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INCODING case studies reports

Co-determining Algorithmic Management and Artificial intelligence at work?

The role of collective bargaining in Germany

Partner: Wissenschaftszentrum Berlin für Sozialforschung

Authors: **PHILIP WOTSCHACK**

FLORIAN BUTOLLO

LEON HELLBACH

JORDI ZIOUR

WZB

Berlin Social Science Center

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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.

1. INTRODUCTION

As shown in our stock-taking report, the use and regulation of AI and AM in Germany is not subject of specific legal regulations (with a direct focus on AI or AM) but a relatively large number of established legal regulations, sectoral and company agreements, and union and works council activities that are (indirectly) governing the field of AI and AM application by addressing issues of data protection, platform work, co-determination, or discrimination. In addition to the General Data Protection Regulation (DGSVO), the Scientific Service cites the German Civil Code (BGB), the Unfair Competition Act (UWG), the Copyright Act (UrhG), the Administrative Procedure Act (VwVfG), the

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

Product Liability Act (ProdHaftG), the Road Traffic Act (StVG), the General Equal Treatment Act (AGG) and the Works Constitution Act (BetrVG) (WisDi 2023).

The German Works Constitution Act ('Betriebsverfassungsgesetz') plays a major role in the regulation of AM and AI in Germany. It provides extensive information and advisory rights as well as effective co-determination rights to works councils that also apply to the use of AI systems and algorithms. They are derived from the general right to information (Section 80 & 90 BetrVG). This broadly defined right applies without restriction to the automation of personnel management using AI systems. Employers are obliged to inform the works council in advance and comprehensively about the relevant planning. The same applies regarding the introduction of technical systems in work processes. However, the current policy debate in Germany underlines substantial challenges for policy makers, worker representatives, and the regulation of AI and AM in different areas of the German work place, including stronger standardization of tasks, work intensification, restriction of autonomy, or increasing performance control.

Accordingly, the ad hoc working group "Algorithmic Management" established by the German Federal Ministry of Labour and Social Affairs (BMAS) and the metal workers' union (IG Metall) emphasizes the need for further regulation, law enforcement, and actions of the social partners to provide transparency, explicability and traceability in the use of AI and AM (Arbeitsgruppe "Algorithmisches Management" 2023). Four key areas of action are identified, like (1) integrated planning of AM systems including participation of workers and their representatives, (2) transparency about used data and functioning of AM systems provided by developers and companies, (3) building know-how for assessing the effects on work processes and conditions during use, and (4) a systematic and knowledge-based change management, for example through strategic goal setting, evaluation and feedback systems (Arbeitsgruppe "Algorithmisches Management" 2023). How works councils and managers cope with these new demands has not yet been explored.

Recently, new regulations like the Works Councils Modernization Act ('Betriebsrätemodernisierungsgesetz') (6/2021) came into effect giving particular importance to procedural co-determination rights (Albrecht & Görlitz 2021) and stronger involvement of works councils in AI usage. According to the law, works council can now call in an external expert to evaluate AI or AM. However, we still lack knowledge on how this law is used and experience by the works councils and how it affects AI or AM usage.

At the level of collective agreements, so called future-oriented forms of collective agreements ('Zukunftstarifverträge') have been introduced in the metal and electrical industry sector (in North Rhine-Westphalia). Though this new type of collective agreement is not focused on AI or AM issues, it might provide some guidance also for these areas. However, according to union representatives these collective agreements are neither widespread (less than 20%) nor popular among the employers. Often the management fears that unions and work councils might interfere in decisions on investments and innovation. Regarding co-determination, these agreements represent a rather soft instrument encouraging the social partners to start negotiations on investments, sustainable products or the improvements of work processes and technology.

However, given the huge level of variation at the company level regarding the type and use of AI and AM systems, it remains an open question – also within the union's debates – to what extent and in which way sectoral collective agreements can be used to regulate AI and AM application. Some argue, for instance, that collective agreements might be used to oblige companies to develop company agreements that cover critical issues of AI or AM usage in terms of transparency,

surveillance, data-use or co-determination. Unsurprisingly, the demands and debates on regulation are shaped by sectoral differences and skill levels. This becomes evident when we compare contrasting areas of the German economy like the industrial core sector and more peripheral parts of the service economy like food delivery. In our field exploration we find evidence that union representatives in the food-delivery sector have a stronger interest to define detailed and binding requirements regarding AI and AM usage at the sectoral level since they lack the power and often works council to regulate these issues at the company level.

Industrial manufacturing and food delivery services represent two contrasting fields regarding skill levels, power relations, management strategies, employee representation, and needs and pathways of AI regulation. Compared to work in the food-delivery sector, where control and transparency issues are salient and power and co-determination is constrained, introduction of AM and AI in the manufacturing sector takes place in a more favorable environment for workers. It is characterized by less biased power relations and a widespread culture and acceptance of co-determination by works councils and unions, which are actively using the given opportunities provided by law.

While food and meal delivery services are usually regarded as an example of strong algorithm-based control and standardization of low-skilled work, existing case-studies in the manufacturing or logistic sector draw a more ambiguous picture. On the one hand, algorithm-based work governance at industrial workplaces is also criticized for its potential to gather data on worker productivity and hence the ability to closely monitor activities (Falkenberg, 2018). Particularly, in assembly work and logistics, algorithm-based assistance systems are applied to guide workers through the assembly process or in the selection of parts. On the other hand, studies show that these systems can indeed be deployed with very different concepts of work: Algorithm-based assistance systems can provide flexible, situational information to employees, or they can be used to improve the transparency of work processes, optimize individual work performance and work organization, and increase the quality of tasks and enhance skills (Klippert, 2020). The literature on AI and AM highlights that structures of co-determination can be a crucial factor in this ambiguous field. Several studies show the importance of co-determination regarding both the introduction of new (digital) technology and issues of performance regulation to recognize aspects of a human-oriented design of assistance systems (Albrecht & Görlitz, 2021; Evers, Krzywdzinski & Pfeiffer, 2019; Krzywdzinski, Gerst & Butollo, 2023).

