Workers and New Technology? Analyzing the Complex and Multidimensional Relation through Job Quality[1]

Bjarke Refslund[2]
Aalborg University, Department of Sociology and Social Work, Denmark

ABSTRACT

While the impact of new technology on work is vast, our knowledge remains somewhat fragmented, particularly from a workers' perspective. This article applies job quality as a multi-dimensional approach to contribute to deepening our understanding of the effect new technology has for public sector workers in Denmark. Job quality is a multi-dimensional concept, and the technological development has a different impact on the various dimensions leading to somewhat mixed results. Despite studying different occupations, the impact on some dimensions was clearer: the results show how worker autonomy is challenged by new technology, the physical work environment is improved, and levels of workload, stress, and job intensity are being more negatively affected. Overall, new technology is improving some dimensions of job quality, worsening others, and yet other dimensions remain less affected, contributing to the overall complexity. However, there is a subjective dimension, with the same technology having varying impact on workers.

KEYWORDS

Digitalization / job quality / new technology / trade unions / worker participation

Introduction

Job quality has long been a prism for analyzing work, but it remains conceptually complex and somewhat ambiguous (Findlay et al. 2013; Warhurst et al. 2022). At its core, job quality reflects multiple dimensions of work organization, working conditions, wages, skills and skills match, autonomy, participation, as well as health and safety at work—which are all important dimensions which may be strongly influenced by the technological development. Numerous studies investigate the impact of new technology on certain dimensions of job quality, like autonomy (Trusson et al. 2018) or skill formation (Holm & Lorenz 2022). Obviously, it is important to understand the effect on the single dimensions, but we also need to understand the overall, multidimensional effects new technology have on job quality. It is particularly important to include the workers' perspective, wherefore a broader, worker-based perspective is offered by this article. Accordingly, the overarching aim of the article is to scrutinize the *workers' perspective* on new technology and job quality through a multi-dimensional understanding of job quality. There is an individual dimension to job quality, which means that a 'good job' is not necessarily the same for all workers. This makes qualitative research well positioned to investigate the workers' different perspectives on how new technology impacts their everyday life and work across different occupations. The article scrutinizes the effect of new technology for public sector workers in Denmark. The Danish public sector has a

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[2] Corresponding author: Bjarke Refslund. E-mail: bref@socsci.aau.dk

high level of new technologies applied, making the context well suited for studying how new technology impact the different dimensions of job quality (Petersen & Schou 2020). Moreover, Denmark along with the other Nordic countries remain well-regulated labor markets with enduring strong representation and involvement of workers and unions in workplace level changes. Hence, the article contributes with new knowledge on how digitalization affects the daily working life in the Nordic countries. Especially the multi-dimensional approach applied along with the conceptual patterns identified can provide new insights, that can then be further scrutinized in future research.

The grand discussion of the impact of technology on the quality and volume of work is by no means new and it dates back (at least) to the first industrial revolution; nevertheless, it seems to have (re-)gained impetus in the first part of the 21st century (Wajcman 2017). Much of the debate since the turn of this century over new technology's impact on work has revolved around the future trajectory of job development. Many arguments have been characterized by various degrees of technological determinism combined with a strong focus on the potential job losses following automation, potentially leading to a 'workless' future (Ford 2015). However, this approach has also been strongly criticized for being overly simplistic and ignoring the societal impact and human agency, as well as the embeddedness of technological development in the political economy. Much of this critique has come from the social shaping of technology tradition (SST) (Howcroft & Taylor 2023; Wajcman 2017), which argues that economics, politics, work organization, existing technology, gender and societal settings, among other factors, influence the way technology is used and shaped in society. Nevertheless, we still know less about how workers experience the overall technological development and its impact on their daily working life and their working conditions.

This article accordingly seeks to contribute toward this research agenda by applying a qualitative approach that emphasizes the workers' experience of technological development. In doing so, I draw on the 'social shaping of technology' approach. In this tradition, the technology also matters, and it thus rejects 'social determinism', where the societal setting determines the use of technology (which can be seen as the reverse perspective to technological determinism (Howcroft & Taylor 2023: 354)). As the aim of this article is not to solve the debate over which of these approaches explains most of the current development, I draw on a pragmatic position, mainly using the SST-framework as a heuristic device to underline the linkages of technology and societal developments as complex and 'mutually constitutive', emphasizing that both the technology, the societal setting, and organizational processes matter (MacKenzie & Wajcman 1999). The results presented in this article clearly support such a line of reasoning, where the technology and the societal development are mutually dependent on each other and accordingly develop in tandem.

I furthermore start from the premise that there is an ongoing acceleration process, which increases the *pace of change* in the world of work, as argued by Hartmut Rosa (2014). Rosa distinguishes between three categories of acceleration: technological, social change, and the pace of life itself (Rosa 2014). All three are important for working life, but I emphasize here the technological acceleration, where automation, robotization, computerization, the internet, and new ICT (information and communication technologies) are altering the everyday work life of millions of workers across the globe. Other technologies like machine learning and the use of 'big data' further supplement the ongoing technological acceleration. In this article, these various new technologies are

subsumed under the term *new technologies*. Obviously, this is a very crude simplification that ignores important differences and nuances. However, since the main aim of the article is to explore *how workers experience* the changes emerging from the new technologies and identify concepts and patterns that can be important for future research, we did not want to narrow down the concept too much. This obviously has the drawback that the empirical insights in some instances are somewhat fuzzy, but I explicitly seek to answer the call of Howcroft and Taylor (2023, p.365) for 'A shift in focus from singular technologies to sociotechnical networks or systems, [as this] will be increasingly necessary for understanding the challenges facing work and employment'. Accordingly, there is a broad view on technology, and rather than scrutinizing the different technologies affecting the workers, we invited the workers to talk about the technologies they found most important in regard to their working life and for their job quality. However, when the workers talked about specific technologies, this is highlighted.

