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INCODING case studies reports

Algorithmic management and employee involvement – A Company Perspective:

The Danish country report

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PREFACE

The INCODING project is a two-year project supported by the European Commission, Directorate-General for Employment, Social Affairs, and Inclusion, receiving funding under the call for proposals SOCPL-2021IND-REL aimed at improving expertise in the field of industrial relations.

The INCODING is a joint project of 5 partner organizations from five countries. The aim of the project is to analyse the role of collective bargaining and other forms of employee involvement at workplace level in (co) governing the black box of Algorithmic Management (AM) with a view to identify the main challenges for workers and their representatives, and explore its contribution to Inclusive AM understood as the turn to more transparency in the design and implementation of Artificial Intelligence (AI) based systems at company level and guaranteeing human oversight of automated processes. Moreover, the project also aims to learn from best practices, develop collective bargaining strategies and provide recommendations for trade unions, workers' representatives and employers negotiate the conditions under which AM and AI systems are used.

The first phase of the project consists of gathering existing information on the role of collective bargaining in governing Artificial Intelligence and Algorithmic management systems. The output of this activity is the publication of four national (DK, ES, GE and HU)[1] stock taking reports summarising the state of the art in each country, paying attention to the sectors where company case studies have been selected, and one stock taking report summarising the state of the art in relation to legal and social dialogue development at EU level.

The second phase of the project consists of empirical qualitative research of two companies (in two sectors) where artificial intelligence and algorithmic management is used by the company. At supranational level, fieldwork consists in the analysis of positions, views, and discourses of relevant actors in relation to artificial intelligence. The output of this activity is the publication of a set of national reports and an EU-level report presenting the findings of the two company cases studies and the analysis at EU level.

This case study report is part of the Danish contribution to the project entitled. The report first briefly outlines the recent digitalization trends, debates and policy initiatives related to algorithmic management (AM) and artificial intelligence (AI)-based technologies before exploring if and how Danish companies have implemented such technologies, the employee involvement in these processes as well as the implications of AM and AI-based technologies for the day-to-day work processes. To explore this the report draws on two illustrative in-depth case studies with one company within Danish manufacturing and one company within the subsector of food delivery within the Danish platform economy. We would like to thank the interviewees taking part and contributing to this project. Their insights and knowledge have been pivotal to better understand the dynamics unfolding at the shop floor when introducing new technologies such as AM and AI-based solutions.

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[1] INCODING Stock taking reports available at: https://incoding-project.eu/country-stock-taking-reports/

1. INTRODUCTION

Algorithmic management (AM) and artificial intelligence (AI) based solutions have gained increased political and academic attention in Denmark, not least following the recent waves of various generative AI technologies and large language models such as ChatGPT. The Danish government, national and local social partners have not only debated AM and AI-based solutions, but they have also developed a series of tripartite, bipartite and individual responses to address the associated challenges and to utilize the various potentials arising from these novel technologies (Larsen et al. 2022). For example, the Danish government and social partners have hosted a series of workshops, involving both academics and practitioners, to discuss the challenges and possibilities tied to AM and AI-based technologies, including ways to address these issues as well as regulate such technologies through statutory law and collective bargaining (ADD, 2023; FH, 2023; KL & Dansk Erhverv, 2023). Likewise, local employers have also to varying degrees consulted local union branches, workplace representatives or workers directly when introducing or modifying AM and AI-based technologies at individual workplaces as illustrated by our and other recent case studies (Ronaldsson et al. 2021: Ilsoe and Larsen, 2021). Such studies including our case studies also illustrate that in some workplaces, local social partners have also utilised their company based bargaining systems or collaboration committees to develop joint guidelines or negotiate and sign local agreements on data security, data ethics, work organisation, prevention of health and safety risks, surveillance of workers etc. following the introduction of AM and AI-based technologies.

Ample research tends to explore the recent digitalisation trends as well as national debates and responses to the recent development on AM and AI-based technologies, while only few studies have examined the workplace initiatives on AM and AI-based technologies, at least in a Danish context. Thus, little is known about AM and AI practices emerging at the shop floor, the social dialogue processes associated with companies introducing such technologies as well as their implications for companies and workers, respectively. Through in-depth case company studies, this report offers novel insights into the implementation of AM and AI-based technologies and their implications for the day-to-day work processes in Danish companies with a particular focus on the role of employee involvement in these processes. We draw on two company-based case studies with one illustrative example from Danish manufacturing and another example from the Danish platform economy. Danish manufacturing and the platform economy are not only some of the sectors at the very forefront of using AM and AI-based technologies to optimise work processes, but they also represent two extreme cases of the Danish industrial relations model (Statistics Denmark, 2023a; Larsen et al. 2022). Danish manufacturing is often considered one of the strongholds of the Danish collective bargaining model while the digital platform economy resembles a less regulated sector with the collective bargaining coverage and the union density being fairly patchy, if not nearly non-existent in most parts of the platform economy (Larsen and Ilsøe, 2022a; Ilsøe and Larsen, 2021).

Our findings indicate that the aforementioned cross-sector variations influence the involvement of workers when implementing AM and AI-based technologies at company level, although Denmark has a well-established framework for employee involvement and consultative rights, especially when introducing new technology – employee rights that are strongly embedded in both collective agreements and statutory labour laws (see also Larsen et al. 2022). We also find that the reliance on AM and AI-based technologies appear more visible within the Danish platform economy and seem to be the central to the business model of most digital labour platforms, where different AM and AI-based measures are tied to the individual workers and their performance. By contrast, our case studies suggest that companies' reliance on such technologies within Danish manufacturing comes across more hidden. AM and AI-based technologies tend to be embedded within different technical

solutions which have typically been gradually introduced over time, and unlike the platform economy, the performance measures are rarely tied to workers and their performance, but different digital devices and machines. We also find that there seems to be stronger formal employee involvement and development of joint guidelines and company-based agreements on various aspects related to AM, AI/based technologies and digitalisation more broadly within Danish manufacturing than the platform economy. However, informal employee involvement, especially with workers at the shop floor appears to be the dominant approach within both case studies. In both case studies we also find that there is limited awareness among the different employee groups, but workers appear often more critical towards for example tracking of individual workers in Danish manufacturing than the platform economy, where it is more widespread to trace individual workers.

The paper is structured in seven main sections. Following this introduction, we briefly present examples of recent debates and government led and social partner led initiatives on AM and AI-based solutions. We then present the used data and methodology in section three. In section four and five, we present the main findings from our in-depth case studies organised around the common outline circulated by the coordinating team as well as the themes identified within the interviews and other supplementary material. In section six, we briefly compare and discuss our findings before the main conclusions are drawn.

2. RECENT DANISH DEBATES AND INITIATIVES ON AM AND AI-BASED TECHNOLOGIES – 2023 A YEAR OF PLENTY

The share of Danish companies relying on AM and AI—based technologies is rapidly increasing. In 2023, around 15 per cent of Danish companies with 10 or more employees relied on AI-based technologies for a variety of tasks, including automating and optimising work processes compared to 5 per cent in 2017 (Statistics Denmark, 2023a). Micro-companies with 5-9 employees and SME's across industries are also increasingly using AI-based technologies, but there continue to be marked variations across sectors and company sizes. For example, in 2023, 13 per cent of micro companies relied on AI-based technologies compared to 15 per cent of small companies (10-99 employees), 29 per cent of medium sized companies (100- 259 employees) and 51 per cent of large companies with 250+ employees (Statistics Denmark, 2023a; Statistics Denmark 2023b). Likewise, AI-based solutions are more widely used within the Danish service and manufacturing sector with the labour market becoming increasingly fragmented: In 2023, 44 per cent of information and communication companies 16 per cent of manufacturing companies and 13 per cent of retail and transport companies relied on AI-based technologies compared to between 13 per cent of information and communication companies and 4 per cent of manufacturing, retail and transport companies in 2017 (Statistics Denmark, 2023b).