However, in both sectors, the functioning and consequences of AM and AI applications often remain a black box. Unforeseeable and unintended effects in terms of control, standardization and work intensification might occur in the long run, pointing towards new and often hidden demands for regulation, even in a favorable setting. The following comparison of two contrasting company cases - one selected from industrial engineering, one from the food-delivery sector, aims to close the outlined gaps in previous research by exploring the introduction, use, co-determination and effects of AM in different sectoral contexts. Based on intense case-studies, our analyses are guided by three questions: (1) How is algorithm-based management and control used by the companies? (2) How is it perceived by the couriers, also in relation to other aspects of their work? (3) What are the works council's priorities, strategies, and achievements regarding co-determination practices?

Contrary to the prevalent perception in the literature on the subject of AI and AM, our analysis shows that human agency is still pivotal when algorithm-based systems are used to manage work processes. In both cases, we do not find clear evidence that algorithm-based performance control would be applied for evaluating and disciplining couriers at an individual level. Salient problems and conflicts rather arise from classical issues of work and employment conditions, like working hours,

pay or safety. Although data- and AM-related issues do not represent a central area of conflict in both cases, our study shows that AI and AM usage pose problems of non-transparency and information asymmetry, which calls for new forms and procedures of co-determination. In the case of the food-delivery company, the question whether AM is used for individual performance control remains a contested issue for the works council.

2. METHODOLOGY

The following results are based on two intensive firm-level cases study that have been conducted in 2022/2023 (a) in a large food delivery company (approximately 10.000 employees) and (b) a medium-sized mechanical engineering company (approximately 500 employees). Based on literature research and field exploration interviews with union representatives and members of our research and company network, we selected the companies due to following criteria: (1) sectoral differences: manufacturing and service sector; (2) substantial usage of AI/AM-systems in similar fields: optimization of planning/distribution of orders; (3) existing structures of co-determination (by works councils and unions). In a first step, we approached the companies via Email followed by a first (virtual) exploratory interview with management (mechanical engineering company) and the works council (food delivery company). In the second step we carried out documentary analyses and (8-10 expert interviews of 1-2 hours) with managers, members of the work council, union representatives or external experts (like software developers) in both companies. Moreover, guided qualitative interviews of ½-1 hour with workers (mechanical engineering company) and couriers (food delivery company) have been carried out. We visited the mechanical engineering company two times for two days and conducted most interviews there. In contrast, most of the interviews for the food delivery company were done virtually.

3. CASE I – AI AND AM IN THE FOOD DELIVERY SECTOR

3.1. BACKGROUND

AM plays an essential role in organizing food delivery work. Taking into account customer demand and restaurant and driver availabilities, the sequence of distribution tasks is calculated and assigned to the couriers by an app on their mobile phones in order to optimize their routes. This process entails constant tracking of the couriers along their routes. One stream in the scientific literature and public debate on platform work emphasizes the control potential of algorithm-based management systems, often referring to the food delivery sector as a typical example (Veen, Barratt & Goods, 2020; Woodcock, 2020). In this view, workers are not only exposed to precarious working conditions but also to algorithm-based forms of monitoring and control.

Digital platform companies are also known for precarious working conditions in terms of low-skilled tasks, temporary contracts, low pay and (unreliably) flexible working hours. Often, they attract migrant workers (often refugees) due to their easy accessibility through low formal requirements, low language barriers, and short recruitment procedures (van Doorn, Ferrari & Graham, 2022).

In the German food delivery sector, AM occurs in the form of “app-based management” (Ivanova et al., 2018, 12) and is often discussed as an example of high external performance control in the sense of Kellogg, Valentine & Christin (2020). The smartphone is the focal point of algorithmic management

in location-based platform work. It not only ensures the mobility of platform workers but also enables the extensive collection of data that can be evaluated – in particular positional data via GPS.

The study by Ivanova et al. (2018) on the management of food-delivery platform work via smart phone applications provided evidence that the tracking of movement generates an enormous amount of data, which enables comprehensive control of work processes. Automatically evaluating this data serves to optimize the processes and to monitor the work performance of the "riders," as couriers are called internally. The assignment of work orders is based on data evaluation. Automated decision-making occurs through algorithms, which often creates the impression of technical rationality and objectivity. The app can also be used to generate additional incentives for motivation and performance improvement ("digital nudging") (Lücking, 2019).

The following in depth-case study was carried out in the German subsidiary of a large international food delivery service group and platform. In contrast to other parts of the platform economy, the company (meanwhile) issues fixed-term and permanent contracts to their couriers. After long periods of labor disputes, structures of co-determination have been introduced. This specific organizational setting gives us the opportunity to study the role of co-determination in the food-delivery sector. The company employs about 600 delivery couriers in Berlin and about 10,000 in Germany. Approximately 20% of the fleet are full-time couriers, while the majority are part-time couriers, a considerable share in precarious employment relationships.

In 2020, the global turnover of the international group grew by more than 50 percent to more than 2 billion euros. The profit mainly stems from the platform's agency fee, not the delivery services (which is considered a cost factor). Productivity gains achieved through the implementation of the algorithmic system thus lie in the very business model of food delivery platforms itself and reaching compatible productivity in deliveries without GPS monitoring would be impossible.

In 2019 a central works council was elected. There are also works council in various cities in Germany. Lately, a works council Berlin was elected, of which two thirds of the elected list members belonged to the 'grassroot' movement of the couriers and only one third came from the list by the trade union. So far, there is no collective agreement for the company. The sector's trade union (NGG) and the union-related works council members are striving for a collective agreement on pay, working hours, work equipment and safety – and also on data and AM issues. However, the management rejects so far. Recently, there have been strikes organized by the union and works councils.

3.2. USE OF AI AND AM IN THE COMPANY

In the observed company, algorithm-based management takes place via an app that couriers need to install on their cell phones. It assigns jobs to couriers, navigates them to the destination and transmits information about pickup and arrival times to customers. This means the company continually tracks the location, speed, response time, delivery time, and route of the couriers. But, according to the company officials and couriers we interviewed, this information is not used to discipline couriers and achieve performance gains, at least not in an automated way. The management emphasized that individual performance characteristics are neither generated nor used for individual performance control. The works council is skeptical in this respect and argues that such information is being used informally and cited as evidence in regular performance reviews.