The aim of the article is thus through qualitative, in-depth data from interviews and focus groups with workers and workers' representatives to provide novel insights on the following research questions: *How do workers experience the impact of new technology?* And following from this: *Which are the most important implications of the new technology for job quality from the workers' perspective, and why is this so?* The article proceeds as follows. First, the multi-dimensional concept of job quality is discussed as a heuristic frame, after which a literature review of the existing knowledge about new technology and job quality is presented. Thereafter, I turn to the methods and the context of the study before presenting the results. Finally, the results and the implications thereof are discussed.

Job quality—a multidimensional concept

While job quality is increasingly addressed by both scholars and policy makers, the multidimensional character, the difficulties in measuring the concept, and ongoing discussions over subjective versus objective approaches to measure it makes it a somewhat amorphous concept, which calls for conceptual reflections and clear conceptualization when it is applied in empirical research (Findlay et al. 2013; Warhurst et al. 2022). Moreover, there are different scholarly traditions measuring job quality, in particular, psychology that emphasizes the typically subjective individual dimensions; sociology emphasizing complex qualitative measures of work organization and control, and economics that often prioritizes wages and the volume of jobs. Here, I follow mainly the sociological tradition. There has been a range of attempts to develop measures that can be applied across countries and sectors to compare job quality (Holman 2013; Muñoz de Bustillo et al. 2011). These macro-level measures have been effective in expanding the understanding of job quality and, particularly, how job quality varies across institutional regimes, job types, and occupations. Here, I provide a short overview of the core elements typically applied in assessing job quality. Then, I address the five key dimensions of job quality I apply in the analysis. These five dimensions have been derived from the literature.

Although job quality is a multi-dimensional concept, some consensus on the key elements constituting (high) job quality have emerged (Berg et al. 2022). As a starting point, there is a distinction between the material dimensions of job quality reflecting pay levels, working time and career prospects, and the dimensions that relate to qualitative

elements such as job content, work organization, autonomy, intrinsic motivations, and labor processes. Occupational health and safety (OHS) can be added as occupying a middle ground and having both a material and non-material dimension. It may be argued that wages and other 'material' dimensions is a separate issue, which is at the core of industrial relations research and labor economics. I argue that new technology does not have a direct effect (at least in the short term) on wages in my data and the case of the Danish industrial relations system; therefore, I stress the qualitative dimensions of job quality in this article. This is not to say that wages and other material dimensions of job quality are not highly important, but they did not feature as important in the qualitative data.

Some of the key dimensions typically highlighted in the literature (beyond wages) relate to the workers developing and utilizing their *skills*, where workers are challenged but in a way that matches their competences and skills [the demand/control model (Karasek 1979)], *discretion* in making choices in the actual job processes, and finally, *participation* in work-related decision-making (Findlay et al. 2013; Gallie 2013). Job quality also relates to workloads, where the acceleration thesis of Rosa (2014) (among others) suggests that workloads and work-pace are increasing, resulting in an *intensification* of work which typically leads to reduced job quality (Green 2001). There are indications that, in particular, digitalization can lead to increased workloads, for instance due to increased demands for documentation (Green et al. 2018). Lastly, both physical and psychosocial *health and safety* are included in the evaluation of job quality. I use these five key dimensions: skills/demand, participation, discretion/autonomy, job intensity, and (occupational) health and safety derived from the literature to analyze the data on the workers' experience with new technology. To underscore the complexity of the term job quality, I argue that these five dimensions may be pointing in different directions. Consequently, we might think of a certain job having a good balance in terms of skills demands, discretion, and participation, but which is nevertheless unhealthy in terms of, for instance, high workloads or physical strain, which makes an overall (clear-cut) assessment of its job quality difficult to achieve.

Previous research has shown how micro, meso and macro factors contribute to shaping job quality outcomes of new technology. This article emphasizes the worker's experience at workplace level experience (and hence the micro-level) of job quality, which is somewhat underdeveloped in the literature on technology and job quality. The study took a rather explorative approach, where we emphasized the workers' experience with new technology and how it impacts job quality. While the impact of new technology mainly occurs at the workplace level, the organizational (meso) as well as the political-economic (macro) levels do also shape the effects, as stressed by the SST-approach, which is utilized as a general framework in the article.

Whether we should strive for a purely 'objective' measure, or a more subjective measure of job quality (like 'job satisfaction'), is still somewhat debated in the literature (Berg et al. 2022; Findlay et al. 2013). However, as I emphasize, the workers' own experience with the new technology there is a subjective element, and I further note here that many findings in this study are both complex and somewhat ambiguous, partly because different workers may perceive the same element differently. For example, some workers enjoy the flexibility of answering emails at any time, while others find it stressful (Shevchuk et al. 2019).

