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# The impact of digitalization on frontline employees' knowledge work – a literature review

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**Abstract.** Information and Communication Technologies are transforming the public sector, e.g. in the form of self-service solutions, automated decision-making, and case management systems. These technologies change the work practices of frontline employees (FLE) who we conceptualize as knowledge workers as they produce, access, and document knowledge with the aim of making decisions. We analyze how technologies are affecting FLEs by investigating how their roles and work practices change in real-world settings. The research question “How do ICTs affect knowledge workers' roles and work practices in digital public encounters?” is addressed through a systematic literature review of qualitative studies. The main findings are (1) mainly three types of technologies affect FLEs' role and the knowledge required for their work, i.e., self-service, automated decision-making, and case management systems, (2) ICTs affect different aspects of knowledge work, (3) FLEs develop strategies to satisfy systems requirements and apply tacit knowledge as discretion to remain in their role as policy maker. We further discuss our findings and their implications for the CSCW community.

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# Introduction

Information and communication technologies (ICTs) are widely applied in private and public organizations to improve efficiency, optimize processes, save costs, and improve client or customer participation (Jonathan 2020; Castro and Lopes 2022). Digitalization transforms organizational structures, the way services are provided, as well as governance systems (Liva et al. 2020). These changes in the environment are shown to affect employees, who may experience negative control over work which can lead to physical and mental health problems (Peña-Casas et al. 2018), or reduced meaningfulness of work (Stein 2017). Other negative consequences may include changing social structures, work group dynamics, and worker safety and health (Bailey 2022). We further explore this problem by investigating the impact of ICTs on frontline employees (FLE) in the public sector who play an important role in citizens' interaction and satisfaction with their government.

Public organizations have been a focus in IS and CSCW research for a long time, including research on health and welfare technologies and digital innovations for public sector service delivery (Fitzpatrick and Ellingsen 2013; Aaen 2021), ICTs implications on accountability, trust, and transparency in the public sector (Smith et al. 2010; Flügge et al. 2020), and IT-systems not supporting user autonomy in public service provision (Bratteteig and Verne 2012). We add to this research by focusing on the *public encounter*, which is the interaction between the public organizations and the citizens, as Goodsell (1981) says “where state and citizen meet”. The public encounter, which was traditionally a face-to-face interaction, is being replaced, supported, or mediated by ICTs such as self-service, automated decision-making, and case management systems.

While ICTs change the interaction between citizens and public administration, we want to specifically investigate the impact of these technologies on the role of frontline employees (FLE) whom we conceptualize as knowledge workers. Knowledge workers are people who rely on personal knowledge in their work. Aspects of knowledge work include acquiring knowledge, designing knowledge output, decision-making, and communicating the designed output (Davis and Naumann 1999). The CSCW literature has mainly focused on how ICTs support knowledge work (Borchorst and Bødker 2011; Fitzpatrick and Ellingsen 2013; Boulus-Rødje 2018), we add to this knowledge by investigating how ICTs can affect the roles and work practices of FLE as knowledge workers.

We draw evidence from the social and welfare services, such as unemployment benefits or financial support, where FLEs face complex cases. They use their experiences and tacit knowledge to make decisions and exercise discretion (Lipsky 2010). In this way, FLEs working with social services constitute an important but understudied example of knowledge workers.

We conducted a systematic literature review, focusing on qualitative studies investigating digital public encounters in welfare and social services. Our research question is: *How do ICTs affect knowledge workers' roles and work practices in digital public encounters?*

With this research, we contribute to CSCW literature by pointing towards potentially unintended consequences of ICTs on FLEs' roles and work practices. To design the best possible ICT solutions, it is important to understand how they are used 'on the ground' and the implications they have for FLEs. The upcoming sections will include relevant background literature, an overview of data collection and analysis methods, a presentation of results, and conclude with a discussion, limitations, and future research opportunities.

## Background

The concept of knowledge work was first introduced in 1979, referring to organizational knowledge that represents a firm's "intellectual capital" (Kelloway and Barling 2000). It has since been used across many fields, leading to three main perspectives of knowledge work (1) as a profession, (2) as an individual characteristic, and (3) as an individual activity. Kelloway and Barling (2000) propose to define knowledge work as discretionary behavior focused on the use of knowledge.

