



Digital competence is a must: Manager and safety representative perspectives on evolving job skills and balancing digital work environments in transportation, logistics, and home care

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1. Introduction

The transformation of the work environment, influenced by the rapid advancements in digitalization, carries profound implications for the requisite competencies, capabilities necessary and work abilities for employment (Piowar-Sulej et al., 2024). This might affect the work ability for many individuals. Work ability, a concept relative to the demands within the work environment (Tengland, 2011), has experienced a substantial shift due to the widespread adoption of digital tools and technical equipment, leading to significant alterations in job demands (Borle et al., 2021; Stadin et al., 2016; Trenery et al., 2021). Insufficient resources coupled with a heavy workload may challenge the work environment, when new technology is introduced (Palm et al., 2024). However, information and communication technology (ICT) use does not necessarily have a negative impact on individuals' work ability and self-rated health per se; rather, it is the digital intensification and high ICT demands that exert this negative influence (Borle et al., 2021; Stadin et al., 2016). Manager behavior can mitigate the negative impact of introducing new technology by facilitating and encouraging employee decision-making and collegial cooperation (Palm et al., 2024). In addition, from a health perspective, need-supportive leadership may reduce the risk of adverse health outcomes and decrease employee absenteeism (Stenling et al., 2024).

A substantial portion of existing research on digital work environments centers predominantly on white-collar workers in office contexts, overlooking industries like transport, logistics, and home care where digital transformation could have significant, distinctive impacts (Stadin et al., 2021; Waschull et al., 2022). These industries typically employ workers with lower educational levels, a high proportion of immigrant workers, and experience high turnover rates, necessitating a focused study on digital work environment. Additionally, the impact of

workplace digitalization manifests differently across occupational strata, while it tends to enrich the work of white-collar professionals, it may lead to task simplification for blue-collar workers (Waschull et al., 2022). Furthermore, the majority of research on the digitalization of blue-collar work predominantly focuses on productivity aspects, rather than exploring the comprehensive work environmental effects of such digital transformations (Leviäkangas, 2016; Polydoropoulou et al., 2023). This underscores the need for a more inclusive and comprehensive approach to studying digital work environments, one that considers the unique challenges and opportunities across diverse occupational contexts, particularly in blue-collar industries.

The transport, logistics, and home care industries are currently undergoing a profound digital transformation. The incentive for digitalization across these industries stems from the necessity to optimize costs and adapt to evolving customer demands. However, this transformation extends beyond merely enhancing operational efficiency, it is also aimed at fostering more sustainable and supportive work environments for employees. While most studies on digitalization and its impacts have traditionally focused on the employee perspective, understanding the viewpoints of managers and safety representatives could provide critical insights into the broader organizational and safety implications of these changes (Bondarouk & Brewster, 2016). In the transport and logistics sector, employees oversee the movement of goods and services from their origin to consumption, catering to meet customer needs, including passenger and cargo transportation, warehousing, and storage. Logistics operations encompass in-house operations, where goods are delivered directly to customers from nearby stores, and outsourcing, where third-party services manage logistics. This industry requires comprehensive planning and involves various aspects such as storage, handling, inventory, and packaging (Rydström et al., 2023; Sekkay et al., 2018). On the other hand, the home care industry provides personal care and

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homemaking services for individuals who require care in their homes, such as the elderly or those with physical or mental disabilities (Grasmo et al., 2021). Digital working conditions in home care involve the use of technology for communication, scheduling, house security, and electronic medical record documentation (Andersen & Westgaard, 2013). Regarding sociodemographic composition, these industries exhibit commonalities in terms of employees' educational attainment, physical job demands, immigrant representation, and turnover rates, however, they diverge with respect to gender distribution. The transport- and logistics industries are predominantly male-oriented, while home care is characterized by a preponderance of female workers (Andersen & Westgaard, 2013; Grasmo et al., 2021; Rydström et al., 2023) (Table 1). Therefore, the perspectives of managers and safety representatives are essential to clarify the implementation and adjustment of digital strategies within these industries, ensuring that such transformations not only align with business objectives but also adhere to safety standards and promote a healthy work environment.

The influence of digital transformation on job competence in industries such as the transport and logistics, and home care are not well-documented. This oversight emphasizes the necessity for exploring how digitalization reshapes the job requirements in these traditionally less digitalized industries (Leviäkangas, 2016; Persson et al., 2023; Piowar-Sulej et al., 2024). Job competence refers to the skills, knowledge, and abilities required to effectively perform job tasks (Eilström & Kock, 2008). While digital competence at work specifically involves technical competence, the ability to use digital technologies for meaningful purposes, the ability evaluate digital technologies critically, as well as the motivation to participate and commit to the digital work environment (Ilomäki et al., 2016). In industries like transport and logistics, digital competence may involve using GPS technology for routing, digital inventory systems for stock control, or automated software for optimizing supply chain operations (Leviäkangas, 2016). In home care, essential digital skills include managing schedules, handling electronic health records, and conducting telehealth services (Persson et al., 2023). The development and impact of these skills in more hands-on roles have been underexplored due to a focus on office-based professions (Stadin et al., 2021; Waschull et al., 2022). This knowledge gap highlights the need for increased knowledge of the competencies required in these industries. Hence, it is critical to explore strategies by which organizations and managers can enhance employee competencies while simultaneously fostering a safe and healthy work environment.