Literature review: new technology and job quality some evidence

Only a limited number of studies in sociology of work focus specifically on how new technology and job quality are connected, and there are only very few qualitative, worker-centered studies. However, many studies address the job quality-technology nexus through either a *single-dimension of job quality* or through *a specific technology*. Some of these studies are included in the literature review, albeit is not possible to cover them all here due to the scope. Rather, the literature review will provide some background information for the article.

An overall finding from the literature review is that the results—regardless of whether the outcome of the studies is defined as job quality, safety, subjective job satisfaction, etc.—tend to be somewhat mixed, finding both negative, positive as well as mixed results for the impact of new technology on various dimensions of job quality. Berg et al. (2022) address the overall impact on job quality of a specific technology—robotization—across seven different domains associated with job quality, although at a very aggregated data level. They find negative impacts on skills, discretion, and working time quality, along with increased work intensity, but a positive effect on prospects for job security and future earnings growth. In a similar vein Antón et al. (2023) find, in a quantitative analysis of the impact of robotization on job quality that robots effect job intensity negatively but only for the period from 1995 to 2005 and not for later periods; they find moreover that robotization has no effect on physical environment, skills, or discretion. Other studies indicate that ICT and digitalization increase job intensity despite intentions of the opposite (Bergschöld 2018; Green et al. 2018). Trusson et al. (2018) find that ICT tend to lower job quality by reducing professional autonomy, as ICT is often characterized by a managerial logic rather than professional logic. Gundhus et al. (2022) reach similar results on police work, where they find that digitalization leads to both managerialism and lowered discretion for police officers. Hamblin (2022) also includes reflections on job quality in her analysis of new technology within adult social care and homecare, arguing that new technology may lower job quality through 'degrading' the care worker to a role as 'machine babysitter' rather than caregiver. Ertner (2019) in a similar vein show how new technology changes the role of care workers toward 'implementation agents' that are tasked with making the citizens use to the new technology. However, the work of Dupret (2017) shows how nurses make active choices to 'work-around' the technology in a way that sustain their professional identity. These studies illustrate how the role and identity of workers (in particular care workers, but also other workers) may be negatively affected by new technology, as is also shown in other studies (Frennert 2019; MacKenzie et al. 2017), but also that there can be ways for the workers to 'workaround' these negative effects (Dupret 2017). Conversely, there are also studies that suggest positive impacts; Menon et al. (2020) for instance found that the increased use of computers increased job discretion and that in general, computerization did not have any negative impact on working conditions. Gihleb et al. (2022) also found a positive effect of robots on job intensity (i.e., a reduction in job intensity) in the United States and Germany.

Considering both the positive and negative effects of new technologies, the general point from the brief literature review is that the overall impact on job quality tends to

be somewhat mixed (Berg et al. 2022), which reflects the complexity empirically, analytically, and theoretically. Further studies that underscore the complexity include Bisht et al. (2023), who report some paradoxical findings from Indian microfinance institutions, where digitalization has led to increased management control and poorer work-life balances, but at the same time increased job satisfaction and a sense of job security and status. Holm and Lorenz (2022) investigated the impact of AI on work and skill requirements and found that AI may not only result in less monotonous work (often taken as a measure of increased job quality) along with a higher learning potential, but also that it resulted in an increased job pace. Martin and Hauret (2022), reviewing mainly the existing economistic literature, also find that the relationship is ambiguous, but also suggest some evidence that manufacturing robots reduce the risk of injuries, and that digitalization reduces routine tasks. Other studies have highlighted how personality traits impact job outcome, for instance workers perception of techno-stress (Srivastava et al. 2015), which indicates that differences in personal preferences may also impact how new technology is perceived by workers as regards its effects on their job quality. Additionally, the literature has shown national variation in the responses to new technologies (Lloyd & Payne 2019; Peña-Casas & Ghailani 2023), reflecting previous findings that national differences in work practices, workplace regimes, and job quality are highly embedded in national systems (Gallie 2007; Holman 2013) and thus are more persistent than often assumed.

As this literature review reveals, there is still a lot of uncertainty about the connection between job quality and new technology (including digitalization), and there is a general lack of qualitative data addressing the impact on workers. This article takes a first step in the direction of a better understanding of the connection.

Methodology and research design

Data for this article were collected as part of a European comparative project on the impact of new technology and digitalization on job quality. The project focused on public sector workers, which remain highly important in the Nordic countries where up to one-third of the workforce is public sector workers. The Danish public sector employs a comparatively high share of new technologies (Petersen & Schou 2020), which makes it a good setting to study the impact of new technology. To cover the broader aspects of new technology from more than one occupation, we include three different (sub)-sectors: public administration, hospitals, and electricity production and supply. The fact that we analyze three different sectors obviously mean some details will be subsumed in a broader analysis, particularly the fact that there are different technologies in the different sectors. However, we seek to explore common themes and concepts for future research to address. The main data sources were interviews and focus groups. The research design emphasized the workers' experiences (in the focus groups and the interviews) combined with more overall perspectives provided by trade union and worker representatives. In total, 13 semi-structured interviews were conducted with 15 workers, trade union representatives, and officials (see Appendix 1), following an interpretative interview style, although with some general framework for questions laid out beforehand (Scheibelhofer 2023). Of the interviewees, nine were elected or hired union officials, including union top-management, three were shop stewards (two close to full-time

