Study exploring the context, challenges, opportunities, and trends in algorithmic management in the workplace

VT-2022-035

under the multiple framework contracts EMPL/2020/OP/0016

Annexes to the Final Report

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2025 Directorate-General for Directorate-General for Employment, Social Affairs and Inclusion

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Annex 1: Methodological annex

1.1. WP1 Task 1: Analysis of the current state of play and possible future trends in AM

A comprehensive mapping and overview of the existing and ongoing academic literature was carried out in the areas of AM, AI, and digitisation in the workplace. To ensure a wider range of insights and provide a more comprehensive understanding, the literature was collected in a number of different languages. The members of the core team and national experts gathered the relevant literature, with the former concentrating on English-language literature and the latter on the literature in EU languages. Moreover, the identified literature consisted of a variety of document types, such as academic articles in areas of economics, law, sociology, philosophy, and medical research, as well as from studies, institutional reports, and evaluations. Grey literature, such as independent company reports, discussions and working papers, was also reviewed. The total number of collected documents in the area of AM, AI, and digitisation in the workplace was 622 documents.

After identifying potentially relevant literature, it was mapped in an Excel file, highlighting the general information about each document, covered topics, geographic scope, and accessibility of the source. Besides these elements, the objective of mapping was to extract the literature which covered findings of at least one of the eight key research questions, such as (i) **usage** (ii) **drivers** (iii) **opportunities** (iv) **challenges** (v) **worker rights** (vi) **AM beyond work** (vii) **policy approaches and legislative developments**, and (viii) **remaining and emerging gaps** of AM. Literature documents that did not contain any information on these research questions were removed from the literature mapping.

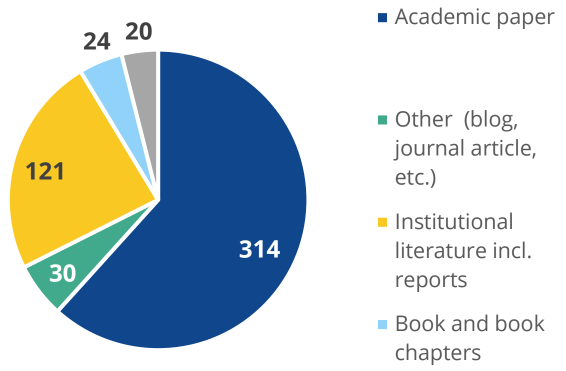
Out of 622 collected documents, 509 of them were identified as the relevant literature for this study. To present the general results of literature mapping, **Table 1** below shows the distribution and scope of different languages in which selected literature was analysed. As the table illustrates, the absolute majority of papers were in English, while significantly less literature was identified in Dutch, German, Italian, Spanish, and Bulgarian languages. Every other remaining EU language covers less than 10 selected literature sources. Additionally, to discuss the overall results of the collected literature, the figure below presents a breakdown of the different types of documents included in the study, highlighting the breadth and depth of the literature reviewed (see **Figure 1**).

Table 1: The distribution of languages in the literature mapping

Language	No. of literature	Language	No. of literature
EN	378	DK	5
NL	22	HR	4
DE	17	RO	4
IT	10	SK	3
BG	10	LT	3
ES	10	SE	2
FR	9	HU	2
PL	8	EL	1
CZ	7	EE	1
FI	7	PT	1
SI	5	TOTAL	509