Davis and Naumann (1999) define knowledge work as mental work performed by humans to generate useful information. Knowledge workers therefore access data, use knowledge, analyze information, design solutions, make decisions, and communicate information.

The CSCW research community has mainly focused on the collaborative aspects of knowledge work – the sharing of knowledge and information. Ackerman et al. (2013) distinguish between knowledge sharing and expertise sharing. While knowledge sharing is enabled or embodied by computational or information technology artifacts or repositories (artifact-centered), expertise sharing is based on discussions among knowledgeable actors and less supported by artifacts (communication-centered). Sharing expertise is closely linked to tacit knowledge which can be learned only through experience and therefore requires contact with others. Research in CSCW has focused on systems that can support knowledge sharing and expertise sharing. Cabitza and Simone (2012) outline that ICT devices can be knowledge-management systems as they support the creation and sharing of knowledge, or knowledge-based systems where knowledge is stored in the system to support decision-making and problem-solving. While this CSCW research has focused on how knowledge workers share knowledge and expertise with their colleagues and peers (e.g. in a team), in our research on FLEs knowledge work we include other aspects of knowledge work such as accessing and analyzing information, decision-making, and knowledge possession.

FLE in the public sector work at the intersection between the citizens and the administration – i.e., the public encounter. They perform knowledge work as they answer citizen requests, handle cases, and make decisions that have the potential to impact people’s lives. Lipsky (2010) describes the role of FLE as that of policy-makers which is built upon a high degree of discretion and relative autonomy from organizational authority. This relates to Kelloway and Barling’s (2000) definition of knowledge work as discretionary behavior. In social- and welfare services, FLE often deal with complex citizen narratives. They build upon personal experience and use discretion to deliver the best possible solutions for citizens (Lipsky 2010). For instance, FLEs might adjust dates to protect citizens’ financial benefits, strategically categorize citizens’ needs to make them eligible for benefits, or adjust demands posed on citizens in order to receive benefits fitted to their life situation (Raso 2017; Gustafsson and Wihlborg 2019). These examples show how FLE apply knowledge about policies and regulations to individual citizens’ situations when making decisions. Discretion is also discussed by Petersen et al. (2020) who investigate how social workers exercise discretion cooperatively, based on consultations and skills. They argue that discretion should not be undermined by technology but rather be integrated within it. This aligns with the CSCW perspective on knowledge and expertise sharing and the ongoing debate on how systems can support these practices.

To exemplify, FLE are knowledge workers as they (1) possess specialized knowledge, e.g. administrative rules and regulations, (2) access knowledge, e.g. information on the citizen's life situation, (3) document and share knowledge, e.g. documenting information on citizens, and (4) make decisions, e.g. on a citizen’s eligibility for certain benefits. These processes are complemented by FLEs experiences and discretionary practices.

In CSCW, the research on knowledge work has mainly focused on practices such as healthcare (Fitzpatrick and Ellingsen 2013), manufacturing (Hoerner et al. 2023), or IT-teams (Spence and Reddy 2012), leaving FLE as knowledge workers in the public administrations and especially social welfare agencies relatively understudied. Borchorst and Bødker (2011) investigate knowledge-sharing and collaborative activities between citizens and the government, drawing on the three cases of parental leave, citizen service offices, and municipal plans. Verne and Bratteteig (2016) present a study of citizens’ calls to the tax authorities requesting help in filling out their tax forms. Both studies focus on the transfer of knowledge between citizens and FLE. Boulus-Rødje (2018) focuses on frontline employees and knowledge practices within the organization. They identify characteristics of caseworker’s knowledge work and discuss implications for the design of ICTs that support these knowledge practices. Dolata et al. (2020) investigate how case and knowledge management systems may disturb the service provision when they are used as a collaborative resource during a service encounter with citizens. We build on this valuable research and extend it with our contribution towards

framing FLEs’ role as knowledge workers and how ICTs affect their knowledge work practices.

## Methodology

This is a research-in-progress paper that presents first results of a systematic literature review with the aim to comprehensively explore the various aspects of digital public encounters. We specifically concentrated on qualitative research studies, as these studies provide valuable insights into people’s emotions, opinions, and behaviors. The research question discussed in this paper emerged as part of the coding process.