shop stewards at hospitals, but still working a few shifts, and one working as an electrician while functioning as shop steward), and finally three were regular workers. Overall, the main aim of the article is to provide new insights into how workers understand and experience technological changes, explore common themes across the occupations, and what these changes mean for their job quality. The interviews with workers and shop stewards in the three sub-sectors mainly revolved around their daily experiences with new technology, whereas the interviews with the trade union representatives took a more general perspective on the topic in the sub-sector, although also accentuating the workers' perspective. The interviewed trade unionists at the national level's experience with workplace technology typically was based on accumulated insights from their members. The unionists all worked with technology or had a specific interest in technology within the occupations their union covers and where specifically selected for the interviews based on their experience and insight with handling and implementing new technology. While they generally talked about second-hand experiences, their insights provided a good point of departure for data collection in the focus groups and the interviews directly with workers and shop stewards as well as important reflections based on the workers' statement and what the unionist found most important in regard to new technology and job quality. Moreover, the interviews with the trade unionist accordingly not only provide contextual knowledge about the industries and the different technological changes happening there but also valuable insights on the general level supplementing the qualitative interviews and the focus groups very well.

The interviews were conducted online between February and October 2022 and recorded (with one exception, where the worker preferred not to be recorded). All interviews as well as focus group interviews were conducted in Danish. The interviews with union and worker representatives lasted between 60 and 90 minutes, while the interviews with workers (interview 11–13, Appendix 1), which focused more specifically on certain aspects of job quality, lasted from 28 to 42 minutes. The online format of the interviews was chosen partly due to Covid restrictions in place at the time and partly out of logistical concerns. To keep an open approach to the new technology, we did not specify the technology in the interviews but rather left it to the interviewees to identify the most important technologies for them. This also reflects the fact that different occupations obviously worked with different technologies. Yet we tried to explore the common themes and patterns across the sample, despite the differences in technologies applied.

The three focus groups (one in each sub-sector) were conducted in early 2023 each lasting 2 hours, and the focus groups provide invaluable insights into the daily practices of the workers (Onwuegbuzie et al. 2009). The insights from each focus group were summarized in a research report, which were then used for analyzing the data. In all three sub-sectors, the relevant trade union helped facilitate the focus group. In the electricity sector, the focus group was conducted in conjunction with a union network meeting for worker representatives from the industry. A total of 27 electricians and technicians participated in the focus group representing two unions within the sector, but mainly from the electrician's union. The workers mainly do skilled electrician work like maintenance and repair of the transformers and installations on-site working individually. The author and a research assistant conducted the focus group which, due to the high number of participants, was divided into two groups which discussed the impact of new technology on their working life, before a concluding discussion across the two groups finalized the focus group. The focus groups in public administration and the hospital sector were

for logistic reasons conducted online and recorded via an online platform software. The focus groups in the hospital sector consisted of four workers who worked, respectively, as medical secretary, nurse, physiotherapist, and radiographer. The focus group in public administration consisted of six participants (including a union representative). The other five participants worked in the tax authority, the police, the correctional services (managing the prisons), and at a university. Two researchers took part in the two online focus groups, one being the author. The author facilitated the focus group discussions, while a research assistant made notes.

All in all, the combination of the focus groups and the interviews resulted in a rich and novel data set with qualitative insights both on the daily experience (mainly through the focus groups and the worker/shop steward interviews) and a more aggregated view on new technology and job quality based on the interviews with union representatives. The qualitative data were analyzed with a semi-open coding, centered around the five dimensions of job quality. Through an iterative analytical process (Morgan & Nica 2020), the main issues emphasized by the workers on the job quality dimensions of autonomy, participation, skills match, occupational health, and safety and job intensity, were analyzed. The categories were supplemented by other relevant aspects that came up in the analytical process (like the dimension of surveillance).

The context of the study

The effect of new technology on job quality appears to vary across countries (Peña-Casas & Ghailani 2023), just as there is significant national variation in job quality (Gallie 2007; Holman 2013; Oinas et al. 2012). There are moreover cross-national differences in how new technology is understood by the public and what effects it may have on work and employment. In the Nordic countries, there is generally a more positive approach to and understanding of the potential effects of new technology (Lloyd & Payne 2019; Marenco & Seidl 2021), and the Danish context is accordingly important for the results. Denmark is among the most digitalized economies in Europe and the world (Petersen & Schou 2020) and has constantly remained among the top of the European Commission's Digital Economy and Society Index (DESI). At least since the early 1990s, different Danish governments have initiated policies and strategies to improve digitalization (Refslund & Borello 2023). The Nordic countries, including Denmark, are typically portrayed as having a comparatively very high level of job quality (Gallie 2007; Holman 2013; Oinas et al. 2012). Moreover, public sector employment is important in the Nordic countries, with substantial shares of the workforce being public workers.