Source: Author's own elaboration, based on the results of the literature mapping

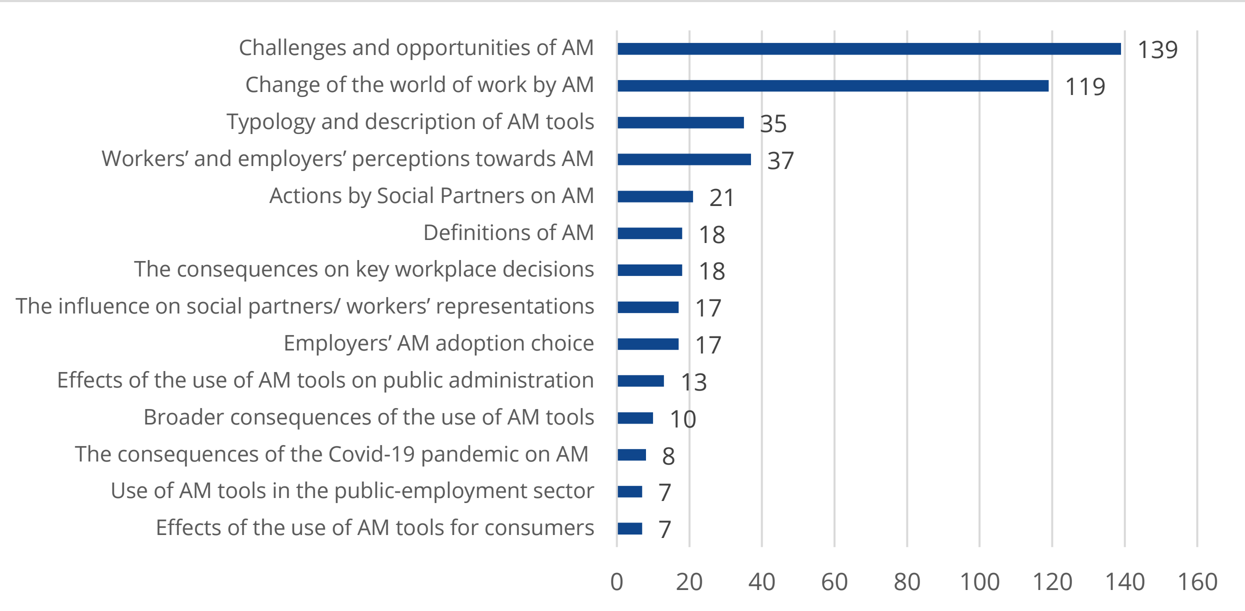
Figure 1: The distribution of collected literature by document type



Source: Author's own elaboration, based on the results of the literature mapping

In addition, the results of the literature review showed how extensively it covers the different topics related to AM in the work context. The papers analysed in the literature mapping explore different aspects of AM, such as definitions and topologies, incentives, AM tools, benefits and threats, actions of social partners, effects on consumers, and more. As can be seen in **Figure 2**, the literature mapping revealed that the AM literature mainly covers the topics of challenges and opportunities, as well as the change of the world of work by AM. However, there is a lack of literature on the impact of the use of AM on public administration and social security systems, consumers, and public employment sectors, as well as on the broader consequences of the use of AM and of the COVID-19 pandemic on the development and usage of AM. Figure 2 below summarises the findings based on the main AM topics.

Figure 2: The coverage of AM topics in the AM literature*



N = 357

(*) Some documents were omitted from the analysis as they were added by our experts and hence were not summaries in the Excel file. Nevertheless, we believe that the trend provided in the visuals would not change if they were summaries.

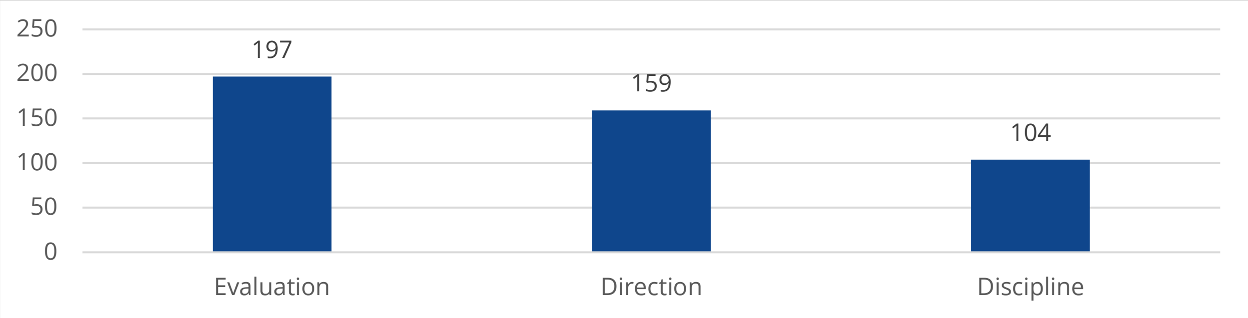
Source: Author's own elaboration, based on the results of the literature mapping

The functions of AM have been thoroughly covered in the existing literature as well. The identified academic literature was categorised according to the three key dimensions described by Kellogg et al. (2020)[1] as a modification of the Edward (1979)[2] taxonomy of worker management and employed as the main typology of AM functions in this study. More specifically, the typology includes **direction** (providing guidance to workers), **evaluation** (monitoring and evaluating workers' performance), and **discipline** (punishing or rewarding workers for their performance). According to the AM literature review, evaluation was the most thoroughly explored function in 197 out of 357 documents, while discipline was the least covered AM function, with only 104 documents out of 357 addressing it. Important to highlight that 357 reflects those documents from 509 that were summarised in the Excel file, while the remaining ones were not as they were added later to the analysis by core team members and hence, we could not classify them according to the aforementioned dimensions. However, the other documents were still used throughout the report where relevant. The table below represents the whole coverage of AM functions in the collected literature (see **Figure 3**).