This development together with the recent waves of generative AI technologies and large language models such as ChatGPT have sparked new concerns and debates on AI and AM throughout 2023 in Denmark. The main themes debated include among others surveillance of workers, data security and ethics, health & safety risks, the legal implications of introducing and using algorithmic management and AI-based solutions as well as the wage and working conditions of workers affected by such technologies in their day-to-day working lives (Larsen and Ilsøe, 2023; Ilsøe et al. forthcoming). In this context, the Danish government, employers' organisations and trade unions

have hosted both jointly and individually a range of workshops, conferences and seminars on these particular issues throughout 2023 with input from external experts and other key stakeholders (ADD, 2023; Finansforbundet, 2023; FH, 2023, KL, 2023). The debates have subsequently led to a series of responses by the Danish legal authorities, the Danish government, trade unions and employers associations, most recently throughout 2023. The responses range from hard-law initiatives (i.e. legal rulings, new legislation and collective agreements) to soft-law initiatives (guidelines, commissioned work, social partner led commissions etc.). Examples hereof are:

- *Recent legal rulings* question the employment status of platform workers with different cases being brought before the various Danish legal authorities. For example, in 2023, the Danish Agency for International Recruitment and Integration (SIRI), ruled - similar to the Danish taxation authorities (2021) and the Danish Labour Market Insurance Authority (2022) - that food delivery couriers working through the labour platform WOLT are to be considered employees, not self-employment and thus covered by Danish labour laws (SIRI, 2023; 3F, 2023; 2022; Hvidt, 2021). By contrast, the Danish Competition and Consumer Authorities ruled in 2020 that platform workers working via the cleaning platform Hilfr, could be considered to be bogus employees from the perspective of Danish competition law (Munkholm et al. 2022,). At the time of writing, the employment status of platform workers remains unclear and has yet to be tested before the Danish labour courts. However, Wolt has recently contested the ruling by the Danish Labour Market Insurance Authority with the case pending before the Danish High Court.

- *Recent joint social partner initiatives:* During the 2023 collective bargaining round, different sector specific trade unions and employers organisations discussed AM and AI-based technologies and subsequently agreed to include these issues in their individual collective agreements. For example, the trade union 3F (representing food delivery couriers) and the employers' organisation – the Danish Chamber of Commerce – (2023) successfully renegotiated their sector- level agreement on food delivery services – the Just Eat Agreement - in Spring 2023. Likewise, the Danish trade union HK (representing freelance interpreters) and the employer organisations -the Co-operative - negotiated and signed a sector-level agreement for interpreters in February 2023 – the interpreter-agreement –, which regulate wage and working conditions of interpreters working as freelancers and platform workers wage and working conditions including various aspects related to AM (HK and Co-operative, 2023). Another third example is within the banking sector, where social partners in their collective agreement agreed to appoint a working group on data ethics, which aims to discuss the development of data-ethics for the benefit of both companies and workers in relation to the usage of AM, AI based technologies and surveillance of workers (FA & Finansforbundet, 2023). In addition, the two trade unions HK and The Danish union of Journalists agreed with the employer association - the Co-operative - to discuss the implications of AI and assess whether the recent development of AI-based technologies will require future adjustments of their collective agreements covering the creative industries (HK-privat et al. 2023). Other joint social partner initiatives are Danish trade unions and employers organisations involvement in the ADD project entitled Algorithms and Democratic processes for both citizens and workers". The ADD project recently published a commissioned study on Danish employers' reliance on Algorithms and AI-based technologies, their approach towards such technologies and the potential challenges notably in relation to workers (Hald et al. 2023: Nielsen et al. 2023). They find that data collection of employees via digital tools and algorithms is widespread on the Danish and Nordic labour markets (Hald et al. 2023: Nielsen et al. 2023). Nearly four out of five Danish employers use such data as important management tools typical to measure their employees' well-being (56%) and to optimise performance (46%) through collecting data on work meeting schedules and time use on different work tasks (Hald et al. 2023). Around one in two Danish employers are positive towards the idea of collecting employee data, but they also stress that these novel technologies may spark

mistrust and the feeling of surveillance among workers. In this context, guidelines on data ethics and social dialogue are considered tools to reduce mistrust and improve occupational health and safety (Hald et al. 2023).

- *Trade union led initiatives:* Besides their joint initiatives, Danish trade unions have initiated their own initiatives. These include for example, the project of Algorithms by the Danish trade union confederation FH (2022-), where they through workshops, commissioned research and expert advice seek to identify examples of algorithmic management practices within the platform e-economy, e-commerce etc. and develop a series of policy proposals (FH, 2023). Likewise, the Danish banking union (Finansforbundet) has commissioned a large-scale research project on the usage of AM and AI-based technologies in the banking sector and found in their recent study that only few employees know exactly what is meant by data ethics related to employee data as well as who is the main responsible for securing compliance with the data ethics. The project further illustrates that employees in the banking sector often accept worker surveillance of employee data related to potential whitewashing and financing of terrorism, but there is also a marked concern about the potential future usage of employee data following the technological development (Dhyrbye og Lovfall, 2022).

- *Employer led initiatives*: AI-based solutions and AM also figure high on the agenda of Danish employers. Most recently, the Danish employer association (DI) and different Danish companies have through their engagement and funding of the Danish think-tank The Danish Academic of Technical Science (ATV) been part of the appointment of two advisory boards: the ATV's The Digital Council for Technology and Science and the ATV Council for Technology and Data ethics. Both advisory boards focus explicitly on AI and aim to be tech positive but also consider the various challenges associated with such technological advancements for their members, which represent business, tech-companies, IT-research communities and social partners (Ilsøe et al. forthcoming). The Danish employer association DI also recently published a series of recommendations on ways to raise awareness of AM and AI-based technologies by integrating such themes into the basic education and further training systems (DI, 2023). Likewise, the Danish employers' organisation –the Danish chamber of Commerce – has together with the public sector employer organisation KL proposed to set up a national task force on AI that aims to develop specific projects on renewal of welfare provision to address labour shortage and limited resources (Dansk Erhverv and KL, 2023).

- *Recent government-led initiatives*: The Danish government has initiated a series of AI-related initiatives that built on the work and recommendations emerging from their various government appointed commissions with tripartite participation such as the Disruption Council (2017), the Data Ethics Council (2019), the Sharing Economy Council (2019) and the Digitalization Partnership (2021). One of their most recent AI initiatives is the Danish government's announcement of launching a new Centre for Social Media, Technology and Democracy in 2023, which aims to develop policy solutions responding to various AI challenges (Ilsøe et al. forthcoming). Other government-led discussions and initiatives have been tied to EU's proposed directive on platform work. For example, parliamentary consultations have concentrated on the surveillance of workers, the existing Danish employee rights to protect workers subject to automatic decision-making on a day-to-day basis and their rights to transparency (BM, 2023). Such Danish employee rights remain few and unclear, whereby EU's proposed directive on platform work in its most recent version will strengthen Danish employees' rights, if adopted and implemented (BM, 2023; Larsen and Ilsøe, 2023: Munkholm et al. 2022).

Besides, the aforementioned initiatives by the Danish government and central social partners, there has also been a series of company-based initiatives on AM and AI-based technologies across

distinct sectors on the Danish labour market. However, less is known about these company based responses, especially the role of social dialogue and employee involvement when developing and implementing such technologies at company level In the following we offer some insights into how local management, workers and their representatives have implemented AM and AI-based technologies at the individual workplaces. Our analytical locus is particularly, companies usage of AM and AI-based technologies, the involvement of workers in these processes as well as the implications of such technologies for work organisations and day-to-day work processes based on the data and methods presented in section 3.

3. METHODOLOGY

This report relies on in-depth case company studies to explore the usage of AM and AI-based technologies within Danish companies, the impact of such technologies on the day-to-day work processes with a particular focus on how such technologies are regulated at the shop floor as well as the role of employee involvement in these processes. We draw on two company case studies with one illustrative example from Danish manufacturing and one illustrative example from the Danish platform economy. These two sectors as well as the case companies were selected as they not only are some of the sectors and companies at the very forefront of using AM and AI-based technologies to optimise work processes, but they also represent two extreme cases of the Danish industrial relations model (Statistics Denmark, 2023a; Larsen et al. 2022). Danish manufacturing is often considered to be at the very heart of the Danish collective bargaining model and this also applies to the selected manufacturing company forming part of our analysis. By contrast the digital platform economy, including the selected digital labour platform forming part of this case study, resembles a less regulated sector with the collective bargaining coverage and the union density being fairly patchy, if not nearly non-existent (Larsen and Ilsøe, 2022a; Ilsøe and Larsen, 2021). The case company from the platform economy operated in the food delivery sector while the case company within Danish manufacturing belongs to the subsector of the Danish metal industry.