At the same time, the Danish economy and in particular the industrial relations system remain comparatively very regulated, with a strong and enduring trade union presence in most of the economy, both the private and public sector. Multiple-employer collective bargaining at the sector-level remains the overarching modus for regulating wages and working conditions (Andersen 2024). This makes trade unions a key actor, and the unions and in particular local shop stewards have an active role in implementing new technologies as the employers typically are obliged to negotiate these changes with the unions and their representatives (Lloyd & Payne 2025; Refslund & Borello 2023). While this is important in both the private and public sector, the tradition of

corporation and worker-involvement is particularly prevalent in the public sector. The unique industrial relations setting with a high degree of worker involvement combined with the advance use of new technology in the public sector makes the case well suited to produce in-depth insights into the effects of new technology on job quality.

Results

The empirical results emphasize the five selected dimensions of job quality: autonomy, skills/demand, participation, OHS, and job intensity. It is obviously not possible to engage very detailed empirically in all five dimensions in the limited space of an article, yet this is not the aim either, especially also since it spans different sectors and thus different technologies. Rather the aim is to illustrate the bigger, multi-dimensional picture across sectors and technologies of how new technology effects job quality. Additionally, I discuss some important, cross-cutting issues that arose during the analysis, before the discussion and conclusion addresses the findings on overall complexity.

Autonomy

While most of the empirical results are mixed in the sense that there are both positive and negative elements for the workers, the results on autonomy are clearer. Nearly all the interviewees and focus group participants across the occupations and sectors reported that new technology, mainly ICT-systems for planning and registration of tasks, tends to reduce or at least challenge their autonomy. One FG1 participant from the hospital sector said mainly reflecting on the planning and administrative systems: 'Before, we controlled everything from A to Z. But this independence has been taken away from us… and it is just so inefficient!'[1] The workers in the study generally felt that the reduced autonomy due to increased registration and documentation in ICT-systems also led to reduced efficiency and quality of the services they provide, and their own job quality. Again, this was felt quite uniformly across the occupations. Another interviewee (talking about hospital healthcare workers conducting the basic care tasks) said: 'Sometimes, you get the feeling that you could leave your brain outside before you go in' (INT7), and a radiographer in a focus group (FG1) stated: 'Previously we had to decide the amount of x-rays given, but now the computer does this, so in a sense we have become button-pushing machines' [simply approving the decisions taken by the machine].

The interviewees mainly referred to the work processes being controlled, registered, and planned increasingly by the ICT-systems as what reduced their autonomy and leaves them with a monitoring-function. Another example of the ICT-systems taking over tasks was given by an interviewed hospital nurse:

> Well, we joke a bit at night [she works night shift] that they have forbidden us to think for ourselves, right? That's because they list things. We have a [computerised] to-do list, and from that time to that time, this and that must be done. (INT13)

As the quote nicely illustrates, many workers in the study felt that the logic of their professions, as for instance nurses or electricians, was being contested by a different logic

that comes with the new technologies, which often emphasizes control and electronic assessments, over their individual assessments based on their professional training. While the control schemes typically are based on professional standards, the workers felt it overruled their professional discretion, for instance the nurse quoted above being allocated very specific time slots to each task, which did not always match their professional assessment. These results resonate with the findings of Trusson et al. (2018), who find that ICT systems often increase the dissonance between actions based on workers' professional logic and the often-inherent managerial logic of ICT systems, which in turn reduces the workers' autonomy. Consequently, it is problematic when the workers' professional assessments and evaluations are overridden by digital technologies (Holm & Lorenz 2022), which, however, was frequently reported by the interviewees. Yet, a few workers in the study did not experience the same decline in autonomy, for instance as shown in this interview with a hospital nurse:

> [Interviewer:] Do you find that technology makes it easier for you to decide about your working day, i.e. to structure your time better, because you get the help of technological tools?
> INT11: No, I generally don't think so.
> [Interviewer:] But you don't find that it makes it worse then?
> INT11: No, but some things become a separate task in themselves, like entering [electronic] documentation, but you also had to do that before.

This confirms previous studies that in some instances, new technology may lead to more professional discretion not less (Bergquist & Rolandsson 2022). However, for most of the public sector workers in this study, autonomy is closely related to their work identity and professional values, and they feel that these are at least partly challenged by digitalization and new technology (cf. MacKenzie et al. 2017). The importance of their occupational values is particularly a reoccurring theme among nurses and healthcare workers as well as social workers, who often have a strong ethical understanding of their obligation to care for patients and citizens. As a hospital worker (FG1) said mainly reflecting on the general impact of ICT-systems:

> I think there is also an element of culture here… we keep hearing that 'this is about human lives!', 'this is not just a factory', etc. This [attitude] lives on, and rightly so! … so we don't dare trust the technology.

Accordingly, there are worries broadly among the care workers and social case workers in the data over the quality of the public service they can provide, and that there is less time for caring for citizens/patients both in public administration and hospitals. A worker in an elderly care home stated: 'And at the same time, we spend a lot of time registering all sorts of things [in the ICT documentation systems], when I would rather have used the time with the citizens' (INT12). Some of the same concerns over professional and occupational identity were found among both public administration workers and electricians as well, albeit from a different angle. An electrician in the focus group stated:

> We are no longer obliged to make professional assessments—the app does this for us. It removes our professionalism. It is no longer up to me to say whether the distribution

> board needs fixing. No one expects me to open and check it, you just get a message about it. But when our responsibilities are taken away, you also lose the quality of your work. (FG2)

An overall finding is that the workers generally were critical toward the effects of new technology, mainly ICT-systems, on their autonomy, with several examples given of the workers' assessments and hence autonomy being greatly stifled, mostly by time and task management ICT-systems. While most of these systems are based on professional standards, the workers felt it as highly inflexible, to a degree where it becomes degrading and ineffective as they had to register almost all acts in the monitoring systems.