[1] Kellogg, K. C., Valentine, M. A., & Christin, A. (2020). Algorithms at work: The new contested terrain of control. *Academy of Management Annals*, *14*(1), 366-410

[2] Edwards, R. 1979. C*ontested terrain: The transformation of the workplace in the twentieth century.* New York: Basic Books.

Figure 3: The coverage of AM functions in the literature review*

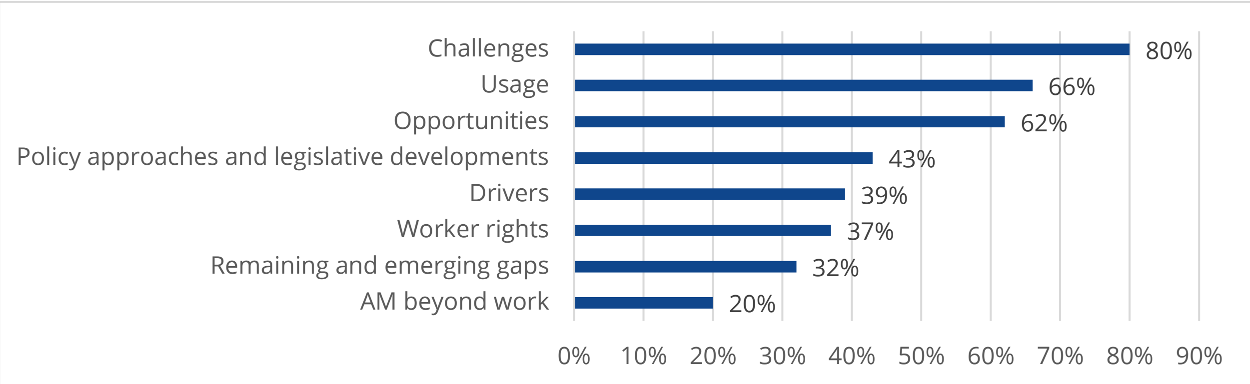


N = 357

(*) Some documents were omitted from the analysis as they were added by our experts and hence were not summaries in the Excel file. Nevertheless, we believe that the trend provided in the visuals would not change if they were summaries. *Source:* Author's own elaboration, based on the results of the literature mapping

Lastly, the mapping of the 357 documents was focused on the main findings based on eight key research questions mentioned previously. As findings showed, emerging gaps, worker rights, drivers, and policy approaches received less coverage than opportunities, challenges, and usage of the AM in the workplace. The former has been discussed in less than half of the mapped literature (32-43%), while the latter was analysed in the great majority of documents (62-80%). Yet, the research question of AM beyond the work received the least amount of discussion, more specifically, only 20% of collected literature sources. A more detailed coverage of the research question in the literature is shown in the table below (see **Figure 4**).

Figure 4: The coverage of key research questions in AM literature*



N = 357. (*) Some documents were omitted from the analysis as they were added by our experts and hence were not summaries in the Excel file. Nevertheless, we believe that the trend provided in the visuals would not change if they were summaries. *Source:* Author's own elaboration.

1.2. WP1 Task 2: Identification of challenges and opportunities

The methodology is provided in the main text, in chapter 2. Opportunities and challenges of AM.

1.3. WP1 Task 3: Quantitative overview of the extent of the use of AM tools in the EU

This section describes the main data sources, analytical strategies, and limitations of both, including: (i) **Quantitative data collection and analysis**; (ii) **Literature review**; (iii) **Interviews;** and (iv) **Case studies**. The remainder of the subsections explore these methodologies in detail.

Quantitative data collection and analysis

Overview of the main quantitative data sources

Quantitative data collection and analysis were carried out by identifying, collecting, and analysing data that contain information on how algorithms are being used to manage workers, as well as, per request of the Commission, information on variables that can serve as proxies for AM. Both free-access data and pay-to-use data were used where relevant and feasible[3]. Given that there is no singular data that contains information on all managerial functions that AM can cover, a variety of different sources was used, including **data that contains information directly related to AM** and **proxy data**.

On the one hand, we considered data to contain direct information on AM when it provides insights into how extensively algorithms are used to carry out any of the managerial functions outlined in subsection 1.1. Concepts and typologies of algorithmic management, or if it provided insights on how extensively algorithms and / or AI are used in human resource management. On the other hand, proxy sources refer to sources that contain information related to digitalisation and technological adoption in companies, which is needed for the implementation of AM. This dichotomy was also applied when employing other approaches such as literature review. Based on the two dimensions, **six data sets** are summarised in **Table 2** below. The table below also highlights which characteristics of employers and workers each data source covers. As can be seen, no source completely covers all relevant dimensions. However, a combination of insights from different sources provides a relatively full picture of AM use.