Both case companies were approached by contacting top management within the two respective companies. Management within both case companies facilitated the contact to workplace representatives, workers and line managers. In both case studies we also contacted platform workers directly through snow-balling, relevant trade unions and online social media platforms. A total of 38 interviews were conducted with management, workplace representatives, workers, central and local trade unions and employers associations. The interview material was supplemented with desk research of relevant company reports, collective agreements and labour law. Table 1 offers an overview of the interviews conducted for each of the case studies. No workplace representatives were interviewed for the case company within the platform economy as there were no workplace representatives elected in the digital labour platform taking part in our study.

Table 1: Overview of number and types of interviews conducted within case companies within Danishmanufacturing.

	Case company I Danish manufacturing	Case company II – Danish platform economy
Interviews with managers	1 global manager 3 local managers	5 (CEO) 3 global managers
Interviews with employees	5 (blue collar workers)	10 (couriers)
Interviews with shop stewards	3	:
Interviews with health and safety representatives	1	:
Interviews with Wolt workers' group	:	2
Interviews with local union branches	1	2
Interviews with central social partners	2 :	
Total number of interviews	16	22

4. CASE STUDY I: A CUTTING- EDGE DANISH MANUFACTURING COMPANY

Case company one is a Danish family-owned multinational manufacturing company with strong historical roots in the Danish collective bargaining model. It was set up in the 1930s and is today one of the leading companies within Danish manufacturing, producing high quality products and using cutting-edge technologies with AI-based solutions and AM forming part of its products. The company also increasingly relies on AM and AI-based technologies as part of the work organisation across its various sites, including the production line, administrative work processes and communication systems. Recently, top management published their strategy for the coming years and stated that AI-based technologies will be an important strategic investment area for the company, where it aims to double its financial turnover from products relying on AI-based technologies on an annual basis. However, the levels of automation and digitalisation, including the reliance on AM and AI-based technologies in products and work processes are highly fragmented across the company and tend to vary depending on the individual site and their production.

The case company employs around 30.000 workers worldwide and has around 100 factories and 50 sales offices in more than one hundred countries. The headquarter is in Denmark, where the case company also has several sites. Part of the company's production, sales, product innovation and distribution has remained in Denmark and the distinct sites produce, develop, sell and distribute different products and services. The workforce composition at the Danish sites comprises of 60 per cent white collar workers, 9% skilled workers and 31% unskilled workers. Most employees hold full-time open-ended contracts, but between 10% and 30% of the workforce are temporary agency

workers and their share varies across the individual production sites. There is nearly an equal gender division if not in some places a larger share of women at the Danish sites. Older workers are overrepresented among the staff and the employee turnover is low with the average tenure-ship being 20+ years.

The Danish sites have well-established institutions for collective employee representation. They include among others company based bargaining systems at each site, European works councils, local and central collaboration committees, health & safety committees as well as employee elected board members. In addition, a survey measuring employee satisfaction is conducted annually throughout the company and its domestic and foreign sites, enabling the employees worldwide to air their voice. The trade union density is particularly high among the skilled and unskilled workers – around 75% - with some Danish production sites reporting of a union density at almost 100%. The union density is considerably lower among the white-collar workers. All blue-collar workers are covered by collective agreements, whilst this only applies to 10% of their white-collar peers, who are expected to negotiate their wage and working conditions individually with management. Thereby, the case company is an illustrative example of Danish manufacturing, where the Danish bargaining model appears not only comparatively strong internationally, but also compared to other parts on the Danish labour market regarding union density (75% in 2015), collective agreement coverage (88% in 2015) and workplace representation (87% in 2015) (Larsen and Ilsøe, 2022; European Company Survey, 2015).

The two Danish sites interviewed represent the diversity among the company's production sites regarding their degree of digitalization and reliance on AM and AI in the digitalizing the production line, administrative and communicative work processes. One site interviewed is at the very fore regarding automating and digitizing work processes along the production line, whilst the other site only recently started to digitize their production site but has historically been much advanced in terms of digitizing their administrative and communicative work processes.

4.1. THE USE/EXTENSION OF AI AND AM IN THE COMPANY

The case company increasingly relies on AM and AI-based technologies to optimize its work processes and various products with such technologies being considered an important strategic investment area by top management and forming part of the overarching corporate digitalization strategy. The digitalization strategy involves various aspects and levels within the organization and consists of four main pillars. One pillar concern digitizing customer support, service and sales functions, while the second pillar concentrates on developing and applying cutting-edge technologies such as AM and AI-based solutions to incorporate a digital touch in the various products and the product development process. A third pillar concerns digitalizing and automating the production line, while the fourth pillar involves the development of an overarching corporate administrative system that through digitalization, including AI and AM-based technologies unite and streamline the administrative systems and processes of individual sites and business areas within the company. Top management has particularly prioritized the second and fourth pillar with the latter being one of the largest investments by the company in recent time.

 The distinct company sites and segments interviewed have gradually automated and digitized their production line, administrative and communicative processes over the years. This digitization voyage has been highly diverse, where decisions on introducing new technologies have been taken with careful consideration for the associated productivity- and efficiency gains, positive financial investment return as well as health and safety risks:

"If you need to automate an assembly line it needs to be profitable to make such investments... Here it is pivotal that you get a more efficient productivity, which has to increase while your production costs decrease. It is also about if you have the possibility to set up a robot in places where there historically has been a person producing exactly the same, but with negatively implications for their health and safety. However, it is not all that can be automated and that is especially the more complex things" (Management representative, case company I).

The digitalization and automation of work processes is thus highly fragmented across the company. Some production sites, especially those mass-producing standardized components, are highly automated and digitized where the case company has purchased and installed more advanced robots and technologies including AM and AI-based solutions with the aim to automate and optimize manual work processes. Other sites have only recently begun this voyage of digitalization within the last five years since their products are highly complex, typically customised to individual or limited customer group's specific requests and needs. The manual work processes tied to the more complex production have thus been difficult to digitalize with the expected productivity gains in mind, mainly because the robots are not as flexible as manual manpower to adjust to frequently changing work processes and product requests. There are also sites within the company that continue for example to manually rather than automatic register data from the production line as well as rely on traditional white boards rather than plasma screens to post information and status updates about the production line, overview of potential break downs, repair needs etc.

Digital devices: Digital devices with embedded AM and AI-based technologies are recent examples implemented by the company to ease the management-employee communication, the communication internally between employees as well as to digitize the interface/communication between the workers and the machines/robots. The introduction of smartwatches is an example of this. Instead of having to repeatedly check various monitors on the individual machines/robots for their status and operations, the smartwatches inform the employees about the running of the production line, any break downs and other technical problems with one or more machines/robots. A few employees were initially selected to test and report about their experiences with the smartwatches before management decided to roll out the idea of using smartwatches throughout the company.

Data registration & plasma screens: Another recent example of the company's increased reliance on AM and AI-based technologies is the digitalization of data registration which in many instances thus far have been and continue to be manual rather than automatic. Workers have manually noted down on paper by hand the number of types of and reasons for break downs of machines/robots as well as the units produced by specific robots/machine etc. for then to manually enter them into a computer database. Thereafter, the data is communicated through plasma screens/white boards to other colleagues as well as digitally sent to management for status reporting, data processing and analysis. Some company sites have started to test and implement IT maintenance systems with embedded AI-based solutions that aim to digitally register and inform via pop-up windows about warnings and predictions of potential break downs, timely shifts of spare parts or repairs of a machine/robot to prevent breakdowns. These IT solutions also include digital tools measuring the units produced by individual machines, not individual workers as this were highly contested by the workers.

Co-bots, 3D scanners and driverless trucks: The company has also experimented with Co-bots, 3D Scanners, driverless trucks, but with mixed success. 3D scanners have proven to be a relative success. They were initially purchased to assist the research and development teams in their

development and testing of new products, but are also increasingly used to produce spare parts for products no longer in production and to repair of machines/robots. The introduction of co-bots has been less successful due to the health and safety risks involved for the manual workers that have to work side-by-side with the co-bot. Most co-bots are typically installed with sensors that deactivate the co-bots once a person steps into the predetermined safety zone of the co-bot. However, sensors of the co-bots are fairly sensitive and require a lot of free space around in order for it to work efficiently and not being a health and safety hazard. Some co-bots are also equipped with tools like screwdrivers and move freely within the production site in close proximity of the manual workers. This is considered a health and safety risk as Co-bots risk injuring manual workers unless their speed is significantly reduced. Therefore, the co-bots have not yet been as effective as expected and have had to be fenced in to utilize their full potential. In some sites, management have also experimented with driverless trucks to bring and fetch various materials with some success while in other sites local management have decided to postpone the idea of introducing driverless trucks due to the costs involved as well as the resources required to digitize the various stockpiles with barcodes. Therefore, the company has thus far not been able to put forward a "good business case" for rolling out driverless trucks and digitize logistics that will secure not only a fairly quick investment return that will match or supersede the costs associated with implementing such technologies.