We searched for three terms Digital, Public, and Encounter and their synonyms. The SPIDER tool proposed by Cooke et al. (2012) was used as inspiration for combining the terms. See Figure 1 for an overview of the search terms. The search terms were derived from an initial set of studies and tested throughout several iterations to develop a search string that returned the most relevant results. The final search string was checked against the list of an initial set of studies. We searched in Title, Abstract, and Keywords in Web of Science and Proquest.

— AND —

Digital	Public /NEAR service	Encounter	Empirical
Electronic	Public sector	Discretion	Case study
Technolog*	Public authorit*	Public value	Focus group
ICT	Public administration	Interaction	Mixed method
AI	Public official	Citizen	Qualitative
Chatbot	Government	Accountability	Interview
Robot	Social work	Self-service	Observation
Automat*	frontline	Service delivery	Ethnography
“automated-decision-making”		Fact-to-face	Action-design-research

Figure 1 Overview of search terms for the query.

Several exclusion criteria were added to the search string. These included only peer-reviewed papers and publications from 2015 - now (2023). The time frame is based on the theoretical problem analysis carried out prior to the literature review. To refine the search results the following exclusion terms were added to the search string: inter-organizational, open data, data warehouses, big data, adoption, cloud computing, education, health, blockchain, Covid-19. These terms emerged during the testing and evaluation of the search string, and studies including these terms were considered non-relevant.

A total of 2420 studies were returned from the databases and saved to the reference management software Zotero. After removing duplicates and studies

that were not published in English, Norwegian, or German (languages understood by the authors), 2124 studies were included in the screening process.

The screening process was based on pre-defined inclusion-exclusion criteria (see Table I). The inclusion criteria were derived from the study’s aim to understand how technologies are applied to the context of a public encounter within social service provision, and the impacts on citizens as well as employees.

Table I. Overview of inclusion and exclusion criteria

<b>Inclusion</b>	<b>Exclusion</b>
Studies investigating means of digital interaction between citizens and public administrations	Full-text not available (i.e. not available in the university’s subscription package)
Studies investigating the impact of ICTs and automation on discretion, accountability, and/or the work processes of public officials;	not within the context of social service provision
Studies investigating the impact of ICTs and automation on the role of citizens and/or frontline employees.	Non-empirical research
	Published before 2015

The screening process had three iterations where studies were included based on (1) title, (2) abstract, and (3) full text. The three iterations resulted in respectively 484, 91, and the final sample of 20 studies. An overview of the final sample is presented in the Appendix.

The final sample was imported and analyzed using the Dedoose app for analyzing qualitative and mixed-method research. Following a grounded theory coding approach, the final sample was analyzed using open coding, axial coding, and selective coding “in an intertwined fashion” (Wolfswinkel et al. 2013).

The open coding serves the identification of different concepts that emerge from the literature. Through axial coding, these concepts are grouped into different categories. The process of identifying concepts and categories is iterative in nature and requires revisiting papers, concepts, and categories based on new insights. Selective coding is further used to identify and develop relations between the main categories (Wolfswinkel et al. 2013).

The open coding resulted in 71 codes including concepts such as accountability, barriers, collaboration, control, emotion, flexibility, language, and responsiveness, among others. Through axial coding, we identified *Technologies* as a main category. The category *Technology* contains the sub-categories *self-services*, *automated decision-making / robotic process automation*, and *case management systems*. These sub-categories include codes related to work practices and the roles of FLE.

As this is a research-in-progress, the axial and selective coding will be continued to identify further categories and their relations to one another.

## Results

In the following, we will present how ICTs affect the roles and work practices of FLE. The findings are structured along three technology categories emerging from our sample. These are (1) self-services (SS) (2) automated decision making (ADM) / robotic process automation (RPA), and (3) case management systems (CMS). Each of these has the potential to affect different aspects of knowledge work.

### Self-services

Self-service solutions have the potential to change different aspects of knowledge work conducted by FLEs, leading to changes to current roles, the creation of new roles and duties, and the elimination or outsourcing of traditional roles.

