each other's competence domains, and the relations that are internal to the other competence domain. This illustrates how participatory techniques and agile methods currently applied in software product management are not sufficient in order to understand experts and their constellation of relations, which is crucial to succeeding with AI (van den Broek et al., 2021; Waardenburg & Huysman, 2022). Figure 2 illustrates the data flow between the competence domains through the product-oriented development methodology (naval application and reference panel). Our findings show a richness to the surveyors' knowledge work combined with a perception that development is not seen as part of their focus. Taken together, this indicates that the relationship between different communities must be revisited to enable the successful development and implementation of AI solutions.

Third, we observe that the development of technology and tooling for developers is focused on making the constellation of relations for developers more efficient. We observe that developers are preoccupied with improving their own flow of development (Dennehy & Conboy, 2019) and increasing their capability to deliver and deploy continuously (Fitzgerald & Stol, 2017). They approach this by primarily building on new technological platforms and leveraging new methods and practices to achieve these goals (Gall & Pigni, 2022). This puts an additional load on the developer organization as they must create new relations to methodologies, roles, and technology within their community (Bailey et al., 2022). This is done without sufficient understanding and consideration of the potential cascading effect this can have on other constellations of relations (Bailey et al., 2022).

Fourth, the practices of product management mainly consider technology development as a deterministic process (Gregor et al., 2020), and a one-way street, where the role of the product managers is to elicit as much information as possible from users in order to meet their needs and then test those assumptions on users (Tkalich et al., 2022). Taking a relational perspective, however, we see that there is a *mutual entanglement* between users, technology and the developers (Frauenberger, 2019), and that users also must acknowledge their own agency in creating novel functions in *existing* relations, as well as *novel* relations, both in relation to using the technology and in relation to the ISD process (Bailey et al., 2022).

Given what we now begin to see, both developers and surveyors cannot merely look at technology as a product but rather should consider it as an entity in knowledge production, provided by the constellation of relations emerging in the bridged competence domain of surveyors and developers.

6 Conclusion and Future work

In summary, expert surveyors do not (yet) see the importance of the relations between themselves and the developers, and their agency in changing the technology through their relations with the technology, developer organization, and the world at large. On the other hand, expert developers in their constellation are preoccupied with the product and the efficient and quick delivery of technology. The disconnect that we observed in our preliminary findings must be addressed in order to make better systems for users, that can leverage modern technologies such as AIThese shortcomings are crucial to overcoming with the introduction of AI if the technology should aid, not impede, the knowledge work of the experts.

We are extending our work on this longitudinal case at Marcomp along the following lines :

- Expand our understanding of combining a product orientation with the use of emerging technologies in expert domains, such as AI. In the case at Marcomp, we will focus on the development and implementation of AI-based tools, and how this affects the constellatios of relations.
- Develop the concepts for AI and product development for knowledge workers, aiming to provide a theoretical understanding of the boundary that sits between ISD and IS in use, and how it can be challenged (Waardenburg & Huysman, 2022).
- Triangulate across diverse theoretical perspectives, such as flow (Baygi et al., 2021), to develop add more nuance in our theoretical understanding (Gregor, 2006). We aim to expand our empirical work that foucses on early conceptualization of technology use to development and implementation over an extended period of time, which is essential for generating theories for crossing the implementation line (Leonardi, 2009)
- Emphasize data and knowledge flows that are essential to knowledge work, and how this relates to AI technology in particular, due to its reliance on data, and explore the bandwidth requirements for data flow and transfer as future AI-based technology will support expert knowledge workers.

References

Adomavicius, G., Bockstedt, J. C., Gupta, A., & Kauffman, R. J. (2008). Making Sense of Technology Trends in the Information Technology Landscape: A Design Science Approach. *MIS Quarterly*, *32*(4), 779–809. https://doi.org/10.2307/25148872

Bailey, D. E., Faraj, S., Hinds, P. J., Leonardi, P. M., & von Krogh, G. (2022). We are all theorists of technology now: A relational perspective on emerging technology and organizing. *Organization Science*, *33*(1), 1–18.

Baygi, R. M., Introna, L. D., & Hultin, L. (2021). Everything flows: Studying continuous sociotechnological transformation in a fluid and dynamic digital world. *MIS Quarterly*, *45*(1), 423–452.

Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., & Jeffries, R. (2001). *Manifesto for agile software development*.

Berente, N., Gu, B., Recker, J., & Santhanam, R. (2021). Managing artificial intelligence. *MIS Quarterly*, *45*(3), 1433–1450.

Dennehy, D., & Conboy, K. (2019). Breaking the flow: A study of contradictions in information systems development (ISD). *Information Technology & People*.