Highly advanced digital systems/platforms: The company has recently invested in highly advanced digital systems for communication and administration with embedded AM and AI/based solutions to deal with orders, logistics, data extraction and data analysis. These software systems aim through a single seamless system or platform to systemize, optimize, automate and coordinate companies' different processes across the entire business circle from ordering of raw material to manufacturing goods, human resource management, administrating logistics, stock piles, sales and marketing as well as product delivery, customer services and after sale. This new administrative system provides an overview of all the different company activities and its different subsidiaries, and thus allows management and workers with few clicks to gain insights into the status of the company and its operations being it that stock piles are running low, economic turnover, product- and sales lists, break down along the assembly line, etc. These systems also allow for various data-analyses as well as sharing of real time data between different subsidiaries, departments, the shop floor along the business cycle. The company has for decades used such separate IT systems at individual sites, but it is only within the last seven years that the company has started to develop, test and implement a single seamless digital system or platform that unites all former local sites. Developing this system has been one of the largest financial investments by the company and has been rolled out throughout the company and its different domestic and foreign subsidiaries. It is considered by the interviewees as the ultimo digital voyage within the case company. The main reason for developing and implementing this new IT system was to stimulate a more agile and cost effective company that quickly can adapt changes in customer demands, ease cross-selling across business areas and provide real time data overview of the various activities within the company and its various subsidiaries.

4.2.   DATA COLLECTION AND DATA PROCESSING

The different production units generate different forms of real time data. The data generated are typically via the individual machine or production unit, and not tied to the individual workers. This decision by management to tie the performance measures to the individual machine not the individual workers was largely a response to the opposition by the workers. The workers had opposed any surveillance of individual workers that would occur if and when their individual profile would be tied to any form of data collection measuring their individual performance. Another

example of worker opposition towards surveillance of workers it that the company recently proposed that workers could install work-related apps to their personal, but employer paid, digital devices such as employer paid mobile phones. This idea was also met by fierce opposition by the employees, who felt this was an invasion of their private space and blurring the boundaries between work and private life. Subsequently, the company has together with the workplace representatives developed and negotiated various local company agreements and guidelines on company based practices regarding data-collection. They have agreed that data collection is tied to individual profiles, individualized smart phones etc. is prohibited and the company can only generate data from individual production units or machines, where there is no tracking of individual workers and their performance.

The interviews also indicated that workers are often unaware of the type of data collected and there has hardly been any critical voices, except for when the company proposed to tie data collection to individual workers' profile and personal devices. There also appears to be a relatively low interest among the workers as to how data is used by management. However, it has been put forward by different workplace representatives that the usage of generated data by the various production units has been raised as an issue to be discussed in the high level collaboration committee according to the interviewees, but at the time of the interviews such meetings were yet to take place. Regarding the data analysis of the data generated by the various production units/robots as well as the data produced by the new IT-system, this is done in house by data specialists according to the interviewees. However, both management, the workplace representatives and some workers interviewed stressed that the company is not utilizing all the data opportunities and more could be done and the process could very much be characterized as a learning curve within the company.

4.3. THE IMPACT OF AI AND AM

The digital changes have led to different changes within the case company. They include among other changes to the workforce composition and work organisation along with the introduction of new work tasks and emerging demands for specific skills, notably upskilling of staff.

Job-loss and job creation: Throughout the case company, workplaces and job functions have disappeared or been replaced with new job tasks. It is particularly job functions tied to hard physical- and unskilled and labour intensive work that have been replaced by automation. By contrast, demands for skilled and white collar labour have increased and thus lead to changed recruitment patterns especially for white collar employees with specialized skills such as engineers. In fact, the white-collar employees represent a larger share of the company's workforce than skilled and unskilled workers in the company compared to two or three decades ago when the company started to automate their production. However, in the last decade the heavy investments in technological advancements have reportedly reversed the early trends of job loss. The company has increasingly started to retract some of their production from overseas and thus secure job growth as their Danish sites are now able to produce products cheaper, faster and of higher quality in real time than the foreign sites despite the comparatively higher Danish wages.

Upskilling the workforce and labour shortages: The increased digitisation of work processes have entailed increased needs to upskill the workforce and recruit new staff. The company had initiated a series of measures to attract, especially engineers and data/scientists as they were deemed pivotal in order for the company to utilize, process and analyse the right data generated throughout the company. The company has also invested heavy in upskilling their workforce and offers training programmes that specifically targets their unskilled workers. The company has also started to integrate a new module on digitisation as part of their basic further training packages offered to their

employees. These courses have primarily target blue collar workers – skilled as well as unskilled – while white collar workers are responsible for securing their own further training according to the interviewees. The upskilling of the workforce is a combination of online training courses, information and peer-to-peer training. In fact, peer-to-peer training is common throughout the company also when new technologies are introduced and new recruits needs to learn how to operate specific robots and machines at the production sites.

New forms of work organization: The recent digital changes in the company have also influenced the work organization in different ways by leading to new work responsibilities. For example, in the past, workers only had to oversee and maintain the operation of one machine or robot, but following the new technological advancements with embedded AI-based solutions, they now are responsible for a larger number of units. In some situations, this was considered fairly stressful by the employees, especially when several machines/robots stopped operating and alarms started blinking at the same time. The technological changes had also affected work organisation by blurring the traditional boundaries between unskilled, skilled and specialised white-collar workers such as the engineers. Work tasks and job functions that traditionally were carried out by engineers have shifted hands and are now done by skilled workers which then have seen that some of their former work tasks been delegated to their unskilled co-workers. For example a union representative stated:

> *"There has been a significant change in the work tasks of the traditional factory worker in the past 15 years. There is a constant wave of new tasks, new responsibilities and thus demands for a higher skill level as those on the shop floor we are expected to snap upwards towards the work tasks at the next level above us, which you in the past expected to be carried out by someone with an education. It is expected today that we do all such things and we need to constantly upskill with careful consideration for the work tasks that lie above us"* (Interview: shop steward).

New forms of teamwork: Part of the changes to the work organization has also involved a closer collaboration between the engineers and the skilled and unskilled workers where they each contribute to the development of for example new products as well as gain better understanding of their individual work tasks and how their different tasks feeds into the overall production. As a management representative stated:

> *"It is important that people – skilled and unskilled workers - we have in the production -also contribute to product development, because often when we develop new products we need to involve employees that have practical experience working with these things and they should also be able to participate in classic engineering disciplines besides being collaborators with respect to our future development" (*Management representative)

New forms of team work were also seen among the white collar workers and academics and both representatives from management and employees expected to evolve especially following the introduction of the new IT system/platform. According to the interviewees, white-collar workers and academics are increasingly expected to collaborate closer with blue collar workers at the shop floor as well as with their co-workers across the company. In this context, the new IT/system system/platform will serve as an important platform for connecting different employee groups as it allows them to increasingly link different data and operational processes and thus analyze data or sales lists in a broader context than mainly looking at isolated numbers or products as has been the main practice thus far. Thereby, the interviewees foresee that the introduction of the new administration system will affect the way for example people within sales and marketing, top management and blue collar workers – skilled as well as unskilled - at the shop floor organise their work and collaborate.