Still, overall, our study provides evidence that AM is mainly used by the company for the sake of process optimization, i.e., for optimizing the sequence and allocation of orders. Humans could clearly not oversee and efficiently manage such large numbers of couriers and orders in the delivery

area. According to a typology by Nies (2021), this type of technology use represents "process-oriented rationalization," in contrast to rationalization strategies focusing on individual performance control. This orientation fulfills the function of maximizing efficiency by processing data fast, keeping routes short, and enlarging the geographical scope of deliveries. Nevertheless, it does not mainly aim at individual work performance since couriers are not expected to finish more than around two deliveries per hour and the maximum distance of orders cannot exceed a given number of kilometers.

Regarding the question of performance control, it is evident that couriers are instructed and directed and that their performance is recorded (e.g., start of work, speed, distance, and number of orders). The number of orders also feeds into a bonus system, which rewards couriers when achieving certain numbers of orders per month. But no direct disciplining occurs if couriers are too slow. The technically possible control potential is clearly not exhausted here. We do not find evidence for automated forms of performance control, trying to push couriers or punishing them if late on arrival. The app does indicate couriers who get behind schedule by highlighting the arrival time in red, but it does not execute any automated forms of sanctions. The main variable for the company's productivity, regarding the delivery process, is the efficient coordination of tasks – not the individual work performance.

The app can be characterized as a semi-automated AM system. The system suggests and distributes orders to couriers, but they have to be confirmed by human hand through so-called driver coordinators. The company states that not all problems in everyday logistics can be solved automatically and that individual human attention is always required. As a communication tool for the couriers, the app also establishes contact with the companies 'live operational support', which is supposed to provide help in case that problems, delays or questions occur.

The algorithmic system works based on the factors of worker availability and geographical distance and uses Google Maps for route Navigation. The data is being collected via employees´ phones. Those are aware about this kind of data being collected, but it is rather unclear to them how it is processed in detail, and which additional data is being cumulated. Up until now, it remains unclear to the works council which data is being processed by the company. At the same time, we find some evidence that the companies´ software systems are modular and that some services are conducted by external providers.

3.3. THE IMPACT OF AI AND AM

Tracking and performance recording are widely accepted by the couriers we interviewed, who consider it as "part of the job." We also find evidence that some couriers even prefer to work with the app over constantly being monitored by a human superior. The app is partly experienced as a liberation from direct, personal management control. Interaction with private apps or tracking of private information are more likely to be discussed as hazards. Some couriers even reported that tracking of employees allegedly also took place outside working hours at one point. Hence, there is often the desire that a cell phone should be provided by the company. At the same time, the works council and some riders with a critical stance have strong concerns regarding data protection issues. They emphasize the risk that the company might collect and process information that is not obligatory for the mere execution of the work process. Issues of algorithmic control and data acquisition are seen as a crucial point for negotiations between the works council and the management. Interestingly, the works council applies a kind of double strategy here. On the one hand, it strives for more transparency and co-determination regarding the development and functioning of the app. On the other hand, they can use their information and approval rights (granted

by the Works Council Constitution Act) to enforce non-AM related claims. In this respect, blocking and delaying software adaptations by not consenting to its implementation represents a strong means to pressure companies that apply digital business models.

Surprisingly, basic flaws of the app are a major topic amongst couriers. Bad navigation and poorly calculated arrival times are seen as an obstacle to good work performance. Moreover, the lack of transparency of the app was seen as a major shortcoming. Couriers are unsure what information is tracked and who might possibly see it and use it for performance assessments. As stated above, our research does not provide evidence of such malpractice at the company surveyed. Still, the insecurity about whether this is done does unsettle couriers and thus results in indirect disciplining. As one rider comments:

> *'So, there's this fear that it'll kind of backfire on me. That there is something like a digital profile of me. And if I somehow make mistakes or become rebellious, then I only get very thankless orders, so to speak. I already had the feeling that a few colleagues were very reserved when it came to criticism or confrontation'.* (Courier)

Feelings of insecurity in this regard may be even more significant amongst vulnerable groups like migrant workers, who represent a large proportion of the workforce.

In line with the existing literature emphasizing information asymmetries due to the black-box character of algorithmic systems, it is difficult for the works council to understand and evaluate the functions of the app regarding their effects on couriers. The works council criticizes that the management only reluctantly provides insights on these matters. As a consequence, the works council and individual couriers have developed reverse engineering strategies to grasp the functioning of the app, i.e., using their own Python programming skills and documentation to assess the algorithm of the app.

A direct impact on workers takes place through the algorithmic assignment of work orders with the help of GPS tracking, which is transmitted through the smart phones interface. Orders cannot be rejected, and a timer is triggered when orders are seen by workers. If the timer exceeds five minutes, a dispatcher will contact the rider to review the process. Although the application indicates a specific delivery route, deviations from the predetermined route are possible and there are no penalties for alternative route selection made by workers. In addition to the algorithmic assignment of work orders, the application also calculates scheduled delivery timers based on the speed of riders, decreasing at higher average speeds and vice versa. When riders are late, the timer numbers are highlighted in red. We did not find evidence that the algorithm would directly provide penalties when deliveries are delayed. Nevertheless, the timer for pickups set by the algorithm puts pressure on riders. The situation is in addition aggravated by the fact that restaurants often cannot even provide the food when riders arrive, because restaurants and riders receive their order at the same time.

Interestingly, the company has stated to conduct feedback and appraisal interviews. The goal here is to "talk about performance". However, it is unclear what this means in concrete terms. While the company states not to evaluate performance individually, the works council highlights that performance recording is already taking place through the calculation of "efficiency" scores (orders per hour) and that this measurement is used in staff appraisals.

In contrast to other fields of the Gig Economy, the couriers receive a fixed salary per hour. The company uses a bonus system, which rewards high performers and thus raises pressure to perform, leading riders to work, for example, even in adverse weather conditions. According to management,

the idea of the bonus systems is rather that workers with midi- or part-time jobs get into higher bonus classes, not workers who do a lot of jobs particularly quickly. This corresponds to the business logic of the company, which strives for extended employment times, because of increased ancillary costs for mini-jobbers due to higher numbers of teach-ins and provision of work equipment. The couriers' earnings are also depending on the functioning and efficiency of the AM system. They can earn more money with higher numbers of completed deliveries. In this respect, the app plays an important role for the couriers' wages by assigning the number and profitability of orders. The non-transparency of the system translates into uncertainty about income since it is difficult for the couriers to estimate the achievable number of deliveries.