Fitzgerald, B., & Stol, K.-J. (2017). Continuous software engineering: A roadmap and agenda. *Journal of Systems and Software*, *123*, 176–189. https://doi.org/10.1016/j.jss.2015.06.063

Forsgren, N., Storey, M.-A., Maddila, C., Zimmermann, T., Houck, B., & Butler, J. (2021). The SPACE of Developer Productivity. *Queue*, *19*(1), 20–48. https://doi.org/10.1145/3454122.3454124

Frauenberger, C. (2019). Entanglement HCI The Next Wave? *ACM Transactions on Computer-Human Interaction*, *27*(1), 2:1-2:27. https://doi.org/10.1145/3364998

Gall, M., & Pigni, F. (2022). Taking DevOps mainstream: A critical review and conceptual framework. *European Journal of Information Systems*, *31*(5), 548–567. https://doi.org/10.1080/0960085X.2021.1997100

Gregor, S. (2006). The nature of theory in information systems. *MIS Quarterly*, 611–642.

Gregor, S., Chandra Kruse, L., & Seidel, S. (2020). *Research perspectives: The anatomy of a design principle*.

Hanseth, O., Monteiro, E., & Hatling, M. (1996). Developing information infrastructure: The tension between standardization and flexibility. *Science, Technology, & Human Values*, *21*(4), 407–426.

Huysman, M. (2004). Design requirements for knowledge-sharing tools: A need for social capital analysis. *Social Capital and Information Technology*, 187–207.

Jewitt, C., & Leeuwen, T. V. (2000). The handbook of visual analysis. *The Handbook of Visual Analysis*, 1–224.

Lebovitz, S., Levina, N., & Lifshitz-Assaf, H. (2021). Is AI Ground Truth Really 'True'? The Dangers of Training and Evaluating AI Tools Based on Experts' Know-What. *The Dangers of Training and Evaluating AI Tools Based on Experts' Know-What (May 4, 2021). Citation: Lebovitz, S., Levina, N., Lifshitz-Assaf, H*, 1501–1525.

Lebovitz, S., Lifshitz-Assaf, H., & Levina, N. (2022). To engage or not to engage with AI for critical judgments: How professionals deal with opacity when using AI for medical diagnosis. *Organization Science*, *33*(1), 126–148.

Leonardi, P. M. (2009). Crossing the implementation line: The mutual constitution of technology and organizing across development and use activities. *Communication Theory*, *19*(3), 278–310.

Monteiro, E., Constantinides, P., Scott, S., Shaikh, M., & Burton-Jones, A. (2022). Qualitative research methods in information systems: A call for phenomenon-focused problematization. *MIS Quarterly: Management Information Systems*.

Oates, B. J. (2006). *Researching Information Systems and Computing*. Sage Publications Ltd.

Olsson, H. H., & Bosch, J. (2014). The HYPEX Model: From Opinions to Data-Driven Software Development. In J. Bosch (Ed.), *Continuous Software Engineering* (pp. 155–164). Springer International Publishing. https://doi.org/10.1007/978-3-319-11283-1_13

Poppendieck, M., & Cusumano, M. A. (2012). Lean software development: A tutorial. *IEEE Software*, *29*(5), 26–32.

Qureshi, H. A., & Ünlü, Z. (2020). Beyond the Paradigm Conflicts: A Four-Step Coding Instrument for Grounded Theory. *International Journal of Qualitative Methods*, *19*, 1609406920928188. https://doi.org/10.1177/1609406920928188

Ruggles, R. (1998). The state of the notion: Knowledge management in practice. *California Management Review*, *40*(3), 80–89.

Saldana, J. (2012). *The Coding Manual for Qualitative Researchers*. SAGE Publications.

Springer, O., & Miler, J. (2022). A comprehensive overview of software product management challenges. *Empirical Software Engineering*, *27*(5), 106. https://doi.org/10.1007/s10664-022-10134-5

Thomas, R. L., & Uminsky, D. (2022). Reliance on metrics is a fundamental challenge for AI. *Patterns*, *3*(5), 100476.

Tkalich, A., Ulfsnes, R., & Moe, N. B. (2022). Toward an Agile Product Management: What Do Product Managers Do in Agile Companies? In V. Stray, K.-J. Stol, M. Paasivaara, & P. Kruchten (Eds.), *Agile Processes in Software Engineering and Extreme Programming* (pp. 168–184). Springer International Publishing. https://doi.org/10.1007/978-3-031-08169-9_11

van den Broek, E., Sergeeva, A., & Huysman, M. (2021). When the Machine Meets the Expert: An Ethnography of Developing AI for Hiring. *MIS Quarterly*, *45*(3).

Waardenburg, L., & Huysman, M. (2022). From coexistence to co-creation: Blurring boundaries in the age of AI. *Information and Organization*, *32*(4), 100432. https://doi.org/10.1016/j.infoandorg.2022.100432