4.4.   UNFORESEEN EFFECTS OF THE INTRODUCTION OF AI AND AM – HEALTH AND SAFETY ISSUES

Health and safety has been a central theme in the debates on automation and digitization, especially related to AI-based technologies throughout the company. Some of the health and safety issues discussed were closely related to the introduction of co-bots. The risks of increased work-related accidents associated with having co-bots working side-by side with manual workers were the very reasons why the company had decided to retract the co-bots from the assembly line until the health and safety issues have been resolved according to the interviewees. Other health and safety issues raised by employees and management involved the ethics around increased surveillance and data registration of employees operating distinct machines and robots or carrying the smartwatches. The fact that the technology allows management literally to track individual workers has raised much concern among the employees as mentioned earlier. However, in the Danish sites of the case company, management is thus far not allowed or able to track individual employees as information and data registering is tied to individual machines and not individual workers as mentioned earlier. However, in some of the foreign operations of the company, there have been examples of attempts to implement such tracking of individual employees as the national laws pave the way for such experiments. In addition, issues related to work-related stress has also been debated in the context of automating and digitizing the work processes within the production sites. It has especially the constant data flow and real time updates with alarms ringing and blinking that have been considered a stress factor and thus ways to minimize this have been debated with for example the introduction of smart watches. Moreover, the increased digitization has also had positive effects on reducing heavy lifts and hard physical manual work, which have increasingly been replaced by robots that typically are fenced in or are operating with sensors that force the robots to stop if anyone enters its safety zone. In fact, it is often typically in combination with potential productivity and efficiency gains considered a good business case when local management or employees propose ideas of ways to automate or digitize work processing tied to production, administration or communication according to both sides of management. Therefore, our interviews suggest that health and safety can on the one hand be a facilitator for introducing new technological advancement, but on the other hand health and safety concerns can also block digitization or automation of manual work processes.

4.5.   THE REGULATION AND GOVERNANCE OF AI AND AM

During the interviews, management as well as employees and their workplace representatives stressed that most employees had positively embraced the technological advancements that had been implemented as part of automating and digitizing manual work processes. However, some employees had been more reluctant than others to embrace the new digital changes and feared among others for their job. However, with time even the most critical voices have been able to see the positive elements involved when for example hard physical manual work had been replaced by automation as well as when digitization and automation in fact has secured rather than replaced their jobs as the company has expanded its workforce even when new technologies have been introduced. Other positive elements highlighted by the workers were that for example that the increased digitization and new digital devises have enabled employees to document and explain why a certain robots/machines are not operating efficiently as the new digital devices register any breakdowns or problems with robots/machines. Thereby, the increased digitalization seemed to have had contributed to empowering different worker groups vis a vis management as the digital

devices had helped individual workers to address potential criticism from management regarding the operations and productivity levels along the production line.

To address the more critical employee voices as well as ensure a fairly smooth implementation, there has been a fairly open dialogue between management and employees as well as high employee involvement. This social dialogue has entailed information and consultations about any technological changes at the shop floor, why such technologies will be introduced and how they are expected to impact individual employees and work teams' day-to-day work routines. The introduction of smartwatches in one of the production sites is an example of how employee involvement unfolds when management decides to introduce and test new ways of digitizing work processes. There has been a close dialogue between management and employees, where management first introduced the idea to the shop stewards, health safety representatives and the affected employees that would be using the smartwatches in the workplace. A few employees were then asked to volunteer and test the smartwatches for then to report back to management, the shop steward and the health and safety representatives about their experiences. Based on their feedback and in close dialogue with the other employees and their representatives, management decided to slowly roll out the idea of smartwatches to other areas of the production with careful consideration for those employees that felt that such smartwatches were a stress factor. Therefore, using smartwatches was initially optional for the employees, but has with time been rolled out throughout the company, where also the more hesitant employees have been convinced by the good example and exchange of peer-to-peer experiences among co-workers rather than by force.

Our interviews also reveal that the close social dialogue around digitalization has often been informal and takes typically place outside the well-established formal company based institutions for employee involvement. However, management has also used the official channels for information and consultation at the workplace to inform the employees about their digital projects such as the various collaboration committees, health and safety committees, European works councils and board meetings, where also employee elected representatives are present. However, digitization and automation has only indirectly been a theme in the company based bargaining rounds and let to specific local agreements. For example, there are a number of local company agreements and joint guidelines on worker surveillance, health and safety issues and further training. However, both representatives from management - and the employees foresee that digitalization, notably AM and AI-based technologies will be a future bargaining theme and is already a theme on the agenda of the various collaboration committees. In some production sites there are already systems in place that award employees with bonuses insofar they choose to upskill.

Most of the ideas for digital changes typically flourish from the shop floor and individual sites have reportedly great autonomy to test and develop various digital solutions whereby the digital process is very much characterized by a bottom-up approach with a few exceptions. The recent introduction of new administrative IT system as well as 3D scanners are some of recent exceptions as they reflect top-down management initiatives that have been rolled out throughout the company, but with careful consideration for employee involvement. According to the interviewees, the implementation process has so far been characterized by a close dialogue with the affected employees combined with a number of information and consultation meetings at different levels within the company as well as various online courses and further training on how to operate the system or 3D scanner along with health and safety instructions to secure a smooth implementation.

5. CASE STUDY II: A FOOD DELIVERY COMPANY WOLT

Wolt is a Finnish owned multi-national food delivery platform, which is active in more than 25 countries and 500 cities worldwide. Wolt was established in 2015 and has experienced rapid growth rates, especially within the last few years. In the last few years, the company has also expanded its initial services of food delivery to include other products, such as groceries including retail delivery (Wolt Market) (Ilsoe & Larsen, 2021). In 2021, the platform merged with the American platform DoorDash.

Wolt's business model is based on an app design that connects customers, restaurants, and food delivery workers known as "courier partners", who are responsible for picking up restaurant orders and delivering these to customers. Wolt's business model deviates from other food delivery platforms such as Just Eat by using AM systems to facilitate highly flexible self-employed work arrangements for couriers working on the platform (Haldrup et al., 2023). In addition, and similar to most food delivery platforms, WOLT operates with solo-self employed couriers rather than employees, except for Germany, where the couriers are directly employed by the platform (Scheele et al. 2023: Ilsoe and Larsen, 2022). It is thus the individual courier, not Wolt, who shoulders the traditional employer responsibility of employee protection. However, in Denmark, recent rulings by different public authorities have recently questioned the employment status of food delivery couriers working via Wolt and have ruled that Wolt couriers are to be considered as employees, not self-employed and thus covered by Danish health and safety protection, taxation laws for workers etc. (SIRI, 2023; 3F, 2023; 2022; Hvidt, 2021) Wolt has contested the recent ruling by the Danish Labour market Insurance Authority with the case pending before the Danish High Court as mentioned earlier and the employment status of Wolt courier thus remains unclear at the time of writing.

In Denmark, Wolt operates in 16 cities across Denmark and collaborate with more than 4000 food delivery couriers. It is thus the second-largest food delivery platform in Denmark, just surpassed by its main competitor the food delivery platform Just Eat, who has the largest market share in Denmark and offers slightly different wage and working conditions for its couriers as they, unlike WOLT-couriers, are directly employed by the platform and covered by collective agreements (Ilsøe & Larsen, 2022). In fact, in 2021, the Danish Chamber of Commerce and the Danish trade union 3F successfully bargained and signed a sector-level agreement for food delivery couriers within the platform economy, but so far only Just eat has joined the agreement, leaving large part of the subsector without collective bargaining coverage. (Ilsøe & Larsen, 2022). The agreement introduced measures such as an hourly wage floor (€ 16.5), a minimum of 8 working hours per week, wage supplements for evenings and weekends, and social benefits such as pensions.

Wolt has thus far neither joined the existing sector level agreement between the Danish Chamber of Commerce and 3F nor signed a collective agreement covering their couriers although there have been negotiations between WOLT and 3F with the aim to conclude a collective agreement (Larsen et al. 2022a: Ilsøe & Söderqvist, 2022). This combined with the fact that the platform rely on self-employed couriers indicate that tWolt operates on the outskirts of the Danish collective bargaining model and within the grey zones of Danish labour market laws. In addition, the platform has not no traditions of formal institutions for collective employee representation and the union density among the Wolt couriers continuee to be low even if there have been examples of grass root mobilisation among Wolt couriers, who have come together and attempted to push for improved wage and working conditions with varied success (Hau & Savage, 2022, Larsen et al. 2022).

The decision by WOLT to rely on self-employed, not employees and operate without collective bargaining coverage is reportedly due to the food delivery sector being a highly volatile market, characterized by fierce price competition and fluctuations in daily and seasonal demands and price competition, and labour-intensive work (Ilsoe and Larsen, 2022). These circumstances often require employees to work irregular and unsocial hours, whereby some workers may struggle to balance a full-time job with other life circumstances when working within the food delivery sector. However, for part-time workers, the working conditions in this sector may provide flexibility in the working hours that allow them to balance work with other activities. In both cases, the short-term perspective for many workers causes recruitment and retention issues for many food delivery platforms (Haldrup et al. 2023). The center we studied is part of a multinational that manufactures trains, trams, and metros for railway operators. It is the biggest one in Spain and approximately employs 700 operators. Concerning its industrial relations model, the site is characterized by the strong role of the union. This is reflected in the high degree of affiliation: according to the estimates of the Work Council, 90% are affiliated with a union. In addition to its collective agreement on a national level, the site also has its own (signed in June 2022 by the management of the site and the two majoritarian unions).