For insights on how each data source was used, as well as their target groups, timelines, geographic coverage, and similar see section *1.2. Prevalence of AM in the EU* in the main report for more insights.

Table 2: Coverage of relevant dimensions and characteristics of each quantitative data source

Research dimensions	Characteristics covered	ECS-2019	EWCTS-2021	ESENER-3 2019	Worker survey	Employer survey	DESI
	Country	✓	-	✓	-	✓	✓

[3] For example, we did not employ data from large scale database on companies, which might contain some relevant information, such as Orbis, as the cost of such database is beyond the budget of the study. In addition, it is unclear how much useful information can be derived from this data given the newness and specificity of AM.

Research dimensions	Characteristics covered	ECS-2019	EWCTS-2021	ESENER-3 2019	Worker survey	Employer survey	DESI
Number of employers	Hierarchical function within the company	✓	-	-	-	✓	-
	Public / private sector	✓	-	✓	-	✓	✓
	Economic sector	✓	-	✓	-	✓	✓
	Company size	✓	-	✓	-	✓	✓
Number of workers	Country	-	✓	-	✓	-	-
	Age group	-	✓	-	✓	-	-
	Gender	-	✓	-	✓	-	-
	Level of education	-	✓	-	✓	-	-
	Occupations	-	✓	-	✓	-	-
	Public / private sector	-	✓	-	✓	-	-
	Economic sector	-	✓	-	✓	-	-
	Company size	-	✓	-	✓	-	-

Source: Author's own elaboration based on the relevant data sources.

Weighing the data

The data highlighted in the tables above can be used to indicate how many workers and employers used AM in percentage terms. However, three of the aforementioned data sets – ECS-2019, EWCTS-2021, and ESENER-3 – can also be used to derive the number of workers and employers using such tools. This is because these data sets provide weights, which are numeric values assigned to each observation that can be used with the sample to extrapolate the answers to the whole population. This, in turn, allows us to establish the share of workers in the analysed sample that are subjected to worker monitoring, and how many workers in numeric terms in the EU27 are subject to such tools. The **Table 3** below describes what weights from each data set were used for this extrapolation. In the study we use weighted data from these data sets as it provides a better representation for the whole population.

Table 3: Weights used to derive the number of employers and workers using AM

Data set	Weight	Description
ESENER-3	estex	Based on the ESENER-3 Technical report: "This factor is provided for easier estimations of absolute figures (e.g., absolute number of establishments practicing risk assessments). It should be used for descriptive analyses only." Hence, this weight is used to estimate based on the available sample data how many **enterprises (a.k.a. employers),** with 5 or more workers in each

Data set	Weight	Description
		Member States, would answer each question in ESENER-3. For an extensive overview on how this weight was derived see the ESENER 3: Technical Report[4].
	empex	This weight is essentially the same as estex, with the only difference being that it was estimated for workers rather than enterprises. Hence, it is used to extrapolate how many **workers** working in companies with 5 or more workers in each Member States would have answered each question in the ESENER-3. For an extensive overview on how this weight was derived see the ESENER 3: Technical Report[5].
ECS 2019	s5_wgt_final	This weight extrapolated the number of **employers** in Member States with 10 or more employees who answered the relevant question in the survey. For an extensive overview of the weighting process see the European Company Survey: Sampling and weighting report[6].
EWCTS 2021	weight_core	This weight extrapolated data to the total number of **workers** in Member States. For a very extensive overview of the weighting process see the European Working Conditions Telephone Survey 2021: Sampling and Weighting reports[7].

Possible additional data sources

Per the client's request, we also explored the possibility of deriving additional insights from **online job vacancies**. Namely, by identifying the appearance of phrases related to AM, AI, algorithmic development, etc. in job ads it is possible to gauge the usage of such technologies in the workplace. One source of such information could be the Skills-OVATE database created by CEDEFOP that "offers detailed information on the jobs and skills employers demand based on online job advertisements (OJAs) in 28 European countries"[8]. Another way this could be done is by collecting such information ourselves from online job ads.

However, this approach has several severe limitations that are very important to highlight, including, but not limited to:

- Given the complexity of collecting such data, including linguistic and cultural differences between countries, it is very difficult to accurately extract relevant information from job ads across the EU. In addition, to ensure robustness this data would have to be collected over a long period to capture different hiring patterns in companies.