The digitalization of work has the potential to significantly enhance the digital work environment. Research consistently demonstrates that

digitalization is associated with increased efficiency and organizational development. ICT have been shown to facilitate improved information exchange, boost productivity, and enhance flexibility across various sectors (Rasool et al., 2022; Tarafdar et al., 2007; Trenerry et al., 2021). However, the benefits of flexibility are not uniformly distributed. White-collar workers often experience a higher level of flexibility due to digitalization compared to blue-collar workers or those in non-office professions (Waschull et al., 2022). Moreover, digitalization can improve workplace safety through advanced surveillance and security systems. Yet, this same technology may inadvertently compromise worker autonomy and professional integrity (Moraru, 2024). The tension between enhanced security and potential privacy violation underscores the complex nature of digitalization of work. This disparity highlights the need for a nuanced understanding of digitalization's impacts across different occupational categories.

This paper is grounded in the Job-Demands-Resources model (Bakker & Demerouti, 2007), a theoretical framework that conceptualizes risk factors associated with work-related stress across various occupations. The model is applicable to diverse industries, including transport, logistics, and home care. It categorizes work characteristics into job demands and job resources. Job demands are the physical, psychological, social, or organizational aspects of a job that require sustained effort and are associated with physiological and psychological costs. This may include time pressure, emotional demands, and role ambiguity. Resources can be physical (such as equipment), psychological (such as autonomy in work, opportunities for professional development), social (such as support from colleagues and supervisors), or organizational (such as career opportunities, job security). The interplay between these elements can either lead to strain and health problems when demands are high and resources are low, or foster work engagement and productivity when resources are sufficient to buffer the demands (Bakker & Demerouti, 2007). In these industries, job demands include physical challenges such as awkward postures, manual handling, repetitive tasks, and whole-body vibration (Sekky et al., 2018), as well as psychosocial factors like shift work, solitary assignments, and limited decision latitude (Hämmig & Bauer, 2014). Emotional demands are particularly significant in-home care. Job resources, on the other hand, are factors that enhance efficacy in achieving work goals, reduce job demands, and foster personal growth, learning, and development (Bakker & Demerouti, 2007). The Job-Demands-Resources model can also be operationalized into more specific frameworks, such as the Demand-Control-Support model proposed by Karasek and Theorell (1990). This adaptability allows for a

Table 1
Comparison of characteristics in the included industries.

Job characteristics	Transport industry	Logistics industry	Home care industry
Educational level	Low educational attainment	Low educational attainment	Low educational attainment
Gender distribution	Male-dominated	Mixed but more male representation	Female-dominated
Physical job demands	High (partly manual labor, driving)	Moderate to high (partly manual handling)	Moderate (mobility, assisted transfer of clients)
Psychological job demands	Moderate (tight schedules, safety concerns)	Moderate (coordination, deadlines)	High (decision making, working with vulnerable clients)
Emotional demands	Low to moderate	Low	High (empathy, dealing with clients)
Time pressure	High (strict deadlines)	High (constant scheduling pressure)	Moderate to high (client visits, time constraints)
Lonely work	High (long hours alone driving)	Low to moderate (team environments but can involve isolated tasks)	Moderate (lonely work but interaction with clients)
ICT demands	Moderate (navigation, scheduling)	High (inventory management, tracking systems)	Moderate (electronic health records, digital keys, tablets)

nuanced understanding of stress factors and resources in various occupational settings, enhancing the model's practical utility. Exploring demands and resources in the digital work environment within these industries is crucial, as each sector has unique stressors and support mechanisms. A deeper understanding can lead to better management, where balanced job demands drive goal achievement, reduce stress, and foster personal growth (Bakker & Demerouti, 2007).

The transport, logistics, and home care industries are increasingly adopting digital tools to improve efficiency, safety, and customer service. However, there is a significant knowledge gap regarding how digitalization has affected the required competencies and job demands in these industries. The transport, logistics, and home care industries face high physical demands, low educational levels, high rates of immigrant employees, and high turnover rates, making the impact of digitalization particularly complex (Leviäkangas, 2016; Rydström et al., 2023). Most research on the digitalization of blue-collar work focuses on productivity, overlooking the comprehensive work environment effects (Leviäkangas, 2016; Polydoropoulou et al., 2023). This highlights the need for a more inclusive approach that considers the unique challenges and opportunities in these industries. Exploring these dynamics from the perspectives of managers and safety representatives provides valuable knowledge, as their insights can reveal how digitalization changes job demands and what new skills and competencies are needed (Bondarouk & Brewster, 2016). Managers offer insights into organizational goals, resource allocation, and employee performance, while safety representatives understand the practical challenges and risks faced by the employees. Additionally, leadership behavior regarding digitalization influences the risk of employee stress (Bregenzer & Jimenez, 2021). Together, these perspectives contribute to a more comprehensive understanding of the digital work environment from an organizational point of view. Hence, the aim of this study was to explore how managers and safety representatives perceived the impact of digitalization on job demands, required skills, work environment benefits, and the resources and strategies needed to effectively balance these demands within the transport, logistics, and home care industries.