4.6.   THE USE OF AM AND AI-BASED TECHNOLOGIES

Wolt relies on AM and AI-based technologies as an essential part of their business model as well as in their relations with their courier partners and for work organisational purposes. For example, the interviewed Wolt managers reported that the platform's usage of AM directed at couriers involves task distribution, compensation, and economic incentives (i.e., nudging). These measures are often fully automated. According to Wolt management, the algorithm distributes tasks based on the couriers' geographical location, availability, and type of vehicle, which the couriers can either accept or decline without facing potential penalties. In terms of compensation, Wolt uses AM to calculate the potential earnings for each task based on the courier's pick-up distance to the restaurant, the distance to the delivery point, and a number of spatially defined criteria (e.g., city geography) that vary between cities. Furthermore, Wolt also relied on AM to provide couriers with estimated delivery time, earnings for orders, and aggregated information on daily fluctuations in local demands (i.e., peak hours and "hotspots"), reflecting examples of AM used for economic incentives on the platform. The interviewed couriers also report examples of certain performance appraisal mechanisms during high demand, such as extra bonuses for every ten orders completed during weekends.

Algorithmic adjustments: Wolt continuously adjusts its use of AM, which especially concerns the compensation model. When Wolt entered the Danish market in 2017, the compensation model was initially based on minimum hourly earnings and a shift-based system. Since 2019Wolt has developed a task-fee-based earnings model that includes fixed distance, peak hour, and weekend bonuses. This system was implemented alongside the Covid-19 related restrictions in Denmark during 2020-2021, where the platform experienced rapid economic growth due to increased demands along with it expanding its business to additional areas and cities. In 2023, Wolt introduced its current distance-based model a s way to address the higher inflation rates and slightly declining demands, according to the interviewed couriers.

HRM supported management: Several managerial practices at Wolt are not fully automatized, as support staff supplements the AM systems in various situations. The interviewed couriers reported that they mainly turn to the support staff in order to cancel delayed orders, as many couriers try to minimize their unpaid working time and prefer to pursue new orders elsewhere. According to the

couriers, the remote support staff handles simple inquiries. By contrast, locally situated support staff in Denmark handles typically more complex matters such as disputes between the individual food delivery courier and the customers or the restaurants regarding damaged or delayed orders. According to the interviewed couriers, the platform does not use control mechanisms to sanction or reward courier performances, which echo findings from other recent research on platform work in Denmark (Haldrup et al., 2023; Kusk & Bossen, 2022). Instead, the HRM support staff at Wolt tend to assess if couriers in different situations violate behavioral rules outlined in the "partnership agreement" which all couriers must sign when joining the platform. HRM support staff also inspects the documents from aspiring couriers to ensure they meet the eligibility criteria for working on the platform. This includes for example if they have registered with the Danish food security agency and taken the mandatory health and safety courses on food security when delivering their food orders (Larsen et al. 2023).

4.7.   THE IMPACT OF AM ON PLATFORM COURIERS

According to Wolt management, the platform monitors data through the app. This data is processed and analyzed by in-house data analysts and UX designers to develop the performance of the AM systems. Wolt management declares that their usage of AM aims to improve the efficiency of deliveries and increase the couriers' earnings by ensuring a constant flow of orders. The interviewed Wolt managers further stress that AM-generated information on local demands and the profitability of incoming orders aim to increase couriers' autonomy by allowing them to make informed choices as to which orders they should accept or decline.

Among the interviewed couriers, the perception of the impact of different aspects of AM implemented by Wolt tends to vary depending on their usage and strategies on the platform. In general, the interviewed couriers do not raise any specific concerns regarding the platform's utilization of their data and state that Wolt informs them in the partner app about general adjustments (e.g., compensation) in the algorithmic system. Instead, the interviewed couriers show a keen interest in the aspects of AM that directly affect their earnings, flexibility, and autonomy.

Platform strategies: Efficiency, workflow, and adaptability: Many of the interviewed couriers expressed that they generally consider the algorithm to work well and ensure stable hourly earnings despite continuous adjustments in the compensation model and experienced errors in the task distribution system. Most couriers schedule their working hours during peak hours (e.g., lunchtime, evenings, weekends) when orders and earnings are high. However, the AM system strategies tend to vary between couriers. As efficiency is highly valued by some couriers, , they often spend their time waiting for the most profitable and convenient incoming orders and tend to cancel delayed orders at the different restaurants. At times when the demands for orders (e.g., covid-19 lockdowns) have been particularly high, more couriers report using this strategy as a way to optimize their earnings. By contrast, , other couriers often choose to "follow the algorithm" and accept each incoming order regardless of the promised earnings, delivery distance, and potential delays, as they prioritize a stable flow of orders rather than spending time waiting for better-paying orders.

While these two strategies represent a dilemma among the interviewed couriers on how to utilize the AM system on the platform, it does not seem directly related to their level of dependency on income from working at Wolt, as couriers working both full-time and few hours on the platform reported that they utilised both strategies. However, couriers mainly using the first strategy appear to have the highest reported average hourly earnings (approx. €35-45 per hour), while couriers using the latter often havea lower hourly average (approx. €20-30 per hour).

Other aspects influencing how couriers developed their work strategies in combination with the AM system tend to be related to their non-formalized skills such as knowledge of different types of restaurants, city geography, app technology, and using different vehicle. According to the interviewees, it appears that all couriers seem to avoid orders from certain restaurants that are late or often contain products with liquids, which are difficult to handle during deliveries. Furthermore, some couriers using faster and larger vehicles such as scooters or cars often choose to put on the AM function "bundle mode" (i.e., picking up multiple orders to deliver) and accept orders with a longer delivery distance to increase earnings. By contrast, couriers using bicycles tend to prioritize single orders in the city centre with shorter delivery distances to minimize commuting time. Some couriers also report having utilized different "bugs" in the AM systems to optimize their earnings. One practice involves accepting an order on bundle mode and picking it up at the restaurant but intentionally delaying pushing the "ready to deliver" button. By doing so, they wait for potential incoming orders nearby, which they can pick up in addition to the existing order to increase earnings. However, the interviewed couriers often experienced that the platform fixes these bugs, which point to some form of feedback effects between the algorithmic design and the couriers' work practices on the platform.

Concerns and critique: Transparency and work intensification: Several of the interviewed couriers expressed growing concerns about how the compensation model worked, particularly due to recent AM adjustments and lower demands on the platform. Some couriers, who depend on income from the platform, expressed that they now earn less from the same type of orders and that they therefore have increased their weekly working hours on the platform. The critique of the existing compensation model is especially pronounced among this group of couriers as they consider the distance-based earnings model less transparent and that it often results in larger fluctuations compared to the former model with fixed base fees and bonuses. However, couriers less dependent on income from the platform tend to consider the recent algorithmic development, notably the information on incoming orders and the possibility to reject or accept orders without consulting HRM, to be convenient features that increase their autonomy on the platform.

The interviewed couriers also reported of instances, where the task distribution system contains different errors and discrepancies that disrupt the efficiency of deliveries. For exampled, some couriers often experience delays in the algorithmic system, as they, instead of being offered orders closest to their location, may receive incoming orders from restaurants that they passed by several minutes earlier. Many couriers also criticize the restaurants' practices with using the Wolt app, as some restaurants click "ready" before the order is prepared, which results in extra waiting time for couriers picking up orders at these restaurants. Furthermore, during high-demand periods, couriers experience that the system overheats, which leads to orders being offered to couriers that do not fit their vehicle type or other customized criteria. Other couriers address the remote connection with the platform, as they encounter difficulties when communicating with Wolt management beyond the support level to solve or report AM-related errors or irregularities.

4.8.   REGULATING AM AND AI BASED TECHNOLOGIES

While Wolt has hitherto been solely responsible for introducing and developing AM measures on the platform, issues related to algorithmic transparency have been addressed by 3F and through organized courier protests in recent years (Hau & Savage, 2022; Ilsøe & Söderqvist, 2022). The interviews with the managers, worker representatives, and couriers indicated that there have been various disagreements on the working conditions as well as the use of AM. These disputes have particularly been on income insecurity and flexibility experienced by couriers on the platform. This

has among others led to demonstrations by the couriers especially in the greater Copenhagen area as well as various forms of social dialogue between Wolt management, the couriers and the trade union 3F.