- With job ads, it is often difficult to differentiate between the usage of some tools is growing or if there is simply high turnover in companies. In other words, if a company is often searching for people to add to their "people analytics" team it is very difficult to know if this implies that their people analytics team is growing or that this team has high turnover and therefore, they always need replacements.

- Given that many companies buy AM solutions from outside, as is evident from the case study of AM tools, there might not be a need for a dedicated person in a company to develop or even oversee such tools. That is often AM tool creators get paid a monthly fee to oversee the technical side of such tools while HR managers in companies, who received some training from AM tool creators, only interact with the final outputs of the tool (e.g., aggregated, harmonised, and simplified information on workers) based on which they make decisions.

[4] It can be found here, in addition to other information about ESENER-3: https://oshwiki.osha.europa.eu/en/themes/esener-2019-methodology

[5] Ibid.

[6] See: https://www.eurofound.europa.eu/sites/default/files/wpef20014.pdf

[7] See: https://www.eurofound.europa.eu/sites/default/files/wpef22046.pdf

[8] https://www.cedefop.europa.eu/en/tools/skills-online-vacancies

Hence, even if very granular data from job ads were collected, it is not clear how accurately it would indicate the prevalence of AM.

Because of these, and other issues, this approach is beyond the scope of the study and even if used will produce, in our opinion, biased results that will not justify the costs or the effort needed to collect and analyse such data. Thus, its usage in the study is limited to a “thought exercise”.

Limitations and issues of desk research

During the implementation of the task, we encountered several limitations and challenges. The **Table 4** below highlights and describes how we mitigated them.

Table 4: Limitations and issues of desk research and the mitigation measures we employed

Limitations / challenges	Explanation / mitigation measures
Inconsistencies between data sets	• As was discussed in the main text in subsection *1.2.2. Usage of AM: Evidence from direct sources*, and different data sets covering similar topics often provide relatively different insights. The reasons behind it can range from small differences in analysed samples to differences in formulated survey questions and methodologies. • To mitigate this problem and add robustness: o In case of discrepancies between data sources, we tried to highlight the possible reasons behind them. o Results were corroborated with other sources such as literature reviews and interviews. If we were unable to corroborate the findings, we highlighted this in the text by mentioning that the results might be biased. o We only focused on peer-reviewed documents, including academic papers, EC reports, evaluations, etc. in order to ensure that the analysis is not skewed by grey literature prepared by companies that create, distribute, or in other ways work with AM, which might lead to “overoptimistic” results.
Lack of information on AM evolution over time	• Given the newness of the concept, there are not a lot of data sources providing historical information on how extensively AM was used. • To some extent, this can be mitigated through a literature review which provides some limited historical accounts of AM. Nevertheless, this issue cannot be mitigated fully due to a lack of data.
A relatively small number of answers from the employer's survey	• We received 1,270 full responses from workers, but only 155 responses from employers. Even though both data sets are not representative of the whole EU27, given that the employer's data set is very small, the results from this survey might be biased. • Results from the surveys in the final interim report were primarily used as supporting material for other sources. • We also build upon them with insights from the Delphi survey of experts in the fields and relevant stakeholders.

Literature review

The literature review predominantly covers the identification and analysis of publications that contain data / statistics on the usage of AM. Relevant data included, information on how many organisations use algorithms to automate managerial functions, how many workers use, or are subject to, such technologies, how the usage differs between different occupations and sectors, etc. In this section, only the literature that contains statistical information on AM usage was used, while the literature of a more qualitative nature was predominantly employed in chapter *2. Opportunities and challenges*.

In the analysis, **we focused on high-quality literature, such as peer-reviewed academic papers, EU, EC, OECD, JRC, etc. reports, evaluations, studies, etc.** However, **given the novelty of AM and to ensure that the most up-to-date data is presented, in some select cases grey literature**

was also included. This is also one of the limitations of this approach (i.e., due to the newness of AM there is a scarcity of high-quality academic literature on it). To mitigate possible biases of grey literature, in cases where it was used, we highlighted in the text the possible biases it might have (e.g., that a report created by an AM tool creator might be overoptimistic as they might be trying to attract more users with a message of a "highly growing market").