2. Methods

2.1. Design

To explore the work environment within the selected industries, specifically concentrating on the digital work environment, a qualitative research design was employed. This approach utilized semi-structured interviews to gather open-ended data and solicit perspectives from managers and safety representatives. The decision to use semi-structured interviews was driven by the intention to maintain a focus on the research topic while also providing flexibility to explore relevant ideas that may emerge spontaneously during the interview process (Kallio et al., 2016; Wilson, 2014).

2.2. Data collection and participants

Information regarding experiences related to the digital work environment was gathered through 24 semi-structured interviews with managers and safety representatives recruited from 22 organizations within transport, logistics, and home care industries (Table 1; Table 2). Most safety representatives held regional roles, overseeing multiple organizations. The decision to interview managers and safety representatives for this study was based on their comprehensive perspective regarding the phenomenon of digitalization of work. Furthermore, their position within the power structure, affording them direct influence over the organizational work environment, validated this recruitment strategy. An interview guide, aligned with the study's aim and method recommendations, was developed. It included questions exploring various aspects of work digitalization (Table 3). Follow-up questions primarily served as checks, and were only asked in cases when the

Table 2
Participant characteristics (n = 24).

	n
<u>Sex</u>	
Men (transport and logistics)	16
Women (home care)	8
<u>Age</u>	
Mean (range)	50 (36–68)
<u>Industries</u>	
Transport & Logistics "T&L" (9 managers; 7 safety representatives)	16
Home care "H" (7 managers; 1 safety representative)	8
<u>Years in the industries</u>	
Mean (range)	21 (1–37)
5> years expertise	24
<u>Years in current position</u>	
Mean (range)	8 (0.5–33)
5> years expertise	12

participants have missed to address these points in the initial open-ended questions. The questions were tailored to reflect participants' organizations and industries. Potential participants were strategically sampled using contacts in employer associations, unions, and knowledge of organizations within the targeted industries. Snowball sampling was also utilized to identify a few participants (Johnson, 2014). Interested managers and safety representatives responded to an email containing an information letter and necessary consent documents. Proficiency in the Swedish language was a prerequisite. Of the 24 semi-structured interviews conducted, 21 were facilitated using the Zoom video conference system, while the remaining three were carried out at the participants' workplaces. All interviews were audio-recorded and transcribed verbatim throughout the process. The interviews were lasting between 26 and 62 min, with an average of 50 min per interview.

2.3. Data analysis

The collected data underwent a thorough content analysis, a qualitative method ideal for summarizing data through sorting and comparison to extract implicit information from text (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004). Initially, the interview tapes were listened to, and the transcribed data were repeatedly read to gain a comprehensive understanding. An inductive approach was employed, beginning with open coding where relevant parts of the data related to the study aim were highlighted (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004). The interview transcripts were re-read, and notes were made in the margins until no further aspects could be identified. These notes were then transferred to coding sheets, from which preliminary categories were freely derived. In the process of creating categories, these preliminary categories were compared and grouped based on their relationships to one another. Subsequent data were coded by the first author, with another co-author reviewing the coding sheets and preliminary categories to scrutinize and discuss them, leading to occasional adjustments. To enhance credibility, three interviews representing each industry underwent double-coding by two authors, with disagreements resolved through consensus. Throughout all analysis steps, patterns in the data were scrutinized, compared, and documented in reflective notes. During the abstraction phase, preliminary categories were further examined and merged into sub-categories and main categories. This phase continued until the categories were stable, coherent, and distinct from each other (Table 4; Table 5). The systematic approach used in content analysis not only ensures study replication but also produces

Table 3
Semi-structured interview guide for the digital work environment in the transport-, logistics-, and home care industries.

<u>Topic</u>	<u>Main Question/s</u>
	- Examples of sub-questions
<u>Background characteristics</u>	Can you tell me a little about yourself? - Age? - Number of years in the industry? - Number of years at the current company? Tell me a little about your business and your role in the company/organization? - For example, how many employees? - Who are your main customers? - What does the daily operation look like?
<u>The digital work environment</u>	Please tell me a little about the technology and digital tools you use in the workplace. Give examples of different digital tools or new technology used (IT systems, apps, control panels, etc.) - How long have you been working with these digital tools? - What did it look like before this kind of technology was implemented? Manual work? - How was the organization involved in the implementation process for this technology? - What was the main incentive to implement this technology in the organization? How do you experience that digitalization and the introduction of new technology has influenced the work environment in your organization/industry? - How has the digitalization improved the work situation for employees in your organization/industry? - How has digitalization degraded the work situation for employees in your organization/industry? - How has the ICT demands influenced the overall job demands for employees in your organization/industry?
<u>ICT demands and requirements</u>	How do you experience that the digitalization of work has influenced the employees' job demands? - In what ways has the digitalization of work changed work tasks and routines for employees? - Is there any particular function/competence that is especially important to efficiently cope with ICT demands at work? - What digital competence do the employees in the organization/industry have, in general? - How does the company work to ensure that employees can efficiently cope with the new technology and ICT demands at work? - How do you consider the digital competence in the recruitment of new employees?
<u>Resources and support</u>	What kind of support is needed for your employees to cope with the technology and ICT demands effectively? - What kind of support is offered in your organization/industry to cope with the ICT demands? - How is the availability of time to learn to handle new technology and digital tools in your organization? - What do you do when the technology fails to work properly? - Is the support sufficient? If not, what is missing?
<u>Professional identity</u>	Does the digitalization and ICT demands influence the professional identity? If so, how? - Has the digitalization influenced the relationship or contact with customers/clients? If so, how? - Are the employees dissatisfied with anything related to digitalization of work? If so, what?
<u>IT systems and usability</u>	How well are the IT systems and digital tools in your organization adapted to the employees (users)?

