12-31-2020

Invisible Work Pre- and Post- Digitalisation. The case of a health authority in Norway

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The case of a health authority in Norway

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Abstract: In this paper, we argue that, despite the increasing opportunities for transparency and visibility that come with the digitalisation of workplaces, invisible work remains a highly relevant concept, as it represents practices that are vital to the effective functioning of business operations. Drawing on a longitudinal qualitative case study, we examine invisible work practices before and after the digitalisation of a regional health authority in Norway following the implementation of an enterprise resource planning (ERP) system. The study extends the literature in this field by showing both the changing status of invisible work and the emergence of new invisible work in digitalised workplaces. The theoretical and practical implications are then discussed.

Keywords: Invisible work, ERPs, enterprise systems, transparency, articulation work, digitalisation, workarounds

1   Introduction

Digitalisation, the process of adopting digital technologies, provides opportunities to increase the transparency, standardisation and automation of business processes (Brynjolfsson and McAfee 2014; Plesner et al. 2018; Treem and Leonardi 2012). Transparen-

Accepting editor: Katrin Jonsson

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cy, in particular, has become an important objective of digitalised workplaces and has been found to lead to improvements in the efficiency, quality and agility of the business process (Al-Jabri and Roztocki 2015; Anteby and Chan 2018), and enhance overall performance (Cho et al. 2017). However, although the digitalisation of workplaces increases opportunities for transparency, invisible work does not disappear (Bernstein 2017). Instead, our position is that some work practices may always need to remain invisible due to contingencies and emergencies. In this paper, we study invisible work within digitalised workplaces.

Invisible work, defined as work that is not formally documented, recognised or understood, can contribute to the effective functioning of business operations by maintaining, improving or augmenting existing practices (e.g., Bossen et al. 2013; Cresswell et al. 2017). Paradoxically, transparency may not only lead to the continuation of invisible work, but may also unintentionally increase such practices (Bernstein 2012; 2017). Indeed, there is evidence that invisible work practices exist even in highly digitalised workplaces (Anteby and Chan 2018; Beaubien 2013). Similarly, Lambert (2015) has posited that invisible work may not disappear but move to other individuals, departments or even organisations in order to handle contingencies. In settings where it is perceived that work should be transparent, there is the risk that invisible work is overlooked and not acknowledged, leaving critical and valuable activities unaccounted for (Blomberg and Karasti 2013). Therefore, in digitalised workplaces, it is still important to understand the scope and contribution of invisible work, as this may influence how users adopt new digital solutions.

Although existing research on invisible work has provided an insight into the complex social dynamics of this phenomenon (Hatton 2017), scholars argue that further research is needed to examine invisible work in a variety of settings (Bernstein 2017; Hatton 2017). With this in mind, our research aim is to explore invisible work practices within digitalised workplaces, while distinguishing the invisible work which existed prior to digitalisation and continued post-digitalisation whilst also examining the reasons for them. Although invisible work has previously been evident in digitalised workplaces, no previous research has studied invisible work practices from a longitudinal perspective and therefore how these practices may change over time. As a response to this gap, in our longitudinal study, we are able to make the distinction between invisible work pre- and post-digitalisation showing in this way the role of digitalisation in altering or diminishing invisible work practices.

Our empirical research is based on a longitudinal case study of the implementation of an enterprise resource planning (ERP) system in a health authority in Norway. ERPs are good exemplars of technologies that promote digitalisation in workplaces. More

specifically, ERP systems promote process control and optimisation, and provide opportunities for process improvements, cost reductions, data and process visibility (Parr and Shanks 2000). In addition, ERPs aim for standardisation through the implementation of best industry practices (Parthasarathy and Sharma 2016). One way of taking local needs and contingencies into account is to allow for the customisation of ERPs. However, customisation has been linked to increased cost (Nazemi et al. 2012) and therefore may be minimised. This may itself contribute to the emergence of additional invisible work practices.

The paper is structured as follows: firstly, we review the literature on invisible work, explain the concept and its importance, and present research on invisible work, specifically in the fields of Information Systems (IS) and health IS. Secondly, the research location, methods and analytical approach are described, followed by a presentation of the findings. Finally, the findings are reviewed in the context of the wider literature, the contribution of the study and its implications are discussed, and suggestions for future research avenues are proposed.

2   Conceptual foundations

Varied definitions exist within the organisational literature on invisible work. For this study, we define *invisible work* as work involving activities which are not documented, recognised or understood from the perspective of key organisational actors, policies and/or procedures. It is work that takes place behind the scenes, is informal and hidden (Star and Strauss 1999), but can nevertheless add value to business operations through the maintenance, improvement and augmentation of existing practices (e.g., Bossen et al. 2013; Cresswell et al. 2017). Accordingly, the term 'invisible work' often implies work that is not formally defined and is hidden from those in power. For example, in early computing work, invisible work contributed to the assembly of core memory, a form of data storage that was built by hand, often by women with childcare responsibilities, and had gone unnoticed (Rosner et al, 2018). Articulation work (Sawyer and Tapia 2006) and workarounds (Ignatiadis and Nandhakumar 2009) have also been presented as exemplars of invisible work.

When reviewing previous studies of invisible work, we can distinguish between research on invisible work in general terms, in relation to IS, and lastly, within the specific domain of healthcare (see Table 1).