3.4. THE REGULATION AND GOVERNANCE OF AI AND AM

Regarding the labor policy background, the company is characterized by a very active, dedicated general works council, which uses all options to improve the couriers' working conditions (including appealing to the labor court). However, the focus is not mainly on control questions relating to the algorithm, but on other topics. This includes the definition of the delivery area (which the company wants to be as large as possible) or the destination of the last delivery (as close to the riders' home as possible). Work cell phones, work equipment (first of all, the bikes), pay and working time issues, as well as a fair distribution of shifts, are major issues forming the companies' main contested terrain. The works council has been successfully engaged in all these issues. The app and related control issues, in contrast, rather remain secondary. The works council is primarily concerned with access to the functional parameters, understanding how the app is processing this information and how it affects the work of the couriers. The works council recognizes the need to engage with the app, but reports difficulties in doing so:

> '*I have an idea of what I do as a works council member – co-determination rights. But the problem is when it comes to the question of what I should deal with precisely, I'm poking around in the dark.*' (Works council member)

Therefore, the works council can only assess the consequences of AM to a limited extent. Thus, the scope for co-determination is restricted, and there remain uncertainties about the effects of possible changes in the AM-system. This is illustrated by the attempts to co-determine the length of tracking intervals:

> *'The thing is, we have no idea about what the impact of, for example, extending the tracking intervals will be. That's always the problem. And we are not told that either. If I have a minute now [...], could it be that the orders will become totally stupid for the couriers? Because they aren't tracked as often anymore. And then they get worse jobs? Maybe they'll get better as a result, but those are the scenarios that we can't answer.'* (Works council member)

The management, on the other side, objects to detailed co-determination of globally used core software by the local, German institutions. Moreover, the management is concerned that a delay in software updates due to the constant scrutiny of the works council limits competitiveness and that the technical understanding of the works council does not correspond to the level of software developers.

Conflicts between management and works council are only to a minor extent related to AM issues, more salient are rather classical issues of labor relations in terms of pay, working hours, safety or work equipment. This is also evidenced by a survey among couriers carried out by the works council. Currently, shift planning has become a major concern for the works council and is mentioned to

cause existential fears due to the uncertainty of acquiring desired shifts. A related problem is the contract model. Top-up contracts with low minimum hours are only allowed to be extended at peak times. Thus, when order levels are low, employees cannot rely on an increase in hours. While shift planning was formerly based on preferences of the couriers, they now need to take care of the shift planning on their own. The works council sees this as a management task that is being outsourced to employees.

Regarding the AM system, there are grievances with the app due to many bugs, a chat system that does not work properly, poor navigation and incorrectly displayed addresses. They have direct (negative) effects on the couriers' possibilities to maximize the amount of orders and (related to this) income. Some couriers even complained that the company's app is deficient in comparison to the ones of some competitors.

In 2021, the data protection officer of the state of Baden-Württemberg raised some concerns regarding the app: The data that the app collects and stores about couriers is documented in several data reports, showing that it is possible to track down with high precision when a driver is assigned an order, picks it up, and delivers it. The data protection officer concluded that this 'is a very close-meshed monitoring of the employment relationship.' The exact location of the couriers is passed on at intervals of 15 to 20 seconds. According to the data protection officer, this leads to so-called tracking, i.e., 'constant monitoring of work performance,' which he believes is 'clearly illegal.' The app also sends personal data to third parties, such as Google. The food delivery company denied the allegation and argued that the courier app complied with the applicable data protection regulations since time and location data are essential for the delivery service to function properly. The company also stated that the data collected was not used for unauthorized performance or behavior control and that the couriers were informed on how and for what purpose the data is used. The lawsuit is still ongoing. It demonstrates the difficulties and possible limitations when legal regulations regarding data protection are applied.

The union which cooperates with parts of the works council reports an adversarial relationship to the company´s management. They state that the employer is reluctant to engage in bargaining and that he does not engage in official communication, but exclusively communicates via press releases. They also criticize that the employer does not respond to emails or requests for meetings and even set up a department "whose job it is to boycott works council elections, to intervene". Eventually, the responsible union representative (NGG) listed a number of urgent demands that they would like to push through collective bargaining. Besides safety issues and compensation for night work, a collective agreement should guarantee the right to co-determination and information regarding algorithmic systems and data. Obligations should be reversed: Data collected by the company must be provided to the works council without request. Moreover, the company needs to make sure that no data is passed on to third parties during processing. Live tracking should be abolished and supplemented by worker friendly alternatives, such as clocks that run backwards. Noted as important is also the right to refuse orders, for example in dangerous situations, as well as digital emergency buttons. Regarding the mentioned technical shortcomings of the app, a clarification of liability issues is recommended: In this case the employer has to compensate the couriers for possible financial disadvantages.

4. CASE II – AI AND AM IN THE MANUFACTURING SECTOR

4.1. BACKGROUND

While the food- delivery sector is often regarded as an example of strong algorithm-based control and standardization of low-skilled work, case-studies in the manufacturing sector draw a more ambiguous picture. On the one hand, algorithm-based work governance at industrial work-places is also criticized for its potential to gather data on worker productivity and hence the ability to closely monitor activities (Falkenberg, 2018). Particularly, in assembly work and logistics, algorithm-based assistance systems are applied to guide workers through the assembly process or in the selection of parts. On the other hand, studies show that these systems can indeed be deployed with very different concepts of work: Algorithm-based assistance systems can provide flexible, situational information to employees, or they can be used to improve the transparency of work processes, optimize individual work performance and work organization, and increase the quality of tasks and enhance skills (Klippert, 2020).

The literature on AM also highlights that structures of co-determination can be a crucial factor in this ambiguous field. Several studies show the importance of co-determination regarding both the introduction of new (digital) technology and issues of performance regulation to recognize aspects of a human-oriented design of assistance systems (Albrecht & Görlitz, 2021; Evers, Krzywdzinski & Pfeiffer, 2019; Krzywdzinski, Gerst & Butollo, 2023). A notable result is the relatively high acceptance of digital assistance systems, even in highly standardized processes. There are few conflicts, also due to the strong role of works councils in securing data protection criteria and preventing performance monitoring and behavioral control. Moreover, there is evidence that the acceptance of algorithm-based assistance systems (such as smart wearables) by workers relates to issues of transparency and co-determination. Employees tend to accept such systems if they retain control over the data and data usage and if this has a clear benefit for their work – especially in terms of reducing workload (Evers, Krzywdzinski & Pfeiffer, 2019).