Table 3 (continued)

	- How well are the IT systems and digital tools adopted to your organization/industry?
<u>Surveillance and security</u>	How do you experience that the digitalization has influenced the employee security? - Better or worse? More or less risks? What is your experience of digital surveillance at the workplace?
<u>Future scouting</u>	What you think that the digitalization of work will look like in your organization/industry in the future? - How do you believe that will influence the work environment?
<u>Closing question</u>	Is there anything I forgot to ask about, or anything else you would like to add to the interview?

Table 4
Description of the coding process.

<u>Step</u>	<u>Description</u>
1. Familiarization with the data	Reviewing the data thoroughly
2. Development of a coding scheme	Creation of a framework outlining categories based on research objectives
3. Open coding	Identifying concepts without preconceived categories
4. Creation of code definitions	Defining each code clearly
5. Organizing codes into categories	Organizing group related codes together
6. Iterative processing	Continuously refine the coding scheme
7. Peer-review and inter coder reliability	Consistency check among coders
8. Code application and data segmentation	Applying codes to the entire dataset
9. Data reduction and synthesis	Summarizing and synthesizing coded data

results with high transferability when conducted accurately (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004). Regular discussions among all authors were held to reach a consensus on the interpretation of the data, considering alternative interpretations to ensure the robustness of the analysis.

3. Results

3.1. Managers' and safety representatives' perceptions of digitalization's impact on required skills and competencies in job descriptions

Managers and safety representatives understanding how digitalization has influenced the required skills and competencies for job descriptions in these industries is a complex matter (Table 5). Digitalization has partially reshaped the required job competence in these industries. Participants noted that the contemporary workplace imposes various requirements related to the digital work environment, emphasizing the essential need for individual resources in terms of basic digital competence to effectively navigate the associated demands.

Table 5
Content analysis of managers' and safety representatives' perspectives on the digital work environment.

Theme	FACING THE DIGITAL WORK ENVIRONMENT IN THE TRANSPORT-, LOGISTICS AND HOME CARE INDUSTRIES						
Categories	Job competence and demands			Benefits of digitalization of work		Organizational and management resources for a healthy and sustainable digital work environment	
Sub-categories	Digital competence	ICT demands	Administrational demands	Facilitated and efficient work	Support and security	Support and education	Routines, planning and transparency
Codes	Digital competence required	Accessibility and boundaryless work	Information overload	Communication and information exchange	Feedback on work	Management and motivation	Encourage digital boundary setting
	Generation differences in digital competence	ICT and attention disturbances	Increased administration	Optimized planning	Supporting professional practice	Time and opportunity for practical training	Schedule with a margin for recovery
	Insufficient practice in digital tools and ICT	Usability concerns	Intensified schedules	Facilitated administration	Control and traceability	Need-adapted and flexible support	Attention and secure ICT use
		Insufficient information on system implementation	Real time planning	Automatized work	Digitalization and security	Implementing systems with high usability	Transparency of system use
		Digital vulnerability		Reduced ergonomic strain	Digital surveillance and security	Backup plan for system outage	

They have been working in the same way for 10–15 years, and then someone comes in with new stuff, new technology, new things that they do not really understand. How they are forced to learn new things. T2 (Manager)

Additionally, all participants in this study agreed that different age groups have varying levels of basic digital skills. Younger generations of employees tend to be more digitally proficient, in general.

One thing to consider with home care is that many of those working here are older, and many are somewhat uncomfortable with technology. They lack in the training or in the interest. H8 (Manager)

Moreover, numerous participants highlighted that employees had inadequate organizational resources in term of insufficient time and opportunities to learn and practice how to use digital tools and ICT.

I find it a bit disappointing that they have not provided sufficient training in these specific digital tools that we are supposed to use, such as the computers. And how they actually should be used in practice. T3 (Safety representative)

3.2. Managers' and safety representatives' perceptions of digitalization's influence on job demands in the transport, logistics, and home care industries

Managers and safety representatives perceive that the digitalization of work in the included industries has resulted in increased ICT demands and administrative demands (Table 5). Regarding ICT demands, digitalization increases accessibility, making boundaryless work a risk. Participants noted instances where employees kept their work mobile devices active beyond official working hours, contributing to increased strain. Some participants noted that repeated employer calls during the day further intensified employee strain.

The approach of having a mobile phone is that you are available all the time. Then you may develop a habit of using your phone constantly, and thus also become available for work during times when you should not be working. T6 (Manager)

ICT could also lead to attention disturbances at work, posing a

potential security risk for both employees and others with regard to traffic safety. Participants reported instances where some employees engaged in phone calls or, in extreme cases, watched videos on their phones while driving.

Even though people are accustomed to working with phones and tablets, they are not accustomed to doing it while, for example, driving a forklift. There, we obviously see a risk. L4 (Manager)

In addition, some participants highlighted frustration related to poor usability, encompassing systems that do not function optimally with regard to utility, ease of use, and efficiency. This was exemplified in home care, for instance.