Firstly, the application of self-service solutions can transfer knowledge work from the FLE to the citizen or others helping the citizen. With self-services the citizen has to find information about benefits and services themselves, they have to understand eligibility criteria, and possess general knowledge of how the public sector works (Heggertveit et al. 2022). At the same time, FLEs are changing their role from giving specialized guidance to helping citizens become self-sufficient in using digital solutions, which is shaped by “digital first” policies (Pors 2015; Schou and Pors 2019; Jorgensen and Schou 2020; Bernhard and Wihlborg 2022; Pedersen and Pors 2023). Changing roles also means changing how knowledge work is practiced. FLEs who take on this new role need to be familiar with several areas of service provision and focus more on communication, interaction, and creating a learning environment, rather than principles of law and public administration regulations (Pors 2015). In addition, they often have limited access to citizens' information and records and thus limited ability to help (Bernhard and Wihlborg 2022; Heggertveit et al. 2022). While bound to their new role of guiding citizens to use self-service, many FLEs still use discretion to provide the best possible service within the boundaries of their new role. Based on personal experience and social competence, rather than expertise and professional training, they assess a citizen's digital skills and decide how they can help them (Pedersen and Pors 2023). In some cases, this leads to the FLE taking over, doing the task for the citizen, even though it is against the official policy (Pors 2015; Schou and Pors 2019; Jorgensen and Schou 2020; Heggertveit et al. 2022; Pedersen and Pors 2023). Their new role may hinder them from giving more specialized advice as it is focused on helping to use the technology (Pedersen and Pors 2023).

Giest and Samuels (2022) describe how the role of helping citizens may also be outsourced to volunteers, e.g. library employees, and not performed by FLE. These volunteers are not allowed to give advice or confirmation about eligibility criteria but feel pressure to undertake additional steps to help citizens given the often vulnerable situation they are in. These steps can include calling other services and hotlines for them and checking compliance with services.

Several studies show that FLE's core tasks as specialized decision-makers are replaced with the task of making citizens capable of using digital solutions (Pors 2015; Schou and Pors 2019; Pedersen and Pors 2023). They are further seen as complementing the self-service (Bernhard and Wihlborg 2022).

Another aspect of self-service solutions regards the processing of online applications. Information received through self-services can be "simplified, often binary formats, fragmented and incomplete" (Loberg 2023). This produces two main challenges for the FLE, (1) a cohesive citizen narrative is deconstructed into pieces, and (2) the information is incoherent with conflicting answers. The FLE will then "search for additional information and use previous experience to recontextualize the case and reconstruct the client narrative" (Loberg 2023).

## Automated decision-making and Robotic process automation

Automated decision-making and Robotic process automation (ADM/RPA) are tools that generate decisions based on data input and streamline routine work processes. Similar to self-service solutions, does the deployment of the RPA lead to changing roles for the FLE who are no longer social workers that prove eligibility criteria but now focus on other tasks, such as the reintegration of the citizen into the labor market (Ranerup and Henriksen 2019). While their primary role as decision-makers has diminished (Ranerup and Henriksen 2022; Ranerup and Svensson 2023), FLEs consider it as part of their professionalism to validate data in the decision-making process.

Their changing role allows FLEs to have more time for non-routine tasks such as reviewing citizen's activity plans and appeals against decisions, as well as personal contact with citizens. Some FLEs point out that the ADM improves their capacity to make judgments (Ranerup and Svensson 2022). Other FLEs pointed to the individual micro-assessments they make based on interaction with the citizen which they don't see can be done by ADM. During such micro-assessments, the FLE uses discretionary power to make decisions (Gustafsson and Wihlborg 2019). Another case concerns the deployment of a "fully automated service-delivery model that produces its own legal decisions after caseworkers have input [...] client information" (Raso 2017). In this case, the decision-making behavior of the tool is seen as unpredictable which creates additional tasks for the FLE. FLEs often have to correct errors generated by the ADM which redirects their attention away from the citizen and toward the tool. They describe it as being

overwhelmed with administrative work that takes away time they'd rather spend with the citizens. They had to learn "its [the tools] language" so that they could more effectively manipulate the system and produce wanted outcomes (Raso 2017).