Research on Invisible Work	Key Themes	Exemplary studies
Invisible work in general	Work done in invisible places. Low-status work carried out by people who are treated as invisible. Work related to social and power structures.	Masterson et al. 2019; Rabelo and Mahalingam 2019
	Articulation work of managing the intersection of social worlds. Ignoring of skills needed in ordinary work	Hampson and Junor 2005
Invisible work in IS	Microwork/work of Turker on digital platforms.	Irani 2015; Martin et al. 2014
	Data curation and data labour to facilitate data quality and sharing. Articulation work of managing the operation of IS.	Denis and Goëta 2017; Eschenfelder 2003; Plantin 2019; Sachs 2019
	Articulation work of managing the introduction of IS. Workarounds to deal with contingencies and obstacles.	Beaubien 2013; Ignatiadis and Nandhakumar 2009; Sawyer and Tapia 2006
	Learning and appropriation in relation to user adoption.	Pallesen and Jacobsen 2018; Quiñones 2014
Invisible work within healthcare	Work of patients in terms of self-management including use of technology.	Gorman et al. 2018
	Work of medical secretaries and nurses in terms of care of data in electronic patient records (EPR), and articulation work of coordination and communication at the boundaries.	Bossen et al. 2013; Ellingsen 2003
	Workarounds to both avoid change and create opportunities for system development and change. This includes the introduction of new risks and risk mitigation.	Cresswell et al. 2017; Dupret and Friborg 2018; Patterson 2018

Table 1. Invisible Work and Empirical Literature

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A wide range of studies have made reference to invisible work, including a recent special journal issue on visibility and invisibility in the workplace (Buchanan and Settles 2019). Research on invisible work often points to work done in invisible places or by people who tend to be treated as invisible by their superiors. In particular, for Hatton (2017), invisible work entails "labour that is economically devalued through three intersecting sociological mechanisms—here identified as cultural, legal and spatial mechanisms of invisibility—which operate in different ways and to different degrees" (p. 337). Invisible work is characterised by being both embedded in power relationships, and reflecting and reifying social hierarchies and boundaries (Buchanan and Settles 2019). A body of literature has linked invisible work to disadvantaged, low-status work. This is work done by invisible people, such as domestic workers, including maids, cleaners or carers (e.g., Masterson et al. 2019; Rabelo and Mahalingam 2019). Like work that is in the background and may be taken for granted, invisible work is often connected directly to the conceptualisation of articulation work. As Star and Strauss (1999) explain: "Work may become expected, part of the background, and invisible by virtue of routine (and social status). If one looked, one could literally see the work being done—but the taken for granted status means that it is functionally invisible" (p. 20). For example, Hampson and Junor (2005) point to how articulation work can be used to understand the invisible elements of interactive service work. Similarly, Schmidt (2015) posits that:

> ´Invisibility of work´ [can be] understood as not seeing, as ignoring, or depreciating the value of certain categories of work: their economic, social and human value. […] [W]ork is rendered ´invisible´ in that one denigrates, underestimates, or simply ignores the skills involved in the ordinary work [...] in short, the work to *make work work* (p. 346).

So work which is defined as routine or manual actually requires considerable problem-solving ability and knowledge. Furthermore, Hatton (2017) introduces the phenomenon of the naturalisation of skills as a mechanism contributing to invisibility, where skills and abilities are interpreted as being related to each worker's natural way of being, rather than the result of hard work, talent or expertise.

Within IS, research on invisible work has focused on specific types of IS-related settings. Microwork on digital platforms is an example of invisible work carried out in invisible places by people who are invisible to key organisational actors (Irani 2015; Martin et al. 2014). Another type of invisible work that is largely taken for granted but still shown to have value is work of data labour and curation. For example, Plantin (2019) shows how data curation carried out by data processors is unknown to actors

in the scientific process, but facilitates data quality and data sharing. Denis and Goëta (2017) demonstrate how raw data needs to be manufactured, and that the invisibility of this work prevents the data from exceeding taken-for-granted status. Also, some research draws on the concept of articulation work, where work is dynamic, improvisational, technical and social, or when it is centred around the operation of a digital solution: for example, dealing with algorithmic breakdowns (Sachs 2019) or managing website content management (Eschenfelder 2003). Sawyer and Tapia (2006) studied articulation work when mobile and wireless technologies were being introduced into the workplace, and found that new IT increased the need for articulation but that this issue was not addressed, as it was invisible to leaders. It follows that invisible work is important for handling local contingencies also including the use of workarounds or extra-work. The term 'workaround' refers to actions taken to deal with contingencies and obstacles in work practices (Alter 2014), which have been shown to occur in different empirical contexts, such as post-ERP implementation (Beaubien 2013; Ignatiadis and Nandhakumar 2009). In this context, workarounds can have a negative impact on organisational control, but this needs to be balanced with the value of their ability to operate despite obstacles (Alter 2014).

Workarounds were described by Nardi and Engeström (1999) as an "important layer of ´second order work´ on top of regular work duties" (p. 2). Sachs's study (2019) of work done to repair algorithmic breakdowns is an example of this important but second order work, which emerges from workarounds. Eschenfelder (2003) argues that workers who are engaged in articulation work in response to contingencies may take on extra work or work around existing rules in order to ensure good work practice. She adopts the terms ´augmenting´ and ´working around´ from Gasser (1986), who uses them, together with ´fitting´, to describe strategies used to deal with mismatches between computing and routines. This work can help facilitate the use of new technology (Pallesen and Jacobsen 2018, Quiñones 2014) through learning and training, and the appropriation of user adoption.

Within healthcare, research on invisible work includes the work of patients in terms of self-management, and also their use of technology. In a study by Gorman et al. (2018), this was invisible to health providers but provided value both for them and for the patients themselves. Furthermore, Bossen et al. (2013), who studied the work of medical secretaries, showed that their contribution to coordination and communication is valuable, but also that this contribution is not formally acknowledged and thus remains largely invisible. This includes both the care and maintenance of data in electronic patient records (EPR), and articulation work. Ellingsen (2003) examined the introduction of EPR systems, and showed that a common digital artefact provided more

and richer opportunities for shared information, but also that constructing meaningful representations of this constituted a significant challenge for the health professionals involved, and led to additional and invisible work at the boundaries.

A strand of research on invisible work in healthcare relates to workarounds. Reviewing recent studies of workarounds involving health information technology (HIT), Patterson (2018) finds that they were used to avoid changes and additional steps in the workflow, enabling interdisciplinary communication, coordination and portable access to summarised information. In another study, workarounds are shown not only to introduce new risks, but also to be a source of risks mitigation which is then used as a source of further system development (Cresswell et al. 2017). For the latter to happen, invisible work must be made visible. Workarounds that support innovation have also been found in a study by Dupret and Friborg (2018).