Skills/demand

New technology has become an important part of the work life of the participants in the study, as an interviewed hospital nurse expressed it: '… [talking generally about technology] is such an integrated part of our everyday life that it is also hard to imagine that you didn't have it' (INT11). Accordingly, the changes caused by technology mean that the workers face new demands and thus need to learn new skills. A radiographer in the hospital sector focus group (FG1) stated … 'but when our trade develops, we need to learn new skills'. For some, this is a positive and exciting development that allows them to acquire new skills:

> Today, it is all about looking at data, handling large amounts of data… in a sense, professionalism has moved on. You need to be a little more (…) focused on technological understanding. (public administration worker, FG3)

Hence, several participants highlighted how the introduction of new technologies led to the development of their jobs and in some instance their professions, introducing new and more interesting tasks. A radiographer in the hospital focus group explained: [Our] 'Professionalism has moved on. Now, we need to describe more, we are assisting the radiologists, helping them out'… (FG1). This in turn has made the job more stimulating for this worker. Yet, others were more worried about the requirement to acquire new skills; they were not necessarily confident about mastering the various technologies. A social welfare assistant in a care home for instance said:

> I'm [still] more comfortable with the lift and those [kinds of] things rather than with the computer. For me, it's not completely unfamiliar, but there are many things about it that I can't figure out. (INT12)

Several workers in all three focus groups described how some co-workers (often informally) serve as 'super-users' and help other colleagues handle the new technology, due to some (often older) workers' insecurity on how to handle the new technology, in particular ICT-systems mainly for planning and documenting activities. This collegial help was generally described as a good thing, but it comes with a risk of a technical divide, with some workers being left behind, or at least being semi-dependent on co-workers

or on the goodwill of the company. In the electrician focus group, a participant told of an older colleague, a very skilled electrician, who could not work with the computer, so management had arranged that he could do the required documentation by hand and then some of the office workers would file it on a computer (FG2). In the public administration focus group, a participant talking also about skills and skills development said (semi-joking, albeit still somewhat serious): 'Those who are not curious [to learn new tasks] get to do the routine tasks' (FG3).

Subsequently, some workers see the requirement to learn new skills as a positive development making the job more interesting. Yet, for others less able to handle the technological tasks, there is a risk of feeling left behind and ending up with elementary tasks, which may in turn reduce their job quality because of the deficit in technological skill.

Participation

The literature on new technology emphasizes how the workers involvement in both the planning and implementation of changes is important to achieve the positive gains of the new technology at the workplace level. The participation can in turn increase the workers' job quality, as they have some influence over their own work. This is also reflected in the findings above on autonomy where many workers felt frustrated by declining autonomy and reduced job quality. The active involvement of the workers and their representatives was also stressed in most of qualitative data, however, mostly so by the shop stewards and union representatives who felt that the public sector suffers from a politically controlled top-down approach reducing worker participation, especially on more general issues like ICT management systems. But the workers in the focus groups also stressed the involvement and voice of the workers, as a social welfare assistant in a care home stated:

> It could be that our politicians could try to listen a little more to what those on the floor have to say, rather than always to those at the top. It may be that they listen to our managers, but our managers usually don't know what we are doing, not fully at least. So I would like for them [the politicians] to listen to us a little more (…), maybe come and visit us a bit more [and find out] what is going on. (INT12)

However, many workers still felt involved to some degree in the workplace level processes, especially selecting new technology and implementing it. But even in terms of participation, some complexity could be found. Some workers did not prioritize their own participation but felt rather comfortable leaving it to others—either to management or their worker representatives. An interviewed hospital nurse said:

> [Interviewer:] Are you included [in the decision] when there are technology changes in your workplace, or is it something that only management decides and that's final?
>
> INT11: No, I wouldn't say that I am included. I often think that it has been decided somewhere else. But that doesn't have to be bad, because it may well be that those who make those decisions are better at making them.

One way to improve participation and avoid frustration (or even resistance) among the workers is to ensure that the meaning and purpose of new technology is clear to the workers, as a hospital focus group participant put it: 'we don't mind technology, if it is smart!'. So here, 'information sharing' (which can be seen as the lowest step on the participation escalator) is important, as the workers need to know what technological changes are to be made and why.

In sum, participation can help improve job quality, which was also reflected in the data. However, participation may also improve the organization, implementation, and management of new technologies, as it has been argued in the literature (Lloyd & Payne 2021).

Occupational health and safety

New technology overall appears to have a positive effect on OHS, but the reported positive effect in the data mainly concerned the physical and less so the psychosocial work environment. For the psychosocial work environment, it rather seemed to increase stress and job intensity. As for the physical OHS, new technology in general resulted in reduced strain across the different occupations through reductions of repetitive tasks, strenuous work postures and heavy lifting (like patient-lifting). (FG1, hospital; INT7; INT8; INT9).

INT12: It [technology] makes [the work] easier because I don't have to use my body in the same way I had to when I started 35 years ago. Back then we would lift, and today it is technology, such as [automatic] lifts and stuff, which make our work easier. (home care worker)

Interviewer: So you think that you are less physically stressed by getting help from technology?