For the unions in the manufacturing sector, the topic of AI and regulation has gained high importance. The largest union in Germany – the metal workers' union IG Metall -– is currently involved in the political and social discourse on artificial intelligence, both at federal and European level, through statements and participation in consultations and stakeholder discussions of the European Commission (Albrecht & Görlitz 2021; Gerst 2021). As reported by union representatives, the scale and variety of AI applications is challenging given regulations in the industrial sector. Since AI is moving into decision-making areas that were previously reserved for humans, human autonomy, discrimination, and behavioral control have become major issues for the union. Since AI systems can continuously evolve, they also see a growing need to constantly reassess AI.

Nevertheless, AI is not primarily seen as a threat. Basically, the metal workers' union (IG Metall) strives for using the advantages of digitization without losing sight of the risks and emphasizes the need to actively shape digitization. Possible risks for employees are identified regarding the automation of activities, the processing of personal data, discrimination through people analytics, loss of freedom of action, changing job profiles and growing pressure to perform. A need for action is identified in the following fields: (a) Tackling the lack of co-determination and employee representation regarding the development and implementation of AI and AM systems. (b) Since digitization projects are often planned decentrally, works councils often lack information on the entire process. (c) Digitization requires cross-topic representation of interests, for which works councils often do not have the appropriate body. (d) Digitization requires rapid responsiveness and

resources, while works councils are often not agile enough in this respect. (e) Management is increasingly involving employees in digitization projects and thus competing with established structures of employee representation. (f) Since groups of workers are affected differently by digitization, it is becoming increasingly difficult to establish solidarity. The need for action in these fields is evidenced and demonstrated by the following case-study.

4.2. THE USE OF AI AND AM IN THE COMPANY

The surveyed mechanical engineering company (established in 1920) produces slitting and winding machines, technology, and services. The enterprise has around 650 employees worldwide. 75 of them work in the surveyed production site, most of them as skilled machine operators with stable employment trajectories and standard wages. The company has a long-standing works council (12 members) that is closely cooperating with the trade union ('IG Metall'). Union membership is traditionally high with shares of approximately 80% or more. The management has recently opted out of the sectoral collective agreement ('Flächentarifvertrag') and the future-oriented collective agreement ('Zukunftstarifvertrag'). According to the management, they feared that the union might interfere in areas like investment or innovation. The union representatives denied this. A new agreement ('Anerkennungstarifvertrag') between the union and the company was agreed to guarantee wages at the level of the sectoral collective agreement.

The company recently introduced an algorithmic based production planning system (PPS). The introduction of the system was part of a comprehensive change project in the company - covering very different areas of action, like work organization, material flows, or logistics - that was initiated to encounter economic difficulties. The PPS suggest optimal order sequences based on the given number of orders, delivery times, available machines, and available workers. It functions as a forecasting and decision-making tool for the production planner. According to him, the tool enhances his ability to make decisions in terms of best order and production sequence based on real-time data from the shop floor (machines) and multi-dimensional factor calculations. These calculations exceed the capabilities of human planners.

> *'No one can keep track of the status of order processing for 350 orders. In the past, this was always regulated: 'Whoever roars the loudest gets served.' With the software, scenarios can be planned to see how additional orders [...] affect the entire order processing.'* (Production Manager)

The system was in the first place introduced to increase on-time delivery. Other criteria for optimization (like reducing labor costs or maximizing output) would have been possible but were not prioritized by the production manager. The PPS software is able to prioritize different criteria for optimization (each on a scale from zero to hundred), like optimal labor costs, optimal production effort, optimal capacity utilization, or optimal on-time delivery. On-time delivery was selected by the management as the unique optimization criterium. It is particularly important for the company for three reasons: (1) The company is a supplier of specific, highly important machine parts for the mother company. (2) In the past 37 percent of the total deliveries have not been on time due to bottlenecks in staff and machine capacities. (3) The company often has to cope with short-term changes (due to machine failure or absenteeism) or flexible readjustment of orders (so called master orders with high priority). The PPS calculates the most beneficial sequence of production tasks in relation to available capacities and suggests the distribution of work tasks to the machines, accordingly. This goes along with a digital mapping of the entire production process. The planner evaluates the calculations and suggestions of the PPS based on both, his former experiential

planning knowledge and his experiences with the PPS (new experiential knowledge). If necessary, sequences are recalculated or adapted by the planner.

When the planner agrees on the order and production sequence suggested by the PPS the work tasks are transferred to the machine operators. Operational data for the algorithm-based PPS are provided in real-time based on measured set-up times, costumer orders, and downtimes at the machines. The system automatically calculates the estimated machine utilization time and order. The planner readjusts in case of unexpected incidents (like machine damage or absence of workers) and intervenes manually to ensure that production runs smoothly.

Various forms of data are used and produced by the PPS. First, the PPS uses so-called 'master data' from the EAP system. This is manually defined data specifying how long it takes to produce a workpiece with a machine. The quality of the calculated sequences depends on these master data. It has happened that individual orders could not be delivered on time because the workpieces took longer than calculated by the PPS due to incorrect master data. Second, the PPS maps the production time at the different machines. Consequently, the required production times for different workpieces or orders become visible. However, the production manager claims that this information is only used on an aggregated level to estimate average production times.

Due to considerable improvements regarding on-time delivery – the rate of on-time delivery was enhanced by 30 percentage points to 97 percent – and substantial changes in work organization (independent from the PPS) the company realized huge productivity gains. According to the production manager, one-third of the required working hours to manufacture and assemble the product was saved. These improvements were important to save the companies' future, since the plant had struggled with economic difficulties in the past. Please note that the algorithm-based PPS was only one building block in the company's comprehensive change and reorganization process. It contributed to the economic success next to other non-technological improvements (like work organization) but was clearly not the only cause.

4.3. THE IMPACT OF AI AND AM

At the company level, the most important change brought about by the algorithmic PPS concerns the way production tasks are organized. It turned out that sequential scheduling of tasks leads to superior results, which contradicts the former planning practices. Instead of feeding in as many orders as possible, the number of simultaneously processed orders was reduced from approximately 700 to 350. Consequently, individual orders are processed quicker and more efficiently leading to higher numbers of completed orders in total. Moreover, the system improved the company's flexibility to cope with unforeseen bottlenecks or to feed in (master) orders with high priority. The PPS helps the planner to adapt to these changes by quickly calculating and suggesting new production sequences.