Accordingly, research on invisible work has provided different conceptualisations which illuminate interconnected and partially overlapping dimensions of invisible work practices and how these are related to the reasons for them. Firstly, invisible work can be understood as work done in invisible places or by people who are treated by their superiors as invisible. Secondly, invisible work has been shown to be work of coordination, articulation work, work carried out in the background, informal work and/or routine work. Finally, invisible work is often connected to practices of workarounds or extra-work, and work which improves, changes and/or augments.

The existing literature has therefore given extensive evidence of invisible work in different settings and provided explanations for this type of practice. What is less known is whether the status of invisible work practices changes over time in specific settings. We contribute to this area by exploring invisible practices in a longitudinal study that allows us to distinguish between invisible work that existed prior to digitalisation and that which was introduced afterwards, and we examine the reasons for both of these. We use the case study of a health authority as it adopted an ERP. In the following section, we present the research setting of the study and the methods adopted.

3   Research methodology

3.1   Research setting

We studied invisible work in a Norwegian health authority, both before and after the implementation of an ERP. The regional health authority comprised more than 20,000 employees, 5-10 hospitals and a yearly budget of more than 10 bn NOK (1bn Euros).

The ERP project was undertaken partly because the old system was becoming inefficient, but also because it no longer complied with legal requirements. In addition, the newsletter distributed to all employees stated that: "there is a need for a greater degree of: standardisation, automation, electronic collaboration, efficiency and better information for decision-making and control" (Newsletter, Health authority, 2016). This focused new attention on transparency, monitoring and control, as the project was intended to transform localised and isolated processes into a procedure which was standardised across all departments and hospitals.

The project was implemented over a four-year period and cost more than 200m NOK (~20 m Euros). In 2017, the project was completed and judged to be successful by the health authority, and was promoted as a project of organisational development and change (Newsletter, Health authority, 2017). The project itself was organised as one central project with several local implementation projects. The central project was responsible for managing the phases of planning, specification, development and delivery of the ERP system (see Figure 1). The local implementation projects took over responsibility at the implementation stage. The implementation was carried out in a stepwise and iterative manner, to manage the risk and scope of the project as different hospitals started to use the ERP.

3.2   Research design

We adopted a qualitative case study in the interpretative tradition, where phenomena involving social interaction must be understood through socially constructed meanings in a particular context (Myers 2013). In particular, the case study aimed to focus on how and why (Yin 2003). At the heart of this approach was a desire for a deep understanding of a situated phenomenon which can be achieved with the researcher being close, inside and talking the same language as the people being studied (Myers 2013). Epistemologically, this means that our knowledge of a phenomenon is constructed by meaningful interpretations which are grounded in situated social interactions (Denzin 2001; Walsham 2006). As Gioia et al. (2013, p. 16) argue: "Studying social construction processes implies that we focus more on the means by which organisational members go about constructing and understanding their experience and less on the number or frequency of measureable occurrences".

Initially, following the approach of grounded-theory-based interpretative research (Gehman et al. 2017), we aimed to understand the interplay between formalised and emergent work practices, as well as the role of digital artefacts. Furthermore, we sought

to investigate how this interplay would be affected by the introduction of ERP with standardisation as its goal.

We were guided by the literature on technology use, and by issues of flexibility and the standardisation of work practices. Following this preliminary literature review, our research followed the principle of continuous literature review during the data collection and analysis (Urquhart and Fernández 2016). In the first round of interviews we did not ask directly about invisible work, but about routine flexibility in digitalised environments. Invisible work emerged as a way of understanding the empirical phenomena. This was pursued further in the follow-up interviews, when we added questions asking whether they carried out work that few knew about, understood or acknowledged, and/or which was not part of their job description. An interpretative approach was appropriate as a way of understanding how and why these work practices both occur and persist.

In our study, the first author became involved in data collection in various ways. Firstly, contextual insight and awareness was gained through receiving newsletters about the project and staying in touch with its progress through a gatekeeper who was also part of the project management. Secondly, during the interviews and the three phases of data collection, the first author was gradually getting to know the processes and context in more detail. Thirdly, many of the participants were interviewed twice or, in some cases, three times, making it possible to learn more about changes in their workplace after the implementation of the ERP. The participants appreciated being able to share their experiences and thoughts about the project and the process being adopted.

3.3   Data collection

The data collection focused on the purchase-to-pay (hereafter, P2P) process of supplying medical consumables to two hospitals in the same health authority. This was one of the core processes supported by the ERP system. The process covers ordering, purchasing, delivering and paying for goods. Several staff in the warehouses, in the departments and wards, and an old and new central department were involved in the process, each carrying out different activities.

In the warehouses, medical consumables were either stock-based (goods with high turnover or where safety stock was required) or ordered on demand. For the former, warehouse staff replenished stock, received orders from departments and wards, and packed and shipped these deliveries. For the latter, they received, controlled and sent orders from departments and wards to the supplier.

Within the hospital, the departments and wards maintained their own local stocks of medical consumables and employed dedicated workers who worked full-time, placing orders and receiving deliveries of goods, as well as placing items in the stock rooms. Some nurses in the departments and wards also placed orders and received deliveries in their local stockrooms as part of their normal duties.

Prior to the ERP, a central procurement department was responsible for setting up contracts with suppliers in the health authority. During ERP implementation and as a result of wider organisational changes, this responsibility was moved outside the health authority and was relocated to an external national procurement organisation. However, a new central department was also established, with responsibility for governance of the ERP solution, including the implementation of new contracts or changes to contracts in the health authority.

The data was collected in three phases between 2014 and 2017, as shown in Figure 1, with phases 1 and 2 taking place before the ERP implementation and phase 3 afterwards.
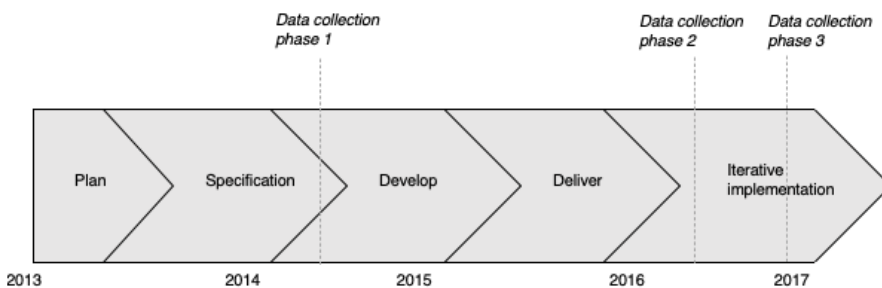

Figure 1. The ERP project in the health authority, showing the phases of data collection

The selection of participants was based on their involvement in the P2P process, ensuring representation of all the different parts of this process, from the initial need for medical supplies in the departments and wards to the delivery of new supplies fulfilling those needs.