Another possible issue with the literature review is that the majority of literature in this field was written in English and focuses on English-speaking countries (e.g., the US and UK), which might not accurately represent the situation in the EU. To mitigate this possible issue, **we employed an extensive network of national experts to identify literature from different EU languages**. Namely, we asked national experts who are part of the team to identify and summaries the most relevant literature in their language and / or which focus on their country that covers directly or indirectly AM. After doing so the identified literature, including those identified by the core team and national experts, was mapped and relevant information about AM usage was extracted. For the results of this mapping see **Annex 2: Literature mapping**. For more information on how the literature review was carried out see **WP1 Task 1: Analysis of the current state of play and possible future trends in AM**.

Besides the issues / limitations discussed, others were encountered during the analysis of the literature covering documents discussing quantitative informants on AM use. The table below summarises how we tried to mitigate each of them.

Table 5: Limitations and challenges of literature covering quantitative data on AM use*

Limitations / challenges	Explanation / mitigation measures

Different methodologies used in literature lead to different results on similar questions	• Different research uses different samples, and even if the samples were similar (e.g., the literature focuses on the same countries and similar sectors) often different data aggregation and analysis approaches were employed in different literature.
	• This, in turn, led to several cases where different sources provided very different results on similar managerial functions that are automated through algorithms.
	• To make sense of these differences:
	  ○ Where relevant, methodological differences between sources are highlighted, such as different sampling strategies, and the possible differences are explained.
	  ○ Results of the literature review, where possible, were corroborated with insights from other data sources.
	  ○ Where different results are presented, we only use insights from per reviewed literature, if possible.

Possibly outdated information	• One major issue is that given the slow process of getting high-level literature published and the rapid development of AM, the relatively recently published information, to some extent, can be considered to be outdated. • To mitigate these limitations, where possible the newest literature was used. Also, we tried to corroborate collected insights, were possible, with the newest data that comes from the worker and employer surveys we carried out in 2023. Nevertheless, we cannot completely mitigate this limitation.

(*) Only issues related to the literature covering quantities of data are discussed in this table. For a list of general issues related to the literature review see WP1 Task 1: Analysis of the current state of play and possible future trends in AM.

Interviews

During the implementation of the study, a variety of semi-structured interviews with EU-level experts, national stakeholders, and companies were carried out. The main goal of these interviews was to tap into existing policy and academic knowledge, collect in-depth insights on algorithmic management, fill in the gaps in the literature and contextualise the analysis of the regulatory framework. These insights were used throughout the report and, where relevant, we highlighted if some conclusions were made based on interview results and on how many interview results these conclusions rest.

During the implementation of the study, 72 interviews have been carried out in total:

- **15 interviews with EU-level stakeholders**: EU-level experts and selected social partners (as agreed with the client, representatives of EU institutions were not interviewed).

- **49 with national stakeholders**: employers and worker representatives, enforcement agencies, trade unions, and other relevant national stakeholders.

- **7 interviews with AM tool creators and users of such tools**: the focus was predominantly on users and creators with their headquarters in the EU, but in some cases, tool creators that are not in the EU but focused on it were carried out (e.g., one interview was carried out with a Ukrainian tool creator).

For more information on the process and results of the interviews please see the **1.7. WP3: Consultations** subsection.

Table 6: Limitations and issues of interviews and the mitigation measures we employed

Limitations / Issues	Explanation / mitigation measures
Different levels of engagement and knowledge	• During the initial contact with potential respondents, many of them expressed that they are not familiar with AM. This was particularly an issue with employer and worker representatives, who might have knowledge about automation at the workplace, but not about algorithmic management specifically. • We tried to contact a wide array of different stakeholders. If a person in one organisation was not familiar with AM, we asked them to point to individuals who might be familiar. However, if such an individual could not be found in a specific organisation, we contacted a different stakeholder from the same stakeholder type. • If we could not find a relevant interviewee in a particular stakeholder group in a country (e.g., often employer representatives did not know much about AM), we contacted stakeholders of similar types, such as employers instead of employer representatives.

Case studies

In total nine case studies were carried out – six country case studies and three focusing on specific AM tools. More specifically, on the one hand, the country case studies covered Germany, Spain, Poland, the Netherlands, Sweden, and Lithuania, each exploring the prevalence of AM across these countries. On the other hand, the three case studies focusing on AM tools used a similar methodology to country case studies and they covered:

- **Recruitment and hiring** – tools that are used to automate, fully or partially, the hiring process of new workers, as well as profiling them.

- **Employee monitoring and surveillance** – tools that, in some way, monitor employers, such as wearables and presence monitoring systems, keystroke loggers, speech and writing monitoring tools, and emotion monitoring solutions.

- **Employee management** – tools associated with rating, rewarding, profiling (excluding profiling for purposes of recruitment), etc. workers and scheduling their work.