### Case management systems (CMS)

Case management systems (CMS) are widely used in public administration. Løberg and Egeland (2023) describe how the use of a CMS "that enables counselors to find information about the client and supports formal decision-making" can lead to an incomplete perception of the citizen. The system cannot always display the full picture of the citizen, as one FLE pointed out that it can be useful to see the citizen as "this tells us something about the person we can lose sight of when everything is digital..." (Løberg and Egeland 2023). The authors argue that this fragmentation can lead to alienation that can rob the work of its meaning (Løberg and Egeland 2023). Fragmentation is also addressed by Devlieghere and Roose (2019) who investigated the case of standardized forms in child welfare protection. Here, FLEs point out that the tool makes it "almost impossible for them" to create a nuanced and complete overview of the citizens' life history. They also point to the system's linguistic structure that lacks narrative. As the FLEs were expected to use the system they developed workarounds such as contacting other services before completing the form, exaggerating a citizen problem or withholding positive information on the citizen's situation, and using certain text fields for unintended purposes (Devlieghere and Roose 2018; Devlieghere and Roose 2019). Other FLEs working with the same tool, appreciated the structure of the IS in providing clear aims, a path to follow during consultations, and helping to structure the thoughts. They considered the IS as a tool to create a single and uniform language that leads to more objective assessments (Devlieghere et al. 2020; Devlieghere et al. 2021). The IS was further seen as helpful in reconstructing citizens' care trajectories (Devlieghere and Roose 2019).

A CMS for social benefits in Canada forced FLEs to develop several workarounds. They enter placeholder data to satisfy the need to fill all fields, adjust dates forward and backward to moderate the system's exacting interpretation of dates, and categorize citizens' needs so that the system will find them eligible for benefits. The FLEs learned to creatively enter client data so that the system generates outcomes that better fit the FLE's perception of the citizens' needs (Raso 2017). Dolata et al. (2020) investigated a CMS that is designed for sharing information, orchestrating processes within the agency, and checking information. It further has embedded regulatory obligations and technical limitations that define the FLEs work but doesn't support citizen consultation very well. As such the FLEs develop strategies for better consultation and

information sharing with clients while having to satisfy the requirements of the system. These strategies include being selective about their documentation and the effort put into documentation depending on the citizen's needs (Dolata et al. 2020). Some FLE reuse frequently used paragraphs or just use keywords to make notes and complete the documentation after the consultation. Another strategy to share information with the citizen includes turning the computer screen toward the citizen. The system itself is designed as a single-user desktop software and has no specific screen-sharing option to be used during consultations (Dolata et al. 2020).

In several of the presented cases, FLEs see the CMS as a control instrument that creates a conflict between satisfying the systems' needs and being responsive to the citizens (Raso 2017; Devlieghere et al. 2020; Dolata et al. 2020).

## Discussion and Conclusion

The findings show how the different technologies self-services, ADM/RPA, and case management systems affect the roles and practices of frontline employees concerning knowledge work as defined by Davis and Naumann (1999) and Kelloway and Barling (2000).

We first relate our findings to the four aspects of knowledge work as presented in the background section: (1) possessing specialized knowledge, (2) accessing knowledge, (3) documenting and sharing knowledge, (4) decision making, as well as the FLEs use of tacit knowledge within those aspects. Subsequently, we discuss the findings with the CSCW perspective on knowledge work.

*(1) Possessing specialized knowledge:* The findings show that specialized administrative knowledge may be transferred to the citizens using self-service, or volunteers helping citizens to use self-services (e.g. Heggertveit et al. 2022; Giest and Samuels 2022). Knowledge of regulations and eligibility criteria may be transferred to the ADM and FLEs are often assigned a new role in which their main task is to guide citizens to use self-services. In that role, they need more general knowledge of the services and the use of the technology. They further need to be able to assess a citizen's digital skills and create a supportive learning environment (e.g. Pors 2015). While their roles changed completely, FLEs still apply tacit knowledge when deciding how much support a citizen needs and whether they might have to 'take over' for the citizen. FLEs who work with case management systems and ADM also develop knowledge of the functionality of the system to use it more effectively. This can also mean manipulating the system to produce a wanted outcome (e.g. Raso 2017).

*(2) Accessing knowledge:* FLEs who take on the role of helping citizens to use self-services often experience limited access to citizens' information and records (e.g. Bernhard and Wihlborg 2022). They are bound to certain rules, such as not being allowed to see sensitive information when assisting a citizen, or simply not

having access to the administration's case management systems. This limits their ability to help the citizens. Yet, FLE may bend these rules when they perceive it as the only way to help the citizen (e.g. Schou and Pors 2019; Jorgensen and Schou 2020).