Interviews were used as the main method of data collection, with the aim of focusing on specific situations and actions related to each participant. The interview protocol was structured using themes and questions, in order to understand three issues: the participants' daily practical work in the P2P process; the use of different tools and technologies; and the various ways in which this varied from day to day or situation to situation. Finally, the participants were asked what they knew about the project, and

whether and how they were involved in it. In order to help participants to reflect on their daily work, the researcher encouraged them to give examples and relate the questions to specific situations and episodes.

Observations were carried out during the interviews. More specifically, the participants were asked to show examples of their work on the computer or paper documents; to demonstrate the stockroom and how this was organised; and to show how they used ERP functionalities and how deliveries were received. In addition, permission was obtained for the researchers to observe P2P workers in one of the sites for two working days before the implementation of the ERP. The notes from the observations were used to complement the interviews, relating the observations to the workers' own experiences and understanding of their everyday work, thus avoiding mere self-presentation (Dingwall 1997). Finally, documents related to the project, such as weekly newsletters, project plans and status reports, were collected, in order to gain more contextual insight into the overall project.

In total, 20 participants were interviewed, with three of them interviewed twice and another four interviewed three times, making a total of 26 interviews. Some interviews were carried out in groups of two or three participants. This variation was due to practical issues of availability at the time of data collection, retirement, job changes and new roles, such as in the new central department of ERP operations, which was established during the period of the data collection. The data was then transcribed and anonymised. Table 2 shows the characteristics of the interviewees and the phase(s) at which they were interviewed.

3.4   Data analysis

The analytical approach was based on grounded-theory-based interpretative research (Gehman et al. 2017), with systematic inductive analysis of data, moving from first-order codes to the overall data structure (Gioia et al. 2013). NVivo (v11.4.3) was used for the data analysis. Initially, the data was coded in terms of activities and practices involved in carrying out an actor´s contribution to a P2P process and which had an element of flexibility embedded in them. This constituted about 46% of the data. Invisible work practices emerged during this phase of the analysis and became the focus and aim of this study. Thereafter, in stage 1, the data was analysed in terms of whether it represented invisible work according to the definition adopted in the study (see Conceptual Foundations): at the same time, invisible work was coded into different invisible work practices as first order concepts. The amount of data included was then reduced to 39% of the data. After merging similar practices (for example 'Order less',

Job titles of participants	Role in process	Phase 1	Phase 2	Phase 3
15 P2P workers	Buying for local and central warehouses, maintaining stockrooms and supplying wards/departments.	X	X	X
2 nurses in hospital departments	Buying for wards/departments, receiving deliveries and maintaining the local stockroom.	X	X	X
1 procurement worker	Participating in the procurement process and facilitating the implementation of new contracts or changes in the health authority.	X	X	
2 P2P workers in the central operations department	Implementing new contracts or changes in the health authority, and providing support for the ERP system.			X

Table 2. Characteristics of interviewees

'Order more because of infection outbreak' and other specific reasons for adjusting orders were incorporated into 'Adjust order'), these were reduced from 56 to 30 different invisible work practices. In stage 2, the longitudinal nature of the study allowed us to adopt a temporal perspective in our data analysis, and to capture any changes to the invisible practices (shown as Status on Table 3): pre-existing, discontinued, changed or new. The next step, stage 3 of the analysis, sought to analyse and group these invisible work practices in terms of reasons, resulting in eight different categories, addressing two questions: "What's going on here?" (Gioia et al. 2013, p. 20) and "Why?". Following Urquhart and Fernández (2016), once the core pattern of understanding invisible work pre- and post-ERP implementation was identified, theorisation continued, to ensure its integration with the wider literature. The reasons for invisible work were further grouped (stage 4 of the analysis) according to five aggregate reasons of invisible work, also shown in Table 3, which presents the data structure that emerged from our analysis.

Stage 1: First Order Themes: Invisible Work Practices	Stage 2: Status	Stage 3: Second Order Themes: Reasons	Stage 4: Aggregate Dimensions
Adjust order because of infection outbreak, patients´ needs, approaching holiday or weekend, approaching surgery, or because MOQ is reached outside planned days for ordering. Document item in EPR to ensure fit with future equipment in use.	Pre-existing	Preventing errors.	Invisible work to prevent errors and deal with contingencies.
Check and review orders in ERP to avoid unit and other errors.	Changed		
Follow up and remind approvers in ERP system.	New		
Follow up on orders that are delayed or not delivered. Check stock levels which have not been updated and contain errors in ERP. Find extra space for items when needed.	Pre-existing	Dealing with errors and contingencies to restore operations.	
Reorder if central warehouse is empty.	Discontinued		
Follow up on errors in orders or data transfer in ERP when ordering.	Changed		

Table 3. Data Structure: Invisible work practices with status and reasons

Stage 1: First Order Themes: Invisible Work Practices	Stage 2: Status	Stage 3: Second Order Themes: Reasons	Stage 4: Aggregate Dimensions
Send order using manual steps because of technical issues in ERP.	Pre-existing	Work around shortcomings in ERP system and data.	Invisible work to manage ERP funct-ionality.
Create shadow systems to maintain overview and document deliveries, orders and stock level. Order using paper-based forms or free-text in ERP because items are not registered in it. Requesting and making changes to ERP and master data.	Changed		
Push printouts from ERP for picking forward because of urgency or to balance workload. Find items in ERP with standardised names and using old system to find items.	New		
Order verbally to negotiate urgency. Plan work to maintain priorities and even out workload.	Pre-existing	Carrying out extra work to maintain priorities.	Invisible work to promote priorities.
Chase approvers in ERP in corridor because of urgency. Order without approval in ERP because of urgency.	New		

Table 3. Data Structure: Invisible work practices with status and reasons (cont.)