For example, there have been negotiations between Wolt management and the trade union 3F with the aim to sign a collective agreement. At the time of writing, these negotiations have been put on hold due to disagreements on especially working time according to the interviewees. Likewise, there has been a series of informal meetings and a continuous informal dialogue between the platform and its couriers, which thus take place outside what is normally considered the traditional fora for employee involvement in Denmark as Wolt has no traditions of collective workplace institutions such as workplace representatives (shop stewards and health and safety representatives), collaboration committees as well as company based bargaining institutions. The absence of such workplace institutions is largely down to Wolt operating with solo-self employed couriers, not employees and the platform is, thus, not bound by Danish labour laws including health and safety regulation or collective agreements, as they only apply to workers with employee status, not self-employed workers.

Although Wolt is not covered by Danish regulation on employee involvement, the platform has regularly engaged in social dialogue with its couriers and Danish trade unions as mentioned earlier. Most recently this dialogue between Wolt and the couriers have concerned discussions on the continues changes to the AM system and the fluctuating earnings in the current compensation model. In this context, the couriers as well as the union representatives interviewed stressed that the continuous changes to the AM system and the fluctuating earnings in the current compensation model have contributed to stress and insecurity among the couriers on a daily basis. Subsequently, this had led the trade union to call for increased transparency and accountability in Wolt's usage of AM as well as policy measures to ensure a certain level of income predictability according to the interviewees. However, Wolt management was, however, slightly critical towards these demands as the interviewed platform managers stated that the suggested changes may compromise central aspects of their business model, since they considered the AM-based task distribution system and the compensation model to provide couriers with flexibility when using the platform. These issues continue to spark debates between the platform, the couriers and the trade union, and thus remain unresolved at the time of writing.

Alongside the aforementioned negotiations, the grassroots organization "Wolt Workers Group" has attempted to mobilize couriers to improve working conditions and aspects of AM on the platform. In doing so, the Wolt Workers Group has collaborated with the trade union 3F in different ways. For example, the trade union 3F has among others provided office space for the group to host their meetings and the trade unions has also helped with organising the various awareness campaigns and demonstrations besides financing some of the activities organised by the Wolt Workers Group (Larsen et al. 2022a: Larsen et al. forthcoming). In this context, the trade union representative interviewed also highlighted the difficulties of mobilizing larger units of couriers working on the platform. It is particularly the short-term nature of platform work and the individualized work practices which often pose challenges to building solidarity and collective action among couriers according to the worker representative. Most of the interviewed couriers echo this perspective by emphasizing their preference for staying self-employed, as they generally favour working time flexibility and autonomy supported by the AM. However, the interviews also indicated that the couriers often raise concerns about income insecurity and lack of social protection when working on the platform, whereby there seems to be some support among the couriers to address the various

challenges related to their working conditions, but without jeopardising the flexibility which they seem to treasure.

In sum, it remains to be seen what will be the next steps, but recent rulings by different Danish public authorities suggest that the classification of couriers as self-employed, not employees may change and thus Wolt couriers will most likely to be covered by the employment and social protection offered by Danish labour laws. In this context, the recent rulings by the Danish public authorities also suggest that individual couriers with the support of the Danish trade union 3F have utilised the broader institutional framework to test the employment and social protection rights of platform workers by utilising the legal system to gain clarification of for example the employment status of Wolt couriers, not least in relation to Danish taxation laws as well as health and safety laws, but so far there have been no cases brought before the Danish labour court and civil courts to gain clarification of platform workers' rights to employment and social protection outlined in Danish labour laws and collective agreements.

6. COMPARATIVE ANALYSIS

Danish manufacturing and the platform economy are at the very fore when it comes to relying on AM and AI-based technologies. However, this digitization voyage is highly fragmented across the two sectors and even within the same company as illustrated by our in-depth company case studies, which both tend to be considered cutting-edge companies when it comes to implementing highly advanced technologies such as AI and AM based solutions. The different digitization strategies used between the two case companies as well as the internally variations across distinct production sites and the assembly line as illustrated in case of the Danish manufacturing appear closely tied to various cost/benefit analyses of the productivity and efficiency gains as well as positive financial investment returns. In the case of Danish manufacturing, we also find that health and safety tend also to be considered to be a good business case for automating or digitizing manual work processes.

We also find marked variations across to the level of automation of work processes within our two illustrative company cases. The AM system implemented by the digital platform company appears fully automated and seems central of the platform's business model, where such technologies are the key tools for the platform to communicate with its couriers, distribute work tasks and measure individual platform worker's performance, although there are also extensive reliance on support staff to solve various work-related issues. Thus, the reliance on AM and AI-based technologies appear fairly visible throughout the company, where individual platform workers seem well-acquainted with the functioning of the AM system and have even in some instances developed strategies to beat the AM-system when it comes to receiving the "best" orders, gain access to bonuses etc. By contrast, our manufacturing company case study indicates that the company's reliance on AM and AI-based technologies is less visible for the individual workers, who typically seem less aware of the data collected by the manufacturing company through these IT-systems and the usage of these data by the company. This may be due to the fact that the AM and AI-based technologies tend to be embedded within different technical solutions, which have typically been gradually introduced over time, and unlike the platform economy, the performance measures are rarely tied to workers and their performance, but different digital devices and machines. Also there continues to be a strong element of manual work involved as well as traditional face to face communication between management and the employees within the manufacturing company.

Thus, the AM-system is not used as the main tool for management-employee communication as well as the communication between workers, which stand in sharp contrast to the platform company. Thereby, our findings point to distinct company practices across the two case companies with respect to their reliance on AM and AI-based technologies to automate work processes and digitalise communication throughout the company, but in neither cases have the work processes been fully automated.

Our case studies also point to important cross/sector variations when it comes to employee involvement when implementing AM and AI/based technologies at company level, although the broader regulatory framework offers comparatively strong consultative employee rights which are embedded within both Danish labour law and collective agreements (Larsen et al., 2022). There seems to stronger formal employee involvement within the Danish manufacturing company than the platform company. Within the manufacturing company, the workers not only have had the opportunity to voice their concerns, but there also seems to be a strong tradition of employee involvement in the distinct stages of the digitization process, where employees are not only informed, but also consulted as well as can influence if and how new technologies are implemented within the manufacturing company. In fact, employees very much appear to contribute to the decisions on which digital pilot projects that should survive and which project that dies within the manufacturing company. In this context, it is noteworthy that the close social dialogue between management and employees typically takes place in parallels to the well-established workplace institutions for employee involvement. By contrast, the platform company has no tradition of any forms of collective workplace representation and the couriers have not been involved in the process of developing and implementing the AM-system. However, and similar to the manufacturing company, different forms of informal social dialogue appear to have taken regularly place between management and the workers within the platform company. In fact, informal employee involvement, especially with workers at the shop floor appears to be the dominant approach within both case studies.

In both case studies we also find that there is limited awareness among the different employee groups about the data collected by their employers, but workers appear often more critical towards for example tracking of individual workers in Danish manufacturing than the platform economy, where it is more widespread to track individual workers. In this context, the manufacturing workers seem to have utilised the various channels for workplace representation to voice their concerns at the shop floor and the disagreements have typically been resolved within the manufacturing company. By contrast, the platform workers have increasingly utilised alternative channels such as social media, mobilised demonstrations, campaigns as well as the legal system with support from the Danish trade union movement to air their concerns and push for solutions. These important cross-sectoral variations may be closely tied to the different traditions of workplace institutions and representation within the two case companies. The Danish manufacturing company has strong historical roots within the Danish collective bargaining system, while the platform company operates on the outskirt of the Danish collective bargaining model as well as within the regulatory grey zones of Danish labour law. Therefore, one of the ways platform workers can raise their concerns when the informal dialogue with management appears unsuccessful is to utilise alternative channels whereby the disputes no longer are refined to the company but forms part of the public debate with different implications for the platform and the platform workers.

In sum, the digitalisation process within the Danish manufacturing company and the platform company differs considerably. The digital voyage within the manufacturing company resembles more an incremental change with careful consideration for the associated productivity- and

efficiency gains, positive financial investment return as well as health and safety risks. By contrast, AM and AI-based technologies are at the very heart of the platform company's business model and thus formed part of the company from the very start although there have been smaller adjustments to the AM system as the platform has expanded their business and experienced rapid growth.