Some things have not worked in the mobile app, such as contacting the nurse. In that case, I have to go through the computer, make a request, and write to the client. It should work, but it did not. That is really a deficiency. H6 (Safety representative)

Concerns about the lack of transparency regarding the implementation plans for new systems were also reported (mainly from safety representatives).

They implement things (systems) and only afterwards do they address communication. I believe they are doing it the wrong way; they should provide information first. L5 (Safety representative)

Participants also discussed vulnerability linked to digitalization. They highlighted how the majority of tasks, especially in the transport and logistics industries, rely heavily on functional technology for proper accomplishment. This dependence makes the work vulnerable to challenges, such as power outages or hacker attacks.

The more you automatize and digitalize, the more dependent you become on a "plug." If the power goes out, if the program gets hacked ... Then you are basically stuck and cannot do anything. L1 (Manager)

Concerning increased administrative demands, participants noted that, while ICT serves as an effective tool for information disseminating, employees often cope with substantial volumes of information, resulting in a cognitive burden and information overload.

They (the employees) find lots of information in the system, and they have a map of how to get to different clients. There is much more information now for the employees to handle. H7 (Manager)

Moreover, increased administration denotes a work context with heightened demands for digital administrative tasks, requiring employees to work more intensively, potentially impacting their ability to recover during the workday. In the transport industry, for instance, participants noted that drivers are obligated to provide continuous digital updates on their routes.

The amount of administration has increased. I mean, you have to inform about when you're leaving, when you arrive, and then you have to inform when you get in touch with those who can unload the goods [...]. The transport must be trackable all the time. T8 (Safety representative)

Furthermore, digitalization in terms of administrative systems allows for enhanced efficiency in filling schedule gaps, implying intensified schedules. Participants observed that this might further limit opportunities for micro-breaks and recovery due to the streamlined scheduling process.

Every moment is scheduled, and this becomes even more evident when it comes to their breaks. Yet, it also allows us to clearly identify where there used to be gaps, enabling us to fill them with client visits. H7 (Manager)

Additionally, participants noted that digitalization through data management systems introduce a challenge wherein new orders for goods arrive at irregular intervals, complicating the planning of daily workloads for employees. This unpredictability can diminish employees' sense of control, leading to heightened stress levels.

It would be easier for me if I had everything that we were going to do at 7 in the morning [...] Now, it can be that we have 100 orders in the morning and then at 12, we have 5,000 orders. I exaggerate somewhat, but it is not that easy to plan the day. L2 (Manager)

3.3. Managers' and safety representatives' perceptions of the work environment benefits of digitalization in the transport, logistics, and home care industries

Managers and safety representatives perceive that the digitalization of work enhances facilitation and efficiency in the work processes, as well as strengthened support from the security perspective, resulting in crucial benefits (Table 5). The digitalization of work has streamlined communication and information sharing among employees, managers, and other stakeholders. Participants noted that this enhanced communication and information flow occurred from various perspectives, including real-time communication and access to both individual and shared information.

In our systems today, we are able to communicate a completely different type of information than we used to. If something happens now and I need to share it, I can easily send it to all the drivers, and they will receive the information immediately. Previously, I had to run down to the warehouse and look for everyone. L4 (Manager)

Additionally, some participants highlighted the use of data management systems containing pertinent information, such as schedules, orders, driving routes, and client details. These systems played a crucial cognitive resource in enhancing coordination and planning for employees. The incorporation of real-time updates within these systems further facilitated a continuous improvement in planning processes.

They (the employees) have a schedule on their phone where they can track their visits in real-time, and they can also see their co-workers' visits, which makes it easy to see who to ask for help, who is behind, and who is ahead. H8 (Manager)

Participants also emphasized how administration systems facilitated

administrative tasks, such as managing vacation requests, handling orders, and reporting deviations — a significant aspect across all included industries. This highlights the capacity of digital administration to minimize processing time, thus enhancing efficiency and productivity.

We have just launched an app that was developed to facilitate for the employees, regarding phone lists, vacation requests, and many different things. Report issues with the truck, etc. T2 (Manager)

Participants from the logistics and transport industries outlined the advantages of automated work. In logistics, for instance, they exemplified this through the implementation of the automated storage and retrieval system 'AutoStore,' which utilizes robots to efficiently manage storage and picking processes.

AutoStore is a system where the picking locations come to you [...] It's an efficient storage solution with multiple bins that the robot drops into compartments where an employee stands and picks from, and then it rotates out constantly. L1 (Manager)

The automation or digitalization of work duties and processes can also imply a physical resource in terms of reduced ergonomic strain. Participants commonly mentioned that these technical solutions alleviated physical discomfort for employees, particularly in scenarios involving repetitive heavy lifting, such as handling goods in transport or logistics, or carrying grocery bags in home care.

About the fact that the clients get help to order grocery shopping online, I think that's a big advantage for the employees' work environment. The grocery bags are often very heavy. H1 (Manager)

Regarding digital support from a security perspective, the employees could receive digital feedback on their work. For example, participants from the transport industry highlighted systems that provide feedback to drivers based on their driving behavior, aiming to enhance driver safety and reduce the risk of accidents.

We can see the driving technique, and we can also see the average consumption, which is important to us. That our drivers receive feedback on it. T6 (Manager)

Detailed digital strategies were commonly employed to inform and remind employees about safety issues and ergonomically beneficial lifting practices, underscoring the potential of digital tools to support and enhance professional practices.