Both types of case studies were carried out employing a similar four-step process:

- **Step #1: Selection of countries / tools to analyse**: Selection was driven by ensuring a good geographical balance and that different types of AM tools were covered. The selection of countries, and to a lesser extent tool, was carried out with close communication with the client.

- **Step #2: Preparing the case study pilots**: In order to ensure the homogeneity of cases and the high quality of deliverables, pilot cases were created. For country cases, the Lithuanian case served as a pilot, while the case covering employee management served as AM tools. The pilot cases were shared with other case authors to serve as templates.

- **Step #3: Data collection**: Collecting information on relevant cases through literature review, desk research, and interviews with relevant stakeholders and representatives of AM tools.

- **Step #4: Drafting the case studies**: Based on the pilot and the collected data case studies were drafted. For the country case studies see *Annex 5: Country case study reports*, while case studies on AM tools are provided in *Annex 7: Case study reports on AM tools*.

Table 7: Limitations and issues of case studies and the mitigation measures we employed

Limitations / Issues	Explanation / mitigation measures
Relying in some instances on grey literature	• Given that the cases go deeper into the country context and the context of specific AM tools, often only grey literature was available covering the cases. This was especially true for cases on AM tools. This is an issue as by its nature, grey literature is not as robust as peer-reviewed literature. • We tried to rely as much as possible on more robust, peer-reviewed literature, quantitative data, and interview results. However, when this was impossible and when grey literature was used, we highlighted this in the text, as well as mentioned what biases such literature might have.

1.4. WP1 Task 4: Future trends

The methodology is largely discussed in the main text, in chapter *4. Future trends* in algorithmic management. However, the annexe discussed one of the main methods that will be used in forecasting future trends, the Delphi survey.

Delphi survey

A **Delphi survey** was carried out with experts in the field to validate, and likely modify, the future predictions on how AM will evolve. The Delphi survey included a large array of questions where respondents had the ability to argument their answers. This method was selected for quantitative predictions as in the absence of robust data it is often a preferred alternative.[9] More specifically, based on Hallowell (2009),[10] firstly, anonymity fostered through the Delphi survey allows for creative opinions to emerge, and to mitigate issues of dominant opinions and conflicts of interest. Second, a geographically dispersed group of respondents allows, to some extent, to diminish some preconceived notions of respondents stemming from cultural differences. Finally, many biases associated with the Delphi survey can be limited through a strategic construction of the questionnaire and efficient facilitation.

The Delphi survey was carried out through a five step process discussed below.

Step #1: Preparing the first questionnaire

[9] See Beiderbeck, D., Frevel, N., von der Gracht, H. A., Schmidt, S. L., and Schweitzer, V. M. (2021). Preparing, conducting, and analyzing Delphi Surveys: Cross-disciplinary practices, New Directions, and advancements. MethodsX, 8, 101401, for an overview of how the Delphi survey can be used including for forecasting.

[10] Hallowell, M. (2009). Techniques to Minimize Bias When Using the Delphi Method to Quantify Construction Safety and Health Risks. Conference paper.

The questionnaire asked respondents to provide their opinions on how the usage of AM will evolve in the next five and 10 years, and how these trends might affect the challenges and opportunities identified in chapter *2. Opportunities and challenges of AM*. We did not ask about the next two years directly as this information will be collected when we will ask respondents to comment on different scenarios.

To guide the respondents, the Delphi survey included a summary of our findings for the three scenarios were explored. To prevent biases as much as possible, the questionnaire was kept as short as possible. It was also programmed only in English given that we predominantly focus on experts in the field and other relevant stakeholders, as will be discussed in the next step, who very likely have a good command of the English language.

For the Delphi survey questionnaire see *Annex 11: Delphi survey questionnaire*. To summarise, in the beginning, respondents received relevant information on AM usage and potential future trends, after which we asked them a list of questions from six categories:

1. **About you –** several questions related to the respondent type and experience level.
2. **Current AM usage –** questions aimed at validating our estimates on how extensively AM is currently used throughout the EU.
3. **Drivers and barriers of change –** questions asking respondents to highlight the most probable drivers of barriers to change. Respondents picked the most relevant from a provided list, but they also could provide their own drivers and barriers.
4. **Future evolution of AM –** respondents were provided with several scenarios on how AM prevalence can evolve in the next 5 / 10 years, from which they had to pick the most likely to occur. This group of questions focused on AM management in general rather than on specific types of managerial functions. The respondents were also able to argue for their answers as well as to provide their own estimates if none of the existing ones were appropriate for them.
5. **Managerial functions that can be automated through algorithms –** questions about which managerial functions will most likely see an influx of algorithms in the future. As with scenario testing questions, respondents had the ability to argue their answers, as well as to provide their own answers.
6. **Likely impacts of the future evolution of algorithmic management –** questions on what kind of impact the evolution of AM will have on employment, administrative burden, costs, etc.