7. CONCLUSIONS

This report has explored the implementation of AM and AI-based technologies and their implications for the day-to-day work processes in two illustrative case studies of Danish companies within the manufacturing sector and the platform economy, where we particularly have focused on the role of employee involvement in these processes. Our findings indicate that the digitalisation voyage within the two case companies have been very different although both companies are considered to be at the very forefront when it comes to using AM and AI-based technologies within Danish manufacturing and the platform economy, respectively. In fact, the usage of AM and AI-based technologies appear more visible in the platform company where such technologies seem central to the platform company's business model while the reliance on AM and AI-based solutions seem more hidden within manufacturing company and merely a tool to optimise work processes and a way for product development than being the very core of their business model.

The two case companies also represent two extreme cases of the Danish industrial relations model. The manufacturing company is strongly embedded within the Danish collective bargaining model while the platform company operates in the regulatory grey zones of Danish labour laws and at the very outskirt of the Danish collective bargaining model. These institutional differences appear to influence the involvement of workers when implementing AM and AI-based technologies at company level. We find stronger traditions of formal employee involvement within the manufacturing company than the platform company, which has no workplace institutions in place for worker consultation. In addition and unlike the platform company, the employees and their workplace representatives have been part of developing the joint guidelines and company-based agreements on various aspects related to AM, AI/based technologies and digitalisation more broadly within the Danish manufacturing company. However, in both company cases, informal social dialogue between management and the workers appeared to be the dominant approach for employee involvement, indicating that the role of collective bargaining played less of a role in both case studies when it comes to implementing AI and AM-based technologies at the shop floor. Nevertheless, our findings also suggest that the institutional framework for employee involvement, including both the company based bargaining system and the collaboration committees serve as an important platform for workers to voice their concern as well as for local social partners to find joint solutions to the different challenges emerging from implementing AI and AM-based solutions. In fact, our case studies indicate if such company-based institutions for workplace representation are non-existent, workers are more likely to pursue alternative channels to voice their concerns and push for solutions, whereby the disputes are more likely to unfold in the broader public than being refined to individual company. Thereby, collective bargaining seems to implicitly play a role for regulating AM and AI based technologies. The recent collective bargaining round in Denmark underpins this, as issues related to AM and AI-based technologies were on bargaining agenda of Danish social partners. The Danish government and Danish politicians more broadly are also increasingly discussing the implications of AM and AI-based technologies, indicating that the topic has gained prominence among Danish key stakeholders, where especially collective bargaining appears to be one way to regulate AM.

LIST OF REFERENCES

ADD (2023) *Lancering af anbefalinger: Hvordan sikrer vi ansvarlig anvendelse af medarbejderdata?*, online worksop december 4th, 2023, Copenhagen: ADD**.**

BM (2023) *Samlenotat til EPSCO møde 12 juni 2023 - Forslag til direktiv om forbedring af arbejdsvilkår for platformsarbejd*e, København: BM.

Danish Chamber of Commerce & 3F (2023) *Madudbringningsoverenskomsten 2023-2025*, Copenhagen: Danish Chamber of commerce.

DI, (2023) *Forstå kunstig intelligens*, København: DI.

Disruption Council (2017). *Kommissorium Regeringen nedsatte den 1. maj 2017 Disruptionrådet – Partnerskab for Danmarks fremtid*. Copenhagen: Beskæftigelsesministeriet.

Dyhrbye JK & Lovfall, S (2022) *Dataetik I den finansielle sektor - Moenstre paa tvaers, report for Finansforbundet*, Copenhagen: Wilke &Copenhagen Learning.

European Company Survey (2015) *Data visualization*, Dublin: Eurofound,

Finansforbundet (2023) *Data ethics in the financial sector: we need to take on the challenges together*, May 30th. 2023, press release, Copenhagen: Finansforbundet.

Haldrup, C, Ilsøe A & Larsen TP (Forthcoming). With or Without Algorithms: Managing self-employed in the platform economy, In Conen W and Reuter E. (eds.) *"Research Handbook on Self-employment and Public Policy"*, Routledge.

Hau, M.F. & Savage, O.G. (2022). Building coalitions on Facebook: Grassroots 'Social Media Unionism' among Danish bike couriers. Paper presented at SASE, Amsterdam, The Netherlands, 9-11 July 2022.HK and Co-operative, 2023

HK-privat, Teknisk Landsforbund and Ko-operationen (2023) *Social media aftalerne*, København: Ko-operationen.

Hvidt, Martine Stagelund, Arbejdsmiljørisici for online platformsarbejdere i et juridisk perspektiv, *Tidskrift for Miljø*, 1/2021.

Ilsøe, A & Larsen, TP (2021): Why do labour platforms negotiate? Platform strategies in tax-based welfare states. *Economic and Industrial Democracy*. https://doi.org/10.1177/0143831X211056974

Ilsøe, Anna & Larsen, Trine Pernille (2022): *Digitale arbejdsmarkeder – fra jobs til opgaver*. Copenahgen: DJØF Forlag.

Ilsøe, A. and Söderqvist, F. (2022). Will there be a Nordic model in the platform economy? Evasive and integrative platform strategies in Denmark and Sweden. Regulation & Governance. https://doi.org/10.1111/rego.12465

Ilsøe A, Larsen TP, Ronaldsson, B & Mattcheu, C. (forthcoming) Negotiating about algorithms– social partner responses to AI in Denmark and Sweden, paper under second stage review at ILR-review.

KL og Dansk Erhverv (2023) AI skal løfte fremtidens velfærd, Copenhagen KL, URL: [Kunstig intelligens skal løfte fremtidens velfærd (kl.dk)](#)

Larsen, TP and Ilsøe A (2022) Varieties of organised decentralisation across sectors in Denmark: A company perspective, Industrial relations journal, 54(4): 368-389.

Larsen TP and Ilsøe A (2023) *Danish Stock taking report: Regulating health & safety in the Platform Economy, report for the GIG-OSH project*, Copenhagen: FAOS.

Larsen, T.P.; Ilsøe A.; and Bach E.S. (2022a). Innovative union services and non-standard workers in DenmarkNational report in the Breakback project, FAOS research report 186. FAOS.

Larsen, Trine Pernille, Ilsøe Anna, Tell, Henriette Krøll and Haldrup, Christian. 2022. *Developments in Algorithmic Management from an IR-perspective - Denmark*. FAOS, Copenhagen: Copenhagen University.

Scheele, L., Im, Z. J., & Leschke, J. (2023). *Unpredictable and Non-transparent Working Conditions? Riders in the Food-delivery Sector in Six EU Countries*. EuSocialCit. EuSocialCit Working Paper The Future of European Social Citizenship No. D4.3 https://doi.org/10.5281/zenodo.7639909

Munkholm, N.V.; Jacqueson, C.; and Schjøler, C.H. (2022). Lønmodtager-/arbejdstagerbegrebet i dansk arbejdsog ansættelsesret – med fokus på platformsarbejde. Teknisk-juridisk rapport udarbejdet for Beskæftigelsesministeriet. Ministry of Employment.

Nielsen MB, Soerensen, JK and Gisselmann, S (2023) *Er de nordiske organisationer klar til AI?* Report by the Tænketanken Mandag Morgen commissioned by the ADD-projektet, DI Digital, Digital Dogme, EY, Finansforbundet, HK, LinkedIn, Microsoft og Netcompany Projektledelse, Copenhagen: ADD project.

Rolandsson, B.; Alasoini, T.; Berglund, T.; Dølvik, J.E.; Hedenus, A.;Ilsøe, A.; Pernille-Larsen, T.; Rasmussen, S.; Steen, J.R.; Hjelm, E.; and Varje, P. (2020). *Digital Transformations of Traditional Work in the Nordic Countries*, in TemaNord 2020:540. Nordic Council of Ministers

Statistics Denmark (2023a) *Virksomhedernes brug af robotteknologi og kunstig intelligens (10+ansatte) efter virksomhedsstørrelse*, branche (DB07), anvendelse og tid, ITAV19, online database Statistikbanken, Copenhagen: Statistics Denmark

Statistics Denmark (2023b) *13 pct. af mikrovirksomheder bruger AI*, Nyt fra Danmarks Statistik, nr 285, 18 august 2023, Copenhagen: Statistics Denmark.