We also work a lot with safety in the app. Weekly reminders to actually think about truck safety, and to think about lifting correctly and such things. L4 (Manager)

The digitalization of work was noted for its positive impact on security matters for both employees and clients. For example, participants from the home care industry highlighted the advantages of using digital keys for clients, citing improved security and efficiency as crucial benefits.

If a client calls and no one is scheduled for that client, then one has to go back to the office, get a key, and then go there. But with Care Lock installed, it will be much easier. H8 (Manager)

Digital surveillance was acknowledged for its significant potential in enhancing employee safety, particularly in unexpected situations. However, participants emphasized the importance of using digital surveillance while maintaining respect for employee privacy and integrity. In the transport industry, video recording activates selectively, such as during heavy braking or when initiated by the driver. Extended stops beyond the expected duration were also noted as a security consideration.

There is also a safety aspect to this. If we start thinking about where a car is and why it has been stationary for so long, it may be that something has happened to the driver. T4 (Safety representative)

3.4. Management strategies and resources for managing job demands in a digitalized workplace

From a management perspective, managers and safety representatives endorse support and education, as well as standardized routines, planning, and transparency, for balancing job demands in the context of increased digitalization at work. Participants described managerial strategies aimed at encouraging employees to explore the potential of digital tools, emphasizing their benefits. These strategies are underpinned by a policy of proactive risk assessment, aimed at reducing the risk that the introduction of new technologies could compromise employee well-being.

For a manager, in any case, I believe it is crucial to try to highlight the benefits of technology. One should strive to showcase the positive aspects of technology and the advantages it brings. H5 (Manager)

Moreover, it was emphasized that a successful system implementation necessitates dedicated working hours for practical training on system usage.

One must ensure that those using the technology have the chance to learn how to use it effectively—time to make mistakes, time to test. Not just being handed something and expected to test it while in full production. T8 (Safety representative)

The participants noted that the requirement for education and support varies when adapting to a new system, emphasizing the importance of need-adapted and flexible support.

During the introduction, employees are responsible for their own phones when walking alongside a colleague. For some, having the phone during the walk suffices. For others, it isn't enough, so we schedule specific times for them to sit down with a planning leader, myself, or a colleague to delve into it more thoroughly. H8 (Manager)

The participants emphasized the importance of systems with strong usability, highlighting their value as physical, cognitive, and psychological resources in the digital work environment. They stressed the need for systems that are easy to use and well-suited to the organization, considering both employees' needs and their level of digital competence.

The IT system shouldn't be difficult to use. When it's challenging, people tend to avoid using the system and opt for another tactic. In this case, the system works better now than it did before. T6 (Manager)

Another crucial aspect of the digital work environment is managing the vulnerability associated with technology dependence. Participants highlighted the necessity of having organizational resources in term of backup plans in place for both production and safety reasons in the event of a system outage.

The backup is always there, and sometimes the old way isn't wrong. In those situations where it simply fits, one shouldn't remove the possibilities because the Internet is indeed sensitive. L3 (Manager)

Regarding routines and planning, the participants suggested setting clear organizational and personal boundaries within the digital work environment. This would support recovery and mental detachment from work, serving as both a physical and psychological resource. For example, participants recommended strategies such as turning off work phones after working hours.

An essential aspect of this process, involving digital tools, is the ability to use them during work and equally important, to be able to turn them off when not working. T6 (Manager)

A drawback of work digitalization in these industries is the potential for intensified schedules. Participants noted that schedules should be organized realistically, considering the employees' work environment, to allow for micro-breaks. A schedule with increased time margins

would enhance employees' sense of control and provide opportunities for recovery. By incorporating these strategies, managers strive to create work schedules that not only meet operational demands but also prioritize employee well-being.

It's important for the employee to have continuity. Mentally, they prepare before, whether consciously or unconsciously, they are going to their job ... When it comes to the digital aspects of schedules, customers, and tasks, a coordinator needs to possess a good understanding. H4 (Manager)

Numerous participants provided examples of situations where ICT use could act as a distractor or stressor, possibly impairing traffic safety. To address this, the participants proposed guidelines for realistic driving estimates and methods of ICT usage, particularly emphasizing safe practices during driving.

There is a requirement for hands-free when driving a truck, and it's the same when we operate a forklift. If you're going to drive a forklift and talk on the phone, you need to have one ear free [...] so you can hear if something happens around you. L4 (Manager)

Finally, to prevent misunderstandings pertaining to system usage, especially with digital surveillance systems, participants stressed the importance of transparency in communicating how and when these systems are employed.

The drivers had doubts, like 'Hey, now can you hear when I snore at night?' ... We had to clarify that this camera has no sound recording. We can't control it from the office, as it starts automatically when you suddenly brake or crash, or if you yourself activate it by pressing a button inside the cabin. T1 (Manager)

4. Discussion

The aim of this study was to explore how managers and safety representatives perceived the impact of digitalization on job demands, required skills, work environment benefits, and the resources and strategies needed to effectively balance these demands within the transport, logistics, and home care industries. The findings underscored that the digitalization of these industries has not only transformed their work environments but also redefined the required job competence. The results indicated that digitalization brought about substantial transformations in these industries, influencing both job demands and resources.