INT12: Yes, absolutely.

A trade union representative of medical laboratory technologists gave another example of machines and robots leading to improved OHS. The technology had reduced the repetitive tasks when taking blood samples and conducting analyses, hence improving OHS for these workers (INT4). While the reductions in strenuous work postures and heavy lifting thanks to new technology was outspoken for care work, it also featured prominently in the electricity workers focus group despite different technologies. Additionally, interviewees from the union mentioned 'co-bots' (collaborative robots) as a future way of improving OHS in the electricity sector, through the reduction of strenuous and repetitive work postures (INT10). However, this development is still largely in its infancy, and none of the electricity workers in the focus group had had any practical experience with co-bots yet, but many were aware of the technology and had discussed it at company level.

As stated, there were contradictions as the physical OHS in general improved according to the participants, while the psychosocial OHS tended to deteriorate or at least not improve. The latter mainly relates to job intensity, workloads, and increased stress, which I accordingly, turn to next under the heading of job intensity.

Job intensity

Increased job intensity is often related to the pace of technological change, as well as the organizational changes following from the technological changes. There was a consensus across the interviewees that the pace of change in the workplace had gone up in line with Rosa's (2014) acceleration thesis. A union representative for the public administrative workers said: 'We are used to the change. It is the pace [of change] that is hard to handle' (INT3). In general, the workers agreed that the new technology, but in particular the increased administration related to registration and carrying out tasks, had not reduced job intensity; in all three sectors, it seemed quite the contrary. The increased intensity was most outspoken in hospitals; a radiographer in the hospital sector focus group stated:

> We are able to do so much more [with the new technology]—it is definitely time-saving. We produce more, but this includes digital material. In our case, a million, billion pictures. And the technology is able to handle that (...). But we also have to work additionally at a faster pace. Before, people used to smoke in the dark-rooms while the pictures were being processed, have a cup of coffee (…), but all this has been cut out. For patients and their relatives, it is definitely the right development. But for us and our breaks?–not so much. (FG1)

Another example was given by an electrician (FG2): In his company, they used 28 different apps, so he felt like 'reinventing the wheel all the time', to make these apps work together, which took up a lot of time, which in turn increased job intensity. Yet also here, the results pointed somewhat in different directions somewhat depending on the technologies: some workers felt that job intensity rose substantially, while others did not feel much change. But overall, the empirical results support the argument in the literature that job intensification tends to rise due to technology (Bergschöld 2018; Green 2013; Green et al. 2018).

Some cross-dimensional findings

Some elements were analytically important but cut across the job quality dimensions derived from the literature and can thus rather be understood within an SST-framework. I now turn to these. First, a core concern has been whether technological development results in fewer jobs, leading to a fear of 'technological unemployment' among the workers and trade union representatives. However, there is no evidence in the data of Luddism or any fear of such technological unemployment among the workers and the worker representatives both at the workplace and in the unions. The respondents were generally positive about the technological development, and many respondents stressed that new technology is necessary to solve the contemporary labor shortage in much of the public sector.

Second, when we asked the workers in the interviews and focus groups about how new technology impacted their job quality, most of them highlighted the impact on work organization, organizational settings, management decisions, and the implementation processes of these technologies, *rather* than the technology itself (cf. Ertner 2019).

As a worker in the focus group in the electricity sector put it somewhat ironically: 'It is not necessarily the technology's fault!', thus implying that the organization and management of the new technology is highly important along with the workers' own skills. An illustrative example of this was given by an electrician in the focus group (FG2):

> There are all sorts of different systems, and there is rarely information available around how they really should be used or what they can be used for. So we are often unable to really benefit from them, compared to what they potentially could do.

Third, monitoring of workers and labor processes via ICT-systems for tracking tasks and time along with GPS-tracking has been highlighted in the literature as increasingly important (and typically problematic) in contemporary capitalism (Moore et al. 2018; Trusson et al. 2018), and relates to both job intensity and particularly, to autonomy. Nevertheless, this did not feature prominently in the qualitative data despite abundant possibilities for the employers to use these technologies for monitoring and measurement of tasks. For instance, in the focus group with electricity workers in public utilities, many of the 27 participants had a GPS installed in their car, which makes surveillance and close performance monitoring very easy for management. This caused tensions when the technology was first installed with quite intense discussions between management and the unions and shop stewards about the use. The workers had however managed to negotiate that surveillance was to be used strictly for purposes like route-planning, and that the systems in general were to stay turned off and not to be used for any sort of performance measurement and management. Moreover, workers stressed that management was very cautious about using it, as they knew it was—as stated by an electrician (FG2); 'a red flag for the workers', and accordingly, 'Management is highly attentive to not cross the red line'. In a public utility company, a trade unionist (INT6) reported that management had even agreed to abstain from using GPS tracking and instead base the procedures on trust after discussing it with the local shop steward. Here, the workers, in the data, may be atypical, as they are still able to reject surveillance and performance management, unlike for instance warehouse workers and food couriers, who are often in a precarious employment relation (Moore et al. 2018). This is most likely explained by the enduring power of the trade unions and workers in the sectors studied (Lloyd & Payne 2025).