Self-services and case management systems can cause fragmentation of citizen information. In those cases, the FLE applies tacit knowledge and engages in further knowledge production based on other sources to re-construct the narrative (Loberg 2023).

(3) *Documenting and sharing knowledge*: Case management systems can support but also limit the documentation and sharing of knowledge. They may help to structure a consultation, thoughts, and re-construct citizens' service history, but are also often seen as too standardized and rigid to allow for a nuanced representation of the citizen's narrative (e.g. Devlieghere et al. 2020). In those cases, the FLEs develop 'creative' documentation practices by entering placeholder data, using text fields for unintended purposes, or engaging in selective documentation practices to satisfy the system (e.g. Raso 2017; Devlieghere and Roose 2018). To better share knowledge with the citizens, they may turn the screen towards the citizen when the system does not provide a special function for sharing (e.g. Dolata et al. 2020). Here, the FLE uses discretion to overcome the limitations perceived by the system.

(4) *Decision making*: Self-services and ADM can remove the FLEs core task of specialized decision-making and leave them with the task of complementing the system. They may still validate citizen data and control the decisions generated by the tool. When the tool takes a supportive role, i.e. the decision must be approved by the FLE, some FLEs state that the tool can improve their capacity to make judgments (e.g. Ranerup and Svensson 2022). Additionally, FLE may correct the tool's decision if it differs from theirs. While the tool is basing its decision solely on data input, the FLE makes use of tacit knowledge and discretion to develop its decision. When the ADM is fully automated and FLEs cannot correct its decision, they will correct it by changing the data input to the system. This includes adjusting dates, exaggerating problems, or withholding positive information (e.g. Raso 2017). Thus, despite the full automation of the decision-making process, FLEs try to remain in control over the decision.

Across all four aspects, we can identify elements of artifact-centered knowledge sharing as defined by Ackerman et al. (2013). Especially ADM and RPA are precisely designed to have knowledge (e.g. regulations, rules, and policies) embodied within them and carry out a task based on that knowledge. They are what Cabitza and Simone, (2012) call knowledge-based systems. These systems, although designed to support decision-making, can cause challenges for the FLE when the system's decision differs from theirs. Case-management systems can be considered knowledge-management systems (Cabitza and Simone

2012) as they allow for documentation and knowledge sharing. As outlined above they often come with limitations regarding documentation and knowledge sharing, especially in complex client trajectories. It can therefore be assumed that they support knowledge sharing rather than expertise sharing. To what degree these systems can support expertise sharing remains unknown from the findings.

As presented above, ICTs affect knowledge work in different ways. However, one aspect of knowledge work, the use of tacit knowledge and discretion, remains present and even dominant across all aspects. This is in coherence with Kelloway and Barling (2000) who suggest that discretionary behavior is at the core of knowledge work. It further agrees with Lipsky (2010), who states that FLE will use discretion to deliver the service they consider best suitable for the citizen, thus taking on the role of policy-makers. It further agrees with Petersen et al. (2020) who argue that attempts to reduce discretion through automation can cause damages. Our findings reveal that automation does not necessarily reduce discretion, as FLEs manipulate the system to create the decisions they deem suitable. Automation may thus create more challenges for FLEs than relieving them of tasks. To conclude, the findings show that while ICTs change how knowledge work is practiced and what role the FLE takes in the public encounter, they cannot fully replace knowledge workers in the public service provision.

## Implication and Future Research

Our study demonstrates that ICTs affect different aspects of knowledge work in the context of a public encounter. As this is an exploratory study, we want to further explore CSCW literature and investigate how ICTs can support all aspects of knowledge work and especially consider discretionary behavior as an essential part of knowledge work. Additionally, the findings presented here constitute only one aspect of the digital public encounter, the impact of technologies on FLE roles and their knowledge work practices in the delivery of welfare and social services. The overarching aim of this research project is to develop a holistic understanding of the digital public encounter and highlight its importance for the CSCW community. Our future research activity will therefore include further analysis of the data from this literature review and develop a framework that captures the different aspects of the digital public encounter, adding citizens and other actors within the public encounter and its service-ecosystem.

The findings have further implications for practice and system designers. To design systems that support knowledge work at the frontline it is important to understand the roles of different actors, how they use the system, and how they are affected by a system. Ill-designed systems that fail to recognize the range of knowledge work practices can lead to negative consequences for workers. Although our findings show some positive effects of ICTs on FLE's work

practices, most research addresses negative effects. Administrations that utilize ICTs in their public encounters should therefore identify clear metrics that help them identify positive as well as negative effects.