To evaluate the effects of the new PPS on the work situation and work experience at the shop floor level, we interviewed several machine operators. It is their work to feed the machines with unpolished and raw metal, to install the required working tools, and to start and monitor machine operations. According to the production manager, the production process has been 'homogenized' and 'smoothened' in terms of fewer interruptions and bottlenecks. Overall, the workers are satisfied with the new planning system and the reorganization of the order processing. They do not report substantial changes or negative effects regarding their work situation. However, they report a (a) reduction of walking distances and related to this less encounters and communication (b) reduction

of setup-times at the machines (installation of new tools), (c) less autonomy to decide about the sequence of setup times, (d) an extended planning horizon.

Less autonomy about the sequence of work tasks is a result of the automated calculations of the PPS. Before its introduction, the operators could to a certain extent influence the sequence of their tasks within the corresponding batch assigned to them. It was reported that they had mostly arranged the orders in a way that reduced the setup times at the machines by merging similar tasks. This seemed rational from their individual point of view, but not from the perspective of the overall process. The calculations of the PPS confirmed that the former approach of the workers did not lead to the best outcomes in terms of on-time delivery.

> *'Employees often tried to avoid multiple setup times. From the perspective on the overall result, this was often suboptimal [...]. That was a very big learning curve that the employees had to go through. To understand that it makes more sense to set up a machine more often than to run everything in sequence.'* (Production Manager)

There were still frequent feedback loops between the planner and the machine operators, also learning processes and a dialogue to explain the reasons for the reorganization of task sequences. However, the decisions of the planner (based on the suggestions of the PPS) have to be executed by the operators. In our interviews, we did not find evidence for complaints about this loss of autonomy. Overall, the operators accept the new system and point at the advantages. Presumably, this has to do with the overall satisfaction about the improved economic situation of the company also resulting in higher employment security. Moreover, the core work content (machine operation) was not affected by the changes. We did not find evidence for deskilling, work intensification or increasing working hours.

Another important change due to the PPS is the extended planning horizon. The sequence of future orders and tasks is now displayed on the machines. The forecast of the upcoming tasks is extended to several weeks or even months. Some of the interviewed workers appreciate this. They use the digital interface and order forecast for long-term planning and adjustments of private activities. Others, mostly older employees, hardly use the digital preview or report difficulties to use it. There was hardly any support or training for this type of workers.

As mentioned above, the PPS systems goes along with higher level of process transparency and visibility of the workers' individual performance. According to management, however, there is no intention to use this data for evaluating or improving the individual work performance.

> '*How long he takes to set up, how long he takes to manufacture – I'm not really interested. Of course, it's running in the background, but he should simply process the order as quickly as he can. He doesn't have to leave here with a wet shirt, he should do it one after another [...]. And so, we now see exactly: How long does he spend on an order? How long does he take to complete an order? And then we adjust our times in the system [...], so that we get an optimal plan afterwards*.' (Production Manager)

According to the production manager, the pace of production is only marginally affected by the speed by which the machine operators execute their tasks. They merely deal with short periods of setup that are followed by long periods of automated operation by the machines. The efficiency of the overall process hence rather depends on allocating resources efficiently and calculating the right sequence of tasks. An important strategic field in this respect is the capturing, processing, and use of data. The plant manager reports a desire to gain more machine data to optimize the

production. He also thinks about sensor technology to obtain more information on machine performance.

In addition to the outlined direct work-place effects, we found a couple of additional rather indirect or non-intended effects going along with the new PPS. The higher level of process transparency, provided by the system, tends to affect the operator's behavior. According to the production manager, the number of orders and their processing at different machines is visible in the system's preview mode. This might affect their pace of work since the PPS provides an overview on the state of the order processing at the different machines. We also find evidence for informal competitions among the machine operators regarding output (piece) numbers.

Overall, our study draws a diverse picture of how the algorithmic system affects the work process and behavior of the machine operators. On the one hand, the influence on the work process is rather weak. According to the machine operators, their work content and work routines have not changed in a significant way. Some of them did not even notice any change at all. Overall, satisfaction with the new system is high. On the other hand, our study evidences several changes like losses of autonomy, reduction of walking distances and communication among workers, more set-up times, or the extended planning horizon and order preview. There is a growing need to align production tasks with the production controller, resulting in a relative loss of autonomy over the execution of work tasks. Eventually, there remains the open question to what extent the huge overall increase in productivity (by approximately 30) can be explained by the outlined reorganization and optimization of order sequences and work processes and to what extent it is also based on some sort of work intensification (e.g., more set-up times, fewer idle times, higher work pace) going along with this process optimization.

4.4. THE REGULATION AND GOVERNANCE OF AI AND AM

The introduction of the algorithm-based PPS was part of a large-scale change project that was mainly initiated, planned and governed by the management in cooperation with a software development and a consulting company. Workers of various functions have been involved in working groups with the aim to identify shortcomings in the labor process und to find solutions to overcome them. The works council was integrated too but played a rather passive role. Regarding the PPS, a working group around the production manager planned and assessed the software implementation process and the related work packages. Overall, we would characterize the implementation process as a top-down implementation with some minor elements of works council or worker participation. This view is also shared by the works council and the responsible union representative.

> *'The colleagues were involved as far as they were able. I mean, what's the point of bringing in a CNC turner or router, whatever, who can only have a limited view of the whole thing because of what they do? He then sits there and maybe says: Oh, I might have the comment and then they talk about participation. Yes, the colleagues have been involved, but to what extent should this be assessed?'* (Union Representative)

> *„Well, how should I put it, the first events were neutral, and you really got an idea and they interviewed the employees. How do you see it? What do you need? This is actually what the works council also likes. But then I had the feeling that they had an idea and image and from that moment on they were not interested anymore. That may sound a bit mean, but then they went on and implemented really straight what they thought they had understood.“* (Works Council)

The PPS software was developed in close cooperation between the factory, production, and planning managers on the one hand and the software development company on the other hand. It was important to the factory manager that the software is not a unique, firm-specific solution but a standard planning software that can be tailored to the specific needs of the company. In this respect, the PPS also reflects the experiential knowledge of the production planner and his team: '*The thoughts of the team are in the software*.' (production manager). This is also expressed in the planner's description of the original software development and training process.