Regarding the JD-R model, a range of social and organizational job aspects that require sustained physical or mental effort have been identified from the perspectives of managers and safety representatives concerning the digital work environment within the included industries. Concurrently, the digital work environment is linked to reduced physical demands in these industries. The social and organizational job aspects encompass demands for digital competence, administrative challenges such as information overload and intensified schedules, as well as ICT demands including accessibility, attention disturbances, usability concerns, and digital vulnerability. The results, consistent with earlier research (Palumbo & Cavallone, 2024; Rasool et al., 2022; Tarafdar et al., 2007), underscore the notion that the digitalization of work may precipitate work intensification, imposing heightened demands on employees to perform tasks with increased speed and effort. Notably, employees in these industries often contend with minimal autonomy in determining how and when their work responsibilities should be fulfilled, thereby increasing the exposure to job strain (Karasek & Theorell, 1990). It has been found that heightened job demands, including work intensification, lead to detrimental effects on employees' well-being by invading their psychological detachment from work and hindering micro-breaks and recovery from work-related stress (Albulescu et al., 2022; Büchler et al., 2020; Demerouti et al., 2009). Recognizing the fundamental role of recovery in sustaining good health over the long-term, organizations should institute work policies that facilitate

adequate recovery, addressing occupational health concerns comprehensively. In essence, fostering an environment that prioritizes employee recovery is imperative to mitigate the risk of exhaustion and promote overall well-being in the face of increasing digitalization in these industries.

Revisiting the JD-R model, managers play a crucial role in ensuring that employees have access to adequate job resources, which are essential for mitigating the negative effects of high job demands and enhancing motivation and engagement, thereby bolstering work performance (Bakker & Demerouti, 2007). In the context of the digital work environment within the included industries, managers and safety representatives identified several physical resources, such as support from lifts, automated picking systems, and other automated processes. However, the availability of psychological resources, particularly in terms of autonomy in tasks related to the digital work environment, was found to be limited. Social resources, which could include need-adapted and flexible support, transparency in system usage, and encouragement of digital boundary setting, are essential but may be constrained by highly intensified work schedules. Moreover, organizational resources in the digital work environment were described, including security measures related to surveillance and digital feedback on performance. However, tight schedules limited colleague interaction, further reducing the potential for social resources. A previous study observed that, although the digitalization of work could foster richer and more continuous exchanges across the organization, bridging distances and differences, it was expected to disrupt face-to-face interactions, with negative implications for the quality of workplace relationships (Bregenzer & Jimenez, 2021). Another study noted that collegial cooperation and employee decision-making can help alleviate the challenges of the digital work environment when new technology is introduced (Palm et al., 2024). This highlights a critical need for a more balanced approach that not only emphasizes the provision of physical and organizational resources but also prioritizes the development of psychological and social resources, which are crucial for sustaining employee well-being and long-term performance in increasingly digitalized work environments.

Previous research suggests that digitalization can strain employees' work ability, particularly when adequate support and training are lacking, potentially leading to reduced well-being and job satisfaction (Bregenzer & Jimenez, 2021). The findings of this study indicate that digitalization in the industries examined requires the development of new professional skills. Additionally, the learning processes within these professions have shifted from a more practical, hands-on approach to a more logically oriented one due to the influence of digitalization. Enhanced digital competence, including skills such as digital literacy, data literacy, and technical proficiency, has become increasingly valuable in these industries. Digital competence is now considered to be essential for successful technology integration in the modern workplace (Bhattacharjee et al., 2020; Ilomäki et al., 2016; Schirmer et al., 2023). Additionally, the shift in professional learning approaches reflects the growing impact of digitalization. From a work ability perspective, challenges may arise as new ICT demands emerge, given that work ability is closely tied to competence, work experience, and learning, as outlined in the second floor of the Work Ability House model (Ilmarinen, 2019). These factors are influencing new job routines, including ICT requirements. This may also help explain generational differences in digital competence observed in this study and previous research (Bhattacharjee et al., 2020; Schirmer et al., 2023), suggesting that changes in work processes may be more critical than age itself. To effectively adapt to the digitalization of work in these industries, the findings suggest that managerial strategies encouragement, dedicated time for practical system training, need-based support, and the implementation of systems with a good usability are crucial for all employees.

The results showed that digitalization offers several work environmental benefits, particularly in enhancing safety and security, improving information exchange, and facilitating administration. Strengthening security is crucial for reducing the risk of work accidents

and injuries, which are common in occupations involving high physical demands and the use of large machinery or vehicles. These findings are consistent with previous research, which has also highlighted the positive impact of digitalization on workplace safety and efficiency (Albrecht et al., 2024; Leviäkangas, 2016; Persson et al., 2023).