## Limitations

The findings of this study are based on a literature review which presents limitations to the data gathering and analysing process. The search string and databases may not have returned all relevant studies, despite testing in several iterations. The data analysis is susceptible to researcher's bias. To reduce bias, the authors discussed codes and findings throughout the process.

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## Appendix

Author (Year)	Title	Publication Title	Technology and Context
Ranerup and Svensson (2023)	Automated decision-making, discretion and public values: a case study of two municipalities and their case management of social assistance	European Journal of Social Work	RPA, income support, Sweden
Giest and Samuels (2022)	Administrative burden in digital public service delivery: The social infrastructure of library programs for e-inclusion	Review Of Policy Research	Self-services, libraries, and community centers, Netherlands
Loberg (2023)	Assessments of digital client representations: How frontline workers reconstruct client narratives from fragmented information	Journal Of Public Administration Research And Theory	Self-service application, needs assessment unemployment, Norway
Pedersen and Pors (2023)	Discretionary responses in frontline encounters: Balancing standardization with the ethics of office	Journal Of Public Administration Research And Theory	Self-services, Citizen service centers, Denmark
Bernhard and Wihlborg (2022)	Bringing all clients into the system - Professional digital discretion to enhance inclusion when services are automated	Information Polity	Self-services, Contact centres, Sweden
Heggertveit et al. (2022)	Administrative burden in digital self-service: An empirical study about citizens in need of financial assistance	Electronic Participation, Epart 2022	Self-services, financial assistance application, Norway
Ranerup and Svensson (2022)	Discretion, automated decision-making, and public values: Background and test of an approach for unpacking human and technological agency	Electronic Government, Egov 2022	RPA, income support, Sweden
Loberg and Egeland (2023)	'You get a completely different feeling' - an empirical exploration of emotions and their functions in digital frontline work 'Du far en helt annen feeling' - en empirisk undersokelse av folelser og deres	European Journal Of Social Work	CMS, income support/unemployment, Norway

	funksjon i digitalt forstelinjearbeid		
Devlieghere and Roose (2021)	Electronic information systems as means for accountability: why there is no such thing as objectivity	European Journal Of Social Work	CMS, Child-Welfare-protection, Belgium
Ranerup and Henriksen (2022)	Digital discretion: Unpacking human and technological agency in automated decision-making in Sweden's social services	Social Science Computer Review	RPA, income support, Sweden
Devlieghere et al. (2020)	Managing the electronic turn	European Journal Of Social Work	CMS, Child-Welfare-protection, Belgium
Dolata et al. (2020)	When the system does not fit: Coping strategies of employment consultants	CSCW-The Journal Of Collaborative Computing And Work Practices	CMS, employment agency, Germany
Jorgensen and Schou (2020)	Helping or intervening? Modes of ordering in public sector digitalization	Journal Of Organizational Ethnography	Self-services, Citizen service centers, and tax call center, Denmark
Ranerup and Henriksen (2019)	Value positions viewed through the lens of automated decision-making: The case of social services	Government Information Quarterly	RPA, income support, Sweden
Schou and Pors (2019)	Digital by default? A qualitative study of exclusion in digitalised welfare	Social Policy & Administration	Self-services, Citizen service centers, Denmark
Devlieghere and Roose (2019)	Documenting practices in human service organisations through information systems: When the quest for visibility ends in darkness	Social Inclusion	CMS, Child-Welfare-protection, Belgium
Gustafsson and Wihlborg (2019)	'It is always an individual assessment': A case study on challenges of automation of income support services	Electronic Government (Egov 2019)	ADM, income support, Sweden
Devlieghere and Roose (2018)	Electronic Information Systems: In search of responsive social work	Journal Of Social Work	CMS, Child-Welfare-protection, Belgium

Raso (2017)	Displacement as Regulation: New Regulatory Technologies and Front-Line Decision-Making in Ontario Works	Canadian Journal of Law and Society	CMS with integrated ADM, financial income support, Canada
Pors (2015)	Becoming digital – passages to service in the digitized bureaucracy	Journal of Organizational Ethnography	Self-services, Citizen service centres, Denmark