> *'There is no point in entering data that does not correspond to reality. Shit in, shit out. That's just the way it is with such software. We looked at the plan together, down to the operations. We took a work process that the software has already planned, but that we would plan differently. And we said, okay, we'll reschedule it. Together with the programmer, who explained to us why the software did it this way. And then we adjusted the parameters until the result came out as we wanted it. Now we were able to work. And that's how we got into it. It was a process of at least a year'* (Planner)

The production manager assembled a team of five people for designing the restructuring program (the so-called "FLOW" project) and the software implementation process. This team identified several goals and work packages. Interviews with employees about shortcomings, bottlenecks, problems and possible improvements in the work process helped to design the measures of the project. The introduction of the PPS was a part of one of the work packages.

Some work packages were led by workers who first received training for moderation and group discussions. According to the production manager workers were involved in many decisions during the implementation process. However, some of the interviewed workers denied this and reported that they played a rather passive role. Regarding the PPS it was one important outcome of the project that workers have different requirements for the interface than the production planner in the office. As a result, the workers' interface was adapted accordingly.

Initially, the restructuring process proved difficult. According to the production manager, the decisive factor in implementing the new digital tool was to find multipliers in the company who could convince critical members of the workforce. In addition, whiteboards and flat screens were installed in the break room giving information on the restructuring process to trigger the interest of the workers.

What was the role of the works council in the change and implementation process? The company has a long-standing and experienced works council (12 members) who closely cooperating with the trade union and the union's technology consulting office (TBS). The works council maintains a cooperative relationship with management. In the past, when the company was facing serious economic problems, the management and works council agreed a (temporary) yearly wage waiver based on 300 hours of unpaid overtime per year (per worker) to provide investments in technological innovations. As it is typical for the sector, many labor issues like over-time, bonuses or work clothing are regulated by company agreements. Both sides describe the relationship with each other as trustworthy. The factory manager even has the impression that the works council would 'blindly trust the management'. At the same time, the management perceives the works council as 'difficult' and 'opposing' with regard to innovations.

The works council was indeed quite critical about the new PPS in the beginning, because of possible monitoring of workers and the risk of work intensification. After participating in the change project and due to the overall positive evaluation of the PPS by the workers the works council agreed. The role of the works council in the change project was a rather passive one. From the very beginning,

the works council has been involved in several work packages of the project right. There was the opportunity to have a say in the design or to object at any time. However, the works council showed little interest in the PPS and agreed to its introduction. No agreement was concluded as part of the implementation process. Neither the management nor the works council saw the need for it. According to management, this was due to the good relationship of trust between them. According to the works council, the workers appreciated the economic advantages of the system and did not indicate any need for regulation or changes. This fits well in the idea 'productivity coalitions' (Krzywdzinski & Pfeiffer, 2019): in cooperative industrial relations models works council tend to make concessions to the management to achieve shared objectives in terms of productivity and economic success. Regarding the PPS, neither the union representatives nor the union's technology consulting office (TBS) were involved. According to the interviewed union representative this happens quite often due to the lack of resources, attention and knowledge to assess new technologies.

> *'A lot of new software is being introduced and so on, and these implementation processes are being monitored, but whether it is actually always clear to the works councils everywhere what these programs and what these technical things can do and what needs to be regulated, I would also think, there it is probably, a lot of potential that could be regulated.'* (Union representative)

Also, in the observed company the works council's priorities and resources were focused on demanding issues like overtime or data protection issues in the administrative departments. In the view of the union representative, the higher level of transparency regarding work processes and machine use establishes new risks for the workers and new demands for regulation and co-determination.

> *Yes, there are improvements, systems, usage time, etc., but we see a strong monitoring tendency behind it and they [the managers] are deliberately blocking it so as not to ultimately allow this monitoring. But I think in the end they won't be able to finally defend themselves. And here it is important to have a stable framework agreement so that these tools are in principle only used for systems, usage and increasing productivity and not for monitoring.'* (Union representative)

5. COMPARATIVE ANALYSIS

The case studies tackle companies with strikingly different characteristics with regard to work content and products, the composition and skills of the workforce, and the traditions of and possibilities for co-determination. The medium-size industrial company comprises of a stable workforce of mostly German, middle-aged employees of an intermediate skill level in a rural region. The delivery service mainly covers large urban regions and has a precarious, low-skilled, mainly migrant workforce with very high levels of labour turnover. The German metal industry is a stronghold of co-determination, whereas trade unions and co-determination are still young and contested at the delivery service.

Despite these differences, there are similarities between the cases.

First, AM systems are primarily introduced to coordinate and synchronize complex processes, not in order to control work performance. In the case of the industrial company, the AM system does not affect the intensity of work, but merely rearranges the sequence of orders, which enhances

productivity and the reliability of on-time delivery. At the delivery service, the function of the app is similar as it matches orders and the supply of drivers and therefore generates productivity gains from the overall coordination of processes. Work intensity, however, is affected through algorithmic coordination, as its goal is to maximize the workload of the riders during their working time, i.e. to reduce idle time. Yet, this is less controversial among riders (who are interested in bonus payments) than insecurity about the fairness of the app and possible surveillance of work performance. While management strongly objects to the suspicion of using data transparency for disciplining workers, the works council claims that this is being done informally.

Second, in both cases the works council does not possess the ability to understand and shape technologies at work. At both companies, the interviewed works council members emphasized the difficulties to understand the operations of algorithmic systems and expressed an inability to monitor and shape the use of technology, yet for different reasons.

At the delivery service, the works council is heavily engaged in demanding co-determination rights that also affect technology development. The works council collects information on the operation of the app and exerts pressure on management to disclose documentation about it. The problem of the technological opacity of the software is complicated by a problem of „social opacity“, as management, in the works councils‘ view, is not willing to share information on the app in a meaningful way. Co-determination on technological issues is contested, which reflects the generally hostile relationship between the works council and management.

At the industrial company, the works council is less inclined to engage in negotiations about the algorithmic system, which is perceived as of minor importance in comparison to other issues like work density and pay. As the company had been struggling economically in the past, which led the works council to give temporary concessions with regard to wages, the economic stabilization of the company is perceived as an important goal by management and workers representatives alike. A relationship of trust is predominant and the introduction of the AM system is seen as one aspect of a reorientation of the company, which is perceived to be beneficial. Under these circumstances, the works council is not as engaged with shaping AM as its peer at the delivery service. Its attitude towards technology is rather shaped by a relationship of trust in the management’s decision. In negotiations, the works council merely addresses standard issues of employee data protection without demanding further insights in technology development, which is perceived to lie without its field of competence.