Discussion and conclusion

One key finding of this study is that the overall impact of new technology on job quality is complex and multi-dimensional. This is largely explained by the variegated effects different technologies have on different dimensions of job quality, wherefore taking a broader approach to job quality as done here provides novel insights to identifying core concepts and common themes, despite the limitations it also entails. While focusing on single dimensions of job quality have contributed with important knowledge, it also somewhat misses this broader picture, hence I have tried to identify core concepts and common themes in how new technology affects job quality, which can be further scrutinized in future research.

Overall, the workers and union representatives were positive toward new technology, yet often stressing both positive and negative effects on the different dimensions and technologies. Nevertheless, some patterns emerged with the technology impacting *specific dimensions* of job quality differently. First, the workers generally reported that new technology reduced or challenged their autonomy, often with an inherent managerial logic of particularly ICT technologies for planning and registration leading to the subsumption of workers' occupational and professional logic. This reduces the autonomy, which lowers job quality. Second, the physical work environment appeared to improve with many strenuous postures, repetitive and heavy lifting tasks being eliminated by new technology. Third, the psychosocial work environment had worsened for many informants through an increased demand for documentation and increased job intensity, which can lead to increased stress. For the two final job quality dimensions addressed—participation and tasks/skills—the results were less clear, contributing to the general complexity of the relation between job quality and new technology.

Overall, the workers were more positive toward specific technologies like robotics, and more skeptical toward ICT systems for planning and documenting tasks often associated with what is perceived as excessive registration and documentation. Like a social welfare assistant in a care home said: 'As for assistive devices, I am very positive but considering all the registration [of data] on computer, then I am probably more negative. I think it has gone the wrong way. It is way too much' (INT12). Consequently, this article illustrates the complexity of the nexus between new technology and job quality, like sociotechnical change in general is complex (Howcroft & Taylor 2023; MacKenzie & Wajcman 1999). While technological determinism has been refuted in much of the sociological literature, there are still widespread arguments that the impact of technology can be understood as mono-causal and hence leading to similar outcomes across tasks and occupations (and countries as well). This article provides qualitative evidence that this is not the case, even down to effects differing for the same technologies and for the individual workers.

Accordingly, another finding is a subjective dimension. So, what for some workers is a welcome new development, is for others a big challenge they would rather be without. This seems to partly correlate with personal preferences and characteristics like age and personal interest in technology. But there are also clearly contextualized and subjective experiences of what the technological development means in the individual respondents' working life. As one worker—a nurse—with quite a positive view on new technology, mainly reflecting on the use of tablets and laptops, stated: 'I'm probably also fairly technically minded. That makes a difference too, right? I usually think I'll figure it out. Otherwise I have to google it. It's not harder than that. (…) And then you learn to make it work' (INT11), whereas another worker (also a nurse) with a less positive view said: 'I'm not technically inclined. Maybe that's the problem basically' (INT13). These quotes illustrate how we must acknowledge that there is a subjective element to how digitalization and technological development influence job quality and the same technology *does not* entail the same for all workers (Srivastava et al. 2015). This makes it a complex, multi-dimensional endeavor to assess the impact of new technology on job quality.

Like all research, this article has some limitations which are worth addressing explicitly. First, while providing a broad, explorative perspective on various dimensions of job quality has proven helpful, it is still desirable to go into more detail with each of the dimensions of job quality as well as the specific technologies, as these have been

analyzed in quite a heterogenic way here. Important work has addressed many of the job quality dimensions already as well as the specific technologies, and although future work would gain from going more into detail on the specific dimensions of job quality, we do also need additional studies assessing the broader picture. Second, for the context of the study, Denmark may also imply some limitations on the generalizability of the results. In particular, the enduring strength of unions and workers, as well as the high degree of worker involvement and autonomy, may make the findings somewhat particularistic. Finally, the results may reflect that the project investigated public sector work, in a public sector still characterized by high wages and good working conditions, which suggests that the workers may have the necessary power to resist some of the potential negative effects of new technology, as for instance monitoring, which has been found to be problematic in several other studies.

1. All quotes were translated from Danish by the author.

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Appendix 1 List of interviews

ID	Gender	Position	Institution/organization	Method
INT1	One male and one female	Consultants	OAO: Organisations of Public Employees	Online
INT2	Male	Political consultant (specializing in digitalization in the public sector)	Danish Trade Union Confederation (FH)	Online
INT3	One male and one female	Chairperson and chief analytical officer	HK/Stat, trade union for salaried employees, section for state employees	Online
INT4	Female	OHS and work environment specialist	Danske Bioanalytiker, trade union for Medical Laboratory Technologists	Online
INT5	Female	Health policy specialist	FOA, trade union mainly for public sector services, e.g., low-wage health and care workers	Online
INT6	Male	Elected national trade union representative	Dansk El-forbund, Danish Electricians' union	Online
INT7	Female	Joint shop steward	Hospital, FOA, trade union for, in particular, health and care workers, but also hospital cleaners and service personnel	Online
INT8	Female	Vice-chair	Danish Nurses Unions/DSR	Online
INT9	Female	Joint shop steward	Hospital, Danish Nurses Unions/DSR	Online
INT10	Male	Electrician and shop steward	Electricity supplier, Danish Electricians' union	Online
INT11	Female	Nurse	Hospital	Online
INT12	Female	Social welfare assistant	Municipal, care home	Online
INT13	Female	Nurse	Hospital	Online