Stage 1: First Order Themes: Invisible Work Practices	Stage 2: Status	Stage 3: Second Order Themes: Reasons	Stage 4: Aggregate Dimensions
Verbal ordering to ease workload of nurses and physicians. Help finding an item or supplier when someone does not know how.	Changed	Carrying out extra work to smooth operations.	Invisible work to encourage cohesiveness and coordination.
Put labels in stock rooms to ensure order quantity, urgency of status.	Pre-existing	Ensure necessary coordination.	
Facilitate substitute during absence.	Changed		
Avoid excessively large selection of products in ERP and standardise locally. Ensure item is from available contracts in ERP. Make selection of local needs from national and regional contracts in ERP system.	Changed	Contracts and standardisation.	
Find out routines for individuals or groups. Help others to find out routines. Make other changes.	New	Maintain or change routine.	Invisible work to support learning.

Table 3. Data Structure: Invisible work practices with status and reasons (cont.)

4   Findings

Invisible work involving activities that were not documented, recognised or understood from the perspectives of key actors in the organisation, policies and/or procedures was evident in our case study. Such practices were evident in the ERP-enabled P2P process within the health authority and involved different groups of employees, including nurses, P2P, procurement staff and warehouse staff. This section is structured according

to the reasons for invisible work practices; we provide evidence of these practices and identify their status, notably whether these were pre-existing, discontinued, changed or new practices that emerged post-ERP.

4.1   Invisible work to prevent errors and deal with contingencies

P2P staff were aware of contingencies and potential unexpected events due to the variation of needs, progress and events in the P2P process including deliveries. As such they took proactive and corrective action to avoid or mitigate any consequences, thereby contributing to invisible work.

Pre-existing practices. A practice that existed prior to the ERP, and which continued afterwards, related to the number of products in an order. A P2P employee might take the initiative to make adjustments to orders for larger or smaller quantities because of local contingencies, such as outbreaks of infection, types of patient in the ward, holiday absences or other unpredictable requirements:

> … sometimes you don´t need that much, sometimes you must order more. … That´s the advantage of being familiar with things, because it depends a little on the patients who are there, […] and when a holiday is coming up, as with Easter next week, you know your departments and that you need to order much more of something. (P2P employee in hospital).

Another kind of invisible work which remained the same was using the Electronic Patient Record system to make a record of equipment, such as prostheses, which would be important when making future orders to prepare surgery for the same patient. As one nurse explained:

> I do not think they [i.e., the ERP project team] have thought about it at all […] because they do not know it exists.

Other invisible work practices remained the same. These included: finding extra space for items when they were needed in the ward; paying attention to and following up orders that were delayed or not delivered; and checking stock levels that had not been updated in the ERP, because it contained errors.

Discontinued practices. If the central warehouse did not have sufficient stock, the order would be cancelled and a new order would need to be placed. This practice was not necessary after the implementation of ERP and therefore was discontinued.

Changed practices. Before the implementation of the ERP, orders were checked and reviewed to avoid mistakes. This continued afterwards in a modified version, as standardisation in terms of units made this invisible work practice more demanding. Furthermore, the practice of following up orders existed both before and after ERP implementation. However, this changed, becoming more time-consuming and complicated, because of increased rigidity in data, tasks and sequences.

> In the old system, which wasn´t that complex, you could take a few short cuts and solve it in an easier way. But now, everything must go through the system, and the system demands that everything is done exactly right. …. So, for now, we work harder for the same result. (P2P worker in warehouse).

New practices. In addition to those invisible work practices, whether in the same or modified versions, that continued after the ERP implementation, some new practices emerged as ways of dealing with contingencies. Interviewees referred to the practice of order approval, in which orders needed to be approved before they were sent out. This meant that there was a new awareness that urgent orders needed to be approved quickly. Shift working, as well as mobile workers that could be difficult to reach, often led to the approval being delayed. However, getting timely approval for urgent orders was a practice that sometimes had to be performed outside the ERP, and thus contributed to invisible work, as a way of dealing with contingencies as the quote below shows:

> To get approval from [Name] I have to run and find her when she is here and say: `Can you approve this so we can send it before one o´clock?`… so, there is a lot of that. (P2P worker in hospital).

As these practices which sought to prevent errors and to deal with contingencies were not formalised, they can be described as invisible according to the definition adopted in this study (see Conceptual Foundations).

4.2   Invisible work to manage ERP functionality

Invisible work practices were explained in relation to the system functionality, i.e., what it did and didn't allow users to do. Some of these practices pre-existed and continued as they were, while others changed to adapt to the new ERP.

Pre-existing practices. Before the change, some items were ordered outside the old system and paper-based lists were still being used. After the implementation, the ERP system was used to a greater extent, but many items were now ordered using free-text ordering. In both cases, additional manual steps from buyers were required. This affected new items which were not registered in the ERP system, so that they were not part of any existing contract.

> Say I have to order tweezers. ... They are not in the system, and I can just enter a letter instead. … It is hard to explain, but I have an order and I get the supplier, and I write in the name of the item, what it costs, which account. ... All this I do manually without the system helping me with it. […] This, we were told, was no longer allowed. [The other hospitals] are allowed to do it, but not here. There must be some reason, but I think most have got around that now. (P2P worker in hospital).

Changed practices. Invisible work was evident when making changes to the system itself, particularly system modifications and changes to the master data. Participants stated that it had been easier to make modifications to the old system, as more people had the necessary access, while with the new system only a limited number of users had access to the system. As a result, participants reported submitting change requests to the ERP system and being aware that it could take a long time for the changes to be made.

> Where earlier we could go manually to change our system to match the supplier´s system … now there are people in the new central department that control this. So they set the unit we order in, which does not necessarily conform to the unit that the supplier delivers. … So they don´t understand what we order, and either the order does not go through at all, or it is delivered, but fails to go through when the goods are received. Then the invoice will not be correct. […] Sometimes we are able to make the suppliers modify their system to fit with ours, and sometimes we get recognition from those responsible for contracts centrally, so that they make the change. (P2P worker in warehouse).