Third, regarding the role of the unions, both cases demonstrate strong engagement and cooperation with the works councils. There is frequent exchange, advise and support regarding legal issues or questions related to technology. Both works councils have access to external experts in the field of AM. In the food-delivery sector the works council used the option provided by the new Works Councils Modernization Act (‘Betriebsrätemodernisierungsgesetz’) to consult an external AI expert. In the manufacturing sector the trade union’s technology consulting office (TBS) offers training and advise to works councils also regarding AI related issues. The office also provides help and guidance when works councils are striving for formalized company agreements on these issues. The union evaluates this type of close cooperation between works councils, the union’s technology consulting office (TBS) and (if necessary) external experts very productive. The union in both sectors – food delivery and manufacturing – underline the importance and need for more formal regulation of AI and AM systems. In their view the risk of monitoring of employees and misuse of data remains high and is often overseen or underestimated by works councils. Union representatives in the food-delivery sector (NGG) express a stronger interest to define detailed and binding requirements regarding AI

and AM usage at the sectoral level since they often lack the power and works councils to regulate these issues at the company level. The metal workers' union (IG Metall), in contrast, puts more emphasize on regulations of AI and AM at the company level.

6. CONCLUSIONS

Previous studies have identified challenges for policy-makers and the regulation of AM in the following three areas of the German workplace, which are confirmed by our findings: (1) Transparency issues: Employers often do not provide sufficient information on the methods used in AI applications. (2) Control issues: According to the existing data protection regulations, employers may collect and process individual data when this information is used to fulfill the specific work purpose. Since this regulation leaves room for interpretation, misuse by companies can occur. (3) Co-determination issues: Processual forms of co-determination gain importance (Krzywdzinski, Gerst & Butollo, 2023), because governance and monitoring of AI and AM are becoming permanent tasks in the context of systems that are frequently updated. Consequently, it is getting more important that employees, works councils, and HR managers possess the appropriate skills and information to draw the right conclusions, anticipating possible long-term effects and unintended consequences.

Our findings complement existing research in this field by shedding light on the role and interplay of management objectives, experiences of workers, strategies of works councils, and co-determination issues regarding AM. Overall, our findings do not support the idea of strong labor conflicts regarding issues of AM in the German regulatory context. Problems and conflicts rather arise from classic issues of labor policies, like wages, shift planning, work equipment, or safety (in the case of the food-delivery company) or working hours and overtime (in the case of the manufacturing company).

Our study did not find evidence for algorithm-based performance control at the individual level, as suggested by the respective literature in the field of AM (Kellogg, Valentine & Christin, 2020; Schreyer & Schrape, 2018). The potential of a rigid, algorithmically driven control system, as it is provided by the collection of vast amounts of data and technological possibilities (as demonstrated in other cases), has not been realized in practice in both cases. However, in the case of the food-delivery company there remains some uncertainty on this issue: While the management strongly objects to the suspicion of using performance data for disciplining workers, the works council claims that this is being done informally by the management. As long as the couriers remain uncertain and suspicious about the possibility to be monitored, AM has an indirect discipling effect and is contributing to feelings of stress. Overall, the outlined ambiguity and uncertainty that is related to the algorithmic system and its effects, underlines the need to encounter the "black-box" character and information asymmetry that goes along with AM. Moreover, we find close linkages and interactions between (automated) algorithm-based order assignments and human readjustments by managers and planners. In this respect, the term algorithmic management might be misleading and should be used more carefully in the scientific debate, since it tends to suggest and emphasize the (AI-based) substitution of management functions.

Concerning the strategies of the works councils, labor policies are first of all concerned with traditional issues in terms of pay, working hours, work equipment, or safety issues. Despite the works council's engagement and (fixed- and long-term) employment contracts, classic elements of

precarious employment in the food-delivery sector tend to persist, such as low pay, the lack of provision of core work equipment, bad and often dangerous working conditions, and insecure employment prospects due to high market fluctuations. In the mechanical engineering company, the works council's priorities and resources were rather focused on classical issues like overtime or data protection issues in the administrative departments.

Regarding the role of collective bargaining, our study underlines the need for more formal regulation of AI and AM systems to encounter the risk of monitoring of employees and misuse of data. Union representatives in the food-delivery sector (NGG) emphasize regulations at the sectoral level, since they often lack influence and representatives at the company level, while the metal workers' union (IG Metall) stresses binding regulations at the company level. Close cooperation between works councils, unions, the union's technology consulting office (TBS) and (if necessary) external experts have proven to be very productive in this respect. So-called future-oriented collective agreements ('Zukunftstarifverträge') in the metal industry are not widespread so far. However, when they are used they seem to have positive effects also regarding negotiation of AM and AI issues.

When trying to tackle issues of AM, the interviewed works councils often reported difficulties to obtain the necessary information on the parameters feeding into the AM system, to understand their functioning and interaction, and to evaluate the effects of possible changes and alternative usages – despite rather rich co-determination rights and recent reforms (Work Council Modernization Act) in the German context. This raises the crucial question to what extent employee representations are able and need to be enabled to co-determine AI- or AM-based systems themselves, as often suggested in the current debate. This would require efforts to strengthen the works councils' capacity to access and interpret information on AM-based systems and the introduction of procedural co-determination rights that allow for negotiating its use even when the apps are constantly updated and modified. An alternative approach to co-determination might put more emphasis on regulating the effects of AM-based systems to prevent negative outcomes regarding staffing, work hours, workload, or safety. Such an approach would rely on classical fields and instruments of employee representation, such as sectoral and company agreements.

Eventually, we find evidence that given regulations touching issues of data protection and technology can provide powerful means to works councils to achieve goals in other areas of action. In the digital platform economy, both efficient day-to-day business and quick innovation depend greatly on the collection and processing of data as well as on the fast and continuous development of (globally used) software. Putting pressure on the collection or processing of data can therefore quickly threaten companies' core business interests and pressurize them to cooperate in bargaining processes. In this respect, existing co-determination rights regarding issues of AI and AM can provide a powerful bargaining resource to employee representation in AM-based business models.

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