Overall, the findings in this paper align with expectations in many areas. However, one particularly surprising insight is the extent of ICT use and its impact on attention among workers in these industries. ICT has become so ingrained as a communication tool and source of distraction that even professional drivers reported using it extensively while driving, with extreme cases including watching films while operating vehicles. In the logistics and transport sectors, the repetitive and sometimes monotonous nature of the work can lead drivers to use ICT as a means of staying connected with colleagues or simply as a distraction. Similarly, participants from home care mentioned that some employees are using smartphones while cycling or driving, often to stay in touch with colleagues, check routes, or read medical records. This behavior presents a significant safety risk, not only to the workers themselves but also to others around them (Albrecht et al., 2024). However, the solitary nature of these jobs might drive employees to seek increased interaction through ICT, highlighting a complex trade-off between social connectivity and safety. Managers play a crucial role in this by conducting thorough risk assessments to identify potential hazards associated with ICT use in transit (Albrecht et al., 2024). These assessments inform the development of guidelines and policies aimed at minimizing distractions and ensuring that technology supports, rather than compromises, safety on the road. By proactively addressing these risks, managers help create a safer work environment for employees.

When considering what organizational resources are needed for employees to effectively cope with the digital work environment, it is essential to delve into what constitutes an ideal digital workplace in the included industries. One aspect worth discussing is whether achieving this ideal scenario is feasible or merely a utopian concept. Nevertheless, striking a balance between technological development and maintaining a healthy work environment is crucial. Promoting a healthy and sustainable digital work environment requires collective efforts from both employers and employees, introspection, clever decision-making, and a dedication to prioritize occupational health simultaneously with other incitements within the workplace, such as productivity, achievement, and organizational growth (Trenerry et al., 2021). Managers themselves also stand to derive considerable advantages from augmenting their comprehension of the digital work environment, given that previous research revealed pronounced exposure to high ICT demands in this cohort (Stadin et al., 2021). The ideal digital work environment can be perceived as a goal that encourages continuous improvement of the work environment, rather than being dismissed as an unattainable vision.

4.1. Strengths and limitations

The current paper, like all research, possesses both strengths and limitations concerning its study aim and methodology. The adoption of content analysis as a robust tool for qualitative data examination (Elo & Kyngäs, 2008; Graneheim & Lundman, 2004) was a notable strength. Similarly, utilizing a semi-structured interview guide offered advantages of both structured and unstructured interviews, ensuring the acquisition of comparable, reliable data with the flexibility to pose follow-up questions while maintaining interview coherence (Kallio et al., 2016; Wilson, 2014). However, content analysis has its disadvantages, including the potential for bias. Instances of bias, such as recall bias stemming from participants struggling to accurately remember past events, and potential interviewer or participant bias, could influence the outcomes. Moreover, interviewing only managers and safety representatives, rather than directly engaging with employees, raises concerns about potential bias in interpreting the digital work environment. However, a previous study involving employees, managers, and safety

representatives found that safety representatives and employees frequently shared experiences with regard to the digital work environment (Palm et al., 2024). In addition, including managers and safety representatives provides a broader understanding of strategic initiatives, policy implementation, risk assessment, resource allocation, and the organizational culture surrounding digitalization. Leadership behavior regarding digitalization can either mitigate or exacerbate employee stress (Bregenzer & Jimenez, 2021; Palm et al., 2024). Additionally, their influential positions within the power structure, allowing direct impact on the work environment, support the validity of this recruitment strategy.

Another aspect to consider is the risk of social desirability bias, which may manifest if participants provide responses perceived as socially acceptable rather than truthful (Althubaiti, 2016). To mitigate social desirability bias, the participants were asked to not only reflect on their organizations, but also on the industry as a whole concerning the digitalization of work. One limitation of the study is the gender distribution: all participants in the transport and logistics industries were men, while all participants in home care were women. This may affect the transferability of the findings. However, these industries were strategically selected to represent male- and female-dominated sectors, providing a more comprehensive understanding of the digital work environment in blue-collar jobs and home care. The purpose of this paper was not to compare these industries. Efforts were undertaken to enhance credibility, including double-coding and comparison of three interviews from each industry, as well as incorporating interdisciplinary input from co-authors with backgrounds in ergonomics, occupational health, public health, occupational therapy, sociology, and human-computer interaction. The results of this study can primarily be transferred to the experiences of managers and safety representatives in the transport, logistics, and home care industries in the Western world. However, transferability may be influenced by minor cultural or legal differences. However, the findings in the present paper should ideally be complemented with studies exploring the employee perspective, as well as quantitative research designs exploring the association between job competence, ICT demands, resources, recovery and leadership styles in the included industries.

5. Conclusion

The digitalization of the transport, logistics, and home care industries has transformed the work environment and the required job competencies. Digital competence has become essential to manage current ICT demands and administrative demands. While digitalization offers benefits such as enhanced safety and improved information exchange, it can also reduce autonomy and flexibility due to increased traceability and intensified scheduling. To address the new job demands in these industries, organizations should invest in employee support and education, allow time for recovery in schedules, be transparent about system use, and encourage setting digital boundaries after work. These efforts are particularly crucial and challenging in sectors with low educational levels, high numbers of employees from immigrant backgrounds, and high turnover rates.

Ethical approval

All procedures performed in the study were in accordance with the ethical standards of the Helsinki declaration (World Medical Association, 2018), or comparable ethical standards. This study has been approved by the Swedish Ethical Review Authority # 2022-02587-01.

CRediT authorship contribution statement

Magdalena Ramstedt Stadin: Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Simon Asplund:** Writing –

review & editing, Validation, Project administration, Formal analysis, Data curation, Conceptualization. **Teresia Nyman:** Writing – review & editing, Methodology, Conceptualization. **Magnus Svartengren:** Writing – review & editing, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Therese Hellman:** Writing – review & editing, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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