Developing and maintaining different shadow systems also entailed invisible work, which emerged as a way of dealing with the inefficiencies of the new system. Such practices existed when the old system was in place, and were modified and adapted for the new system. P2P staff and nurses responsible for purchasing developed different printouts and self-authored lists, so that they could make notes, remember and obtain an overview of work when ordering. A nurse made a list of what to order and how much to take to the stockroom, and referred to it when entering the orders in the old system, and following up the status of deliveries. Some of these tools remained, while new ones were developed in response to the functionality of the ERP system. In one case, spreadsheets were still being used for documentation at store level. Alternatively, as another P2P worker explained, they created their own lists, in which they noted how many pieces there were in each box, so that they could understand the issue of units.

> This [spreadsheet for documenting stock levels] also needs to be maintained. So you spend a lot of time on these things that you really should have not needed to keep track of. (P2P worker in hospital).

New practices. After implementation, new invisible work practices emerged as a way of managing ERP functionalities. For example, in the central warehouse, the picking order was decided by the order of the printouts. When orders were printed, they were removed from the inventory and had to be picked. This meant that to prioritise urgent orders, no printing could be done for the whole week, even though this would have evened out the daily and weekly workload and thus been preferable. Workarounds that were possible in the old system were no longer possible in the new one. However, sometimes, having nothing else to do, workers started to print orders again, although they were well aware that this could restrict their ability to deal with urgent orders. If one ward then needed an item that another ward had ordered, they would bypass the system altogether if the order was urgent enough, and ´steal´ from the second ward's order.

Another new practice was finding items in the ERP. This was now more difficult, and took up time, as the names of items were standardised. Furthermore, the old system was often used to do this.

Practices of managing ERP functionality were not documented nor were part of formal policies and procedures, and therefore can be described as invisible.

4.3 Invisible work to promote priorities

Another reason for invisible work was the urgency of the task at hand. In such cases, actions were taken to resolve the situation, even if they did not meet the required procedures.

Pre-existing practices. Some actions were retained after ERP implementation. A P2P worker referred to a situation in which he was asked to order additional specific items during a delivery to a hospital department. He then had to decide whether it was urgent or not. If not, he would write it on the list on the department's board, which he would refer to when he was next taking orders in the department. If he was told it was urgent, he would make the order immediately; but if it was very urgent, he would call the central warehouse to arrange for delivery as soon as possible. This kind of verbal ordering existed before the implementation of the ERP and continued afterwards.

In addition, P2P staff planned their daily and weekly work not only to even out their own workload, but also to maintain priorities. For example, one individual in the central warehouse kept a list of items that were urgently needed with contact details of suppliers and the different wards and departments in the hospital that might request them. Another example was using manual printouts of orders in order to ensure that priorities were met.

> If we run out of, for example, a type of needle and they want it as soon as we have it back in stock, I tell them to send the orders directly to me, and I have a folder with lists that I go through every day and check if we have received something in our depot. As soon as it arrives, I tick it off my list. (P2P worker in warehouse).

New practices. A new kind of work practice which has emerged since the implementation of the ERP involves chasing approvers because of urgency: "Orders have to be approved by a section manager but Lord knows if they'll be at work for the next three days" (P2P employee in hospital). When the approver is away and uncontactable, the option adopted is to go ahead with the order, even though it has not been approved. Placing an order without approval was an example of invisible work which would create extra work afterwards, when employees had to communicate with the supplier and update the ERP system.

It follows that by prioritising tasks, employees may actually end up creating more work for themselves without their managers knowing about it. Work practices required to promote priorities were invisible because they were not a part of formalised and documented policies or procedures.

4.4 Invisible work to encourage cohesiveness and coordination

Invisible work practices were further explained with reference to the need for cohesiveness and coordination.

Pre-existing practices. Work was carried out in order to ensure coordination with different self-developed paper-based systems in the stockrooms. Moreover, this work was also supporting temporary staff, in order to build cohesive ways of working.

Changed practices. Invisible work was seen to promote cohesiveness in the P2P process. This could involve carrying out extra work to smooth operations through the flexible redistribution of the workload, ensuring necessary coordination, or dealing with contracts and standardisation. Verbal ordering was allowed to ensure prioritisation, and this was also one way in which the actors involved could ease the workload of the nurses and physicians on the wards and in the departments. In this way, they deviated from the normal routine and carried out extra work:

> All the time they come with questions—´Have you got that? Have you got this?'—and you need quite broad experience to be able to answer all those questions. That is something you get through time. […] They send you emails or call you all the time. If it is a question about a product, they try to get your attention using the phone and all sorts of things. … And if they come here, I can help them look things up in these catalogues I have here. (P2P workers in hospital).

Such practices were modified following ERP implementation as the new standardised names in the system created fresh navigational challenges for wards, departments and the P2P workers themselves. It was reported that more time was spent finding products in the ERP system, as wards and departments now had to make order requests within it, rather than on paper or verbally, as they had done before the change.

> …Before ERP we had nurses who would come and say: ´Hi, I need a box of that and a box of this´. And I would have run to get it for them, and afterwards I would document it in the system. But now, all of a sudden, they have to relate to a computer system that they do not know well and do not know how to use. Suddenly, they have to log on, and then find out, because almost every product now has a new name. … Not everybody is that comfortable working with computers in the hospital. (P2P worker in hospital).

A P2P worker pointed out that the more advanced handheld devices which were available after the change made it possible to look up products when they were out on the wards. The time spent making notes and remembering where to find the right product with the right name was therefore reduced. Several participants mentioned the importance of having the old system available to look up products and find old and new product numbers, as well as product names.

In addition to facilitating coordination, enabling temporary workers to manage during holidays or sick leave was also important, as this ensured a smooth operation in the case of absence and substitutes, which continued after the implementation. However, on one of the sites, new workers would request items using the new purchase module, where they could create their own favourites and shop, as though they were using an online shop. However, there were some concerns about what happened when a new supplier company was used for a product, and one P2P worker questioned whether such changes were taken into account by all users involved. In addition to supporting temporary workers, another P2P worker created detailed sets of instructions, explaining how to use the ERP system to place orders. This worker also ensured that it was possible for other people to approve orders, so that the process was not delayed when the usual approver was absent.

The ERP system brought more structure and rigidity to the ordering process. It did so with the use of standardised contracts, as well as standardised procedures for ordering medical goods. Because of the centralised and standardised procedures, making orders outside contracts, as occasionally took place before the ERP, became more difficult to do. Before the change, purchases outside contracts had been only very randomly picked up, but the P2P workers were now starting to follow these up more systematically.

> If we have 20 items in a contract, and something is ordered outside the contract and from a different supplier, we get in touch with the people who placed the order and say we want them to stop ordering from here, because we now have a contract. We've just started doing this. (P2P employee in Central operations department).

Before the change, some of the P2P workers had considered a future situation, where the wards and departments themselves would take more orders themselves, alongside a full selection from the national contracts. They thought that this would increase stock levels across all the hospitals and lead to wastage. As mentioned earlier, P2P workers often helped wards and departments to find products or suppliers. As part of that dialogue, they could sometimes help maintain a degree of local standardisation. After the

change, some new issues emerged within these themes: for instance, the standardised names made it more difficult to navigate, and mean that options were limited. However, there was more potential to maintain loyalty to contracts than before:

> It has become better, but they have had to learn that this suture is like this, and this suture is like that. […] There are thousands of sutures, we have a book about them, and they used to be sorted by name: polysorb, monosorb, vicryl, right? But now almost all of them are called vicryl. (P2P worker in hospital).

Developing contracts for procurement is a formal and well documented visible process. However, before the ERP, it was unclear, random and more or less invisible. However, after the change, it was now a more visible and formal process carried out by the new regional ERP operation department. Making local choices about which items to order was still invisible within the selection available in the ERP system. Nevertheless, the ERP system increased the visibility of orders that were made within or outside available contracts. Maintaining loyalty to contracts is not part of the formal routine and is still invisible to all those who are not carrying out this work.

Like previously reported practices, work practices that were set up by staff to encourage cohesiveness and coordination could be described as invisible because they were not part of the formal policies or procedures.

4.5 Invisible work to support learning

Several new practices emerged post-ERP and these were linked to the need for learning.

New practices. New invisible work practices were devised by employees after the implementation of the ERP as a way of furthering their own learning and development. To this end, staff acknowledged that when they did not know how to use the system, they had to work it out for themselves. In so doing, they were themselves initiating new practices:

> For those everyday practical matters, we have to figure out and make the routines ourselves. (P2P employee in hospital).

> So, it is that kind of ´extra things´, because I know they're difficult to approve, so I´ve created some small guidance at the end of the email about how to approve

orders … and I still get calls from people who need help every time they need me to approve something. (P2P employee in hospital).

Therefore, due to a lack of clarity in some areas of their work, it was found that post-ERP P2P workers were creating new routines for what to do and how to do it, not only for themselves but also for others involved in the corresponding processes. Creating new routines was not part of their formal job description, and the scope of this work and how it was carried out can be described as invisible.

Having presented the reasons for invisible work practices and showed evidence of the different status of these practices pre- and post-ERP, Figure 2 provides a synopsis of the findings. The figure gives us the opportunity to see in which categories (reasons) invisible work practices were more likely to emerge post-ERP and which categories were more likely to show the continuation of practices over time and regardless of ERP implementation. We discuss these findings further in the section that follows.
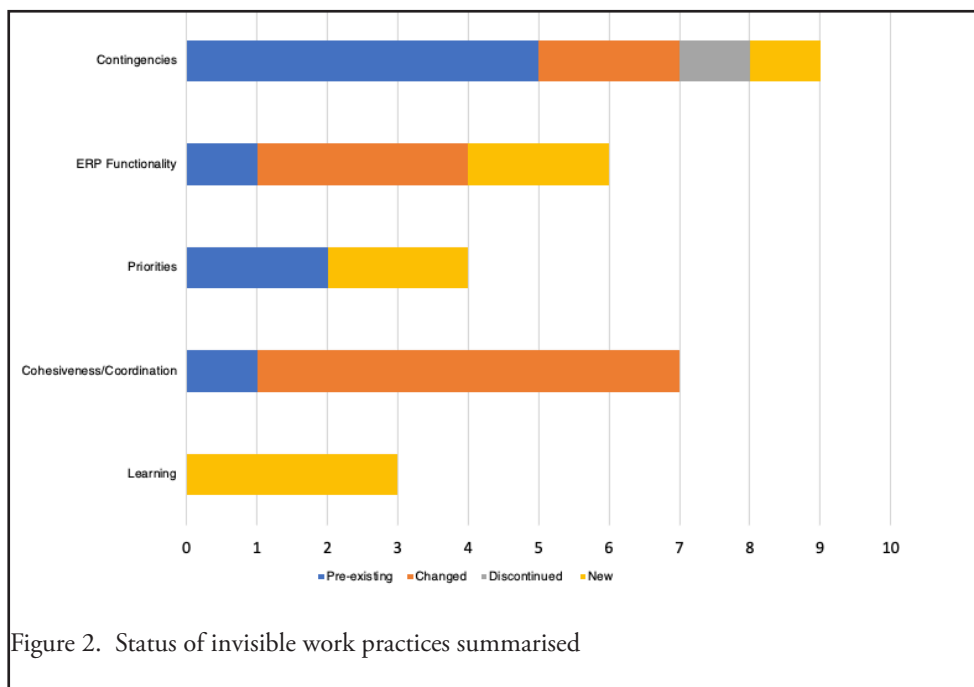

Figure 2. Status of invisible work practices summarised

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5 Discussion

Several benefits may arise from digitalising workplaces, which include the increased transparency and visibility of organisational activities and business processes (Brynjolfsson and McAfee 2014; Plesner et al. 2018; Treem and Leonardi 2012). This could subsequently contribute to improved information sharing, communication and decision-making. Our study has shown that in digitalised workplaces, despite the increased possibilities for transparency and standardisation (e.g., Plesner et al. 2018), invisible work is still widespread. This finding confirms earlier research on this topic (Anteby and Chan 2018; Bernstein 2017). However, this study also extends the literature in this field by showing both the changing status of pre-existing invisible work and the emergence of new invisible work practices in digitalised workplaces as well as the reasons for their existence.

Using the case of a health authority in Norway, where we examined invisible work both pre- and post-ERP linked to P2P processes, evidence of invisible work was widespread. The study showed evidence of invisible work before the implementation of the ERP and identified reasons for such practices. Figure 2 categorises invisible work practices in terms of their reasons and differentiates them according to their status which ranges from pre-existing, changed, new and discontinued. In particular, our findings have demonstrated that invisible work may occur as a way of dealing with contingencies, thus reinforcing earlier views of this issue (Eschenfelder 2003; Hampson and Junor 2005). The need to prioritise because of emergencies is in line with previous research showing time pressure as an important reason for workarounds in health care (Cresswell et al. 2017). Reasons connected to promoting cohesiveness and coordination also commensurate with previous research on invisible work, and then especially from the perspective of articulation work as invisible work both in healthcare (e.g., Bossen et al. 2013) and IS (e.g., Sachs 2019).

Moreover, our findings has allowed us to identify those invisible work practices that emerged after the ERP was implemented, especially connected to managing ERP functionalities as well as supporting learning and development. As Svejvig and Jensen (2013) argue, in order to move forward, ERPs need to adapt over time, deal with and absorb problems and changes. This capacity is strengthened when work for process development and improvement is carried out in a dynamic way, involving improvisation and learning. Therefore, the implementation of the ERP system has not eliminated invisible work practices, but has instead provided opportunities for these to continue and, in some cases, to reappear in new and modified forms. As shown in Figure 2, all invisible support and learning related practices emerged post-ERP in employees' attempt to become familiar with the new digitised workplace and adopt the skills needed

as a way for coping with their new digitalised workplace. This is in line with invisible work as appropriation of user adoption (Pallesen and Jacobsen 2018; Quiñones 2014). It follows therefore that in digitalised settings the scope of invisible work may increase, despite the expected transparency.

Following our findings, we make three contributions to the literature:

Firstly, we contribute to the literature on digitalised workplaces. Despite the inherent features of digital technologies such as ERPs, which promote standardisation and transparency, this study has shown that invisible work is an embedded part of digitalised work. The study reinforces the idea that increasing transparency in a workplace may lead to hiding behaviour (Bernstein 2017). As our case study has shown, this is not because workers actually have anything to hide, but because they have legitimate reasons for behaving in this way, as this makes it possible for them to carry out their work in ways that digital technology may not allow. The findings have also revealed that invisible work is not only evident in specific and localised workplaces, but is also embedded in centralised organisational processes, such as P2P, a core process in the specific healthcare setting, which we investigated. The actors involved in this process all carry out activities, either individually or collectively, in ways that ensure the flexibility, continuity, safety and development of operations, and these activities are performed both proactively and reactively. Invisible work is undertaken to prevent process breakdown or mistakes; to increase cohesiveness, development and learning; to identify process breakdown or errors; to take necessary actions; and to restore operations. All of this is connected to issues of material shortcomings, unpredictable events, priorities, workload and coordination.

Secondly, the study contributes to the literature on invisible work by taking a longitudinal perspective on a pre- and post-change initiative. Previous studies have shown evidence of invisible work and workarounds specifically following the implementation of an IS (Sawyer and Tapion 2006), but this is the first study of invisible work over time pre- and post-IS implementation. While earlier literature has identified the different conceptualisations of invisible work (e.g., workarounds) and identified reasons for them (e.g., Ignatiadis and Nandakumar 2009; Hatton 2017), it does not explain why some invisible work practices may continue and new ones are introduced when transparent digitalised systems are put in place.

The third contribution of the study is to the literature on ERP and ERP implementation in particular. We show that invisible work continues to be an inherent dimension of work practice in digitalised workplaces. In an ERP setting, where appropriate, some of these practices may need to be made visible, thus, acknowledged and formalised, in order to enable further system development (Cresswell et al. 2017) and

support localised customisation. Where there are shortcomings in system development and implementation because of limited customisation to local practices (Nazemi et al. 2012), employees may carry out workarounds either by continuing or modifying, thus adapting, existing invisible work practices or by introducing new ones. However, as we have shown in our study, some invisible work practices may indeed be inevitable due to contingencies and emergencies, and this should therefore be acknowledged when ERPs are implemented, and should not be subject to transparency by default. Acknowledging the existence of invisible work practices therefore increases our understanding of the ways in which ERPs are used in everyday practice, and the ways in which they inform projects and manage change. This will also be important in the future, with an increasing focus on adapting cloud ERPs, with fewer opportunities to customise the system (Abd Elmonem et al. 2016).

6   Conclusion and implications

In this paper, we have shown that invisible work exists in digitalised workplaces, despite the implementation of standardised systems, and that this may take different forms at different stages of ERP implementation. A limitation of the study is that it did not attempt to include the views of the ERP project team. It also did not compare invisible and visible work practices across different time periods. Future research should examine invisible work in different types of organisation, where emergencies or contingencies of different types may occur. The nature of the organisation concerned may therefore explain the need for invisible work in case of emergency, making it necessary to adopt procedures that are not formally recognised or recorded because of the emergency. Further research could also be undertaken to examine the meaning of invisible work for the employees themselves and the extent to which employees feel empowered by engaging in invisible work, as well as comparing the conditions that may lead to invisible work, as opposed to visible work practices. With the implementation of inter-organisational systems, future research should also examine cases of invisible work being moved out from the user organisation to external partners, e.g., suppliers.

The findings have several practical implications. In digitalised workplaces, invisible work should be acknowledged as part of an existing work practice, even if this work is not always formally recognised or recorded. IS project teams should be aware of these practices and be prepared to customise ERPs and similar systems, taking account of, and where appropriate accommodating, local practices. Moreover, departmental managers need to understand and acknowledge the ways in which employees carry out work outside their formal job description, and take this into account in their performance

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appraisals and when considering them for promotion. The end target should not be to make invisible work visible to the organisation, but rather to increase the employees' own awareness of this dimension of work when introducing ERP and similar systems, and thus manage the process of change. Forming an understanding of invisible work, and recognising that some work practices will always be invisible due to contingencies and emergencies, will increase our knowledge of how these systems can be used in everyday practice.

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