Step #2: Identifying the respondents

This step ran in parallel with Step #1 and it covered the following types of respondents:

- **Experts –** individuals with experience in the field of AM. Relevant experts mainly were found through the literature mapping by identifying the authors of the most prolific literature in this area. We strive to ensure a good balance by inviting experts, and other types of representatives, from different fields, countries, genders, etc. To improve the relevance of responses, we predominantly focused on European researchers, while only renowned researchers from outside Europe were invited to participate.

- **Employers** – we reached out to the respondents who highlighted that they use AM extensively in the employer survey we carried out. This way we ensured that respondents have knowledge of AM and hence are in a position to predict their future.

- **Developers of AM tools** – given that they will be the main drivers of the evolution of such tools it is paramount to ask them about what future they predict. We predominantly contacted developers who were analysed through the three case studies on AM.

- **Regulators** – individuals preparing, proposing, and / or overseeing the implementation of regulations related to labour law and the effects of digital technologies on it. Individuals from the EU and its Member States will be invited to participate in the Delphi survey. Their responses are crucial given that future regulations will shape how employers will be able to use AM and to what extent.

- **Workers and / or employers' representatives** – similarly to regulators, we believe that they will be a strong voice in, and in some cases a driving force, on how AM usage will evolve. We predominantly contacted representatives who were active during the worker and employer survey dissemination process. In addition, EU workers and employer representatives were also contacted.

We expected to collect 150 full responses and managed to collect 130 full replies. A lower-than-estimated response is since many respondents were on vacation during the implementation of the survey (July and August). However, given that in some cases we were able to analyse partial answers as well, often the analysis involved around 145 answers.

Relevant respondents were predominantly identified through:

- Identifying prevalent researchers in the field via the literate mapping that we carried out (see *Annex 2: Literature mapping*).

- Collecting contacts of employers who shared them during the employer survey.

- Beyond simply identifying respondents through academic literature and desk research we also identify respondents using OpenAlex[11]. OpenAlex refers to a database of academic papers where each of them is assigned to several categories. Though this data set does not have a category "algorithmic management" it has categories such as "algorithms" and "management". With this in mind, we identified the papers that fall under this category and collected contacts of experts who wrote these papers, expanding on the initial list. This activity was carried out using an algorithm that automatically collected the relevant information from papers, as well as identifying potential contacts. The automatically collected information was validated by the members of the team.

- Reviewing relevant projects and expert networks, such as ADRA and ADRAe https://adra-e.eu/, the VISION CSA and the 4 lighthouse projects https://www.vision4ai.eu/ (the 4 lighthouses together represent around 3000 AI or AI-related researchers in Europe), national science foundations and their AI programs, like Confiance.ai in France or the NL AI Coalition in the Netherlands etc.

Step #3: Piloting the survey

After the questionnaire was agreed upon the survey was piloted with the core members of the team and selected national experts. During the piloting stage, we gauged the accessibility, clarity, and time it takes to complete the survey. We also assessed the feasibility of respondents to provide

[11] https://openalex.org/

insights on the possible future of AM. The identified shortcomings, such as lack of clarity in some instances, were appropriately fixed.

Step #4: Conducting the survey

After the pilot stage, the full-scale surveying stage started in which we asked respondents to provide their opinions. The final questions that were used are provided in *Annex 11: Draft Delphi survey questionnaire*. The survey was launched and managed through the Alchemer™ survey platform. When needed we sent follow-up emails or, in some cases, directly contacted respondents via phone to prompt them to fill in the survey. After collecting all the answers, they were analysed and aggregated.

Step #5. Aggregation, validation, and interpretation of the results

Results from the survey were collected, aggregated, and used to provide insights on how AM could evolve in the next two, five, and ten years. For an overview of the results see *Annex 15: Factual summary of the Delphi survey*, while the main qualitative results from the survey were summarised in *Annex 3: Synopsis report covering all stakeholder consultation*.

Limitations and issues

Table 8: Limitations and issues of the Delphi survey and the mitigation measures employed

Limitations / Issues	Explanation / mitigation measures
Biased opinions and answers	• By ensuring a large pool of different respondents we can mitigate the biases of selected few. • Respondents were required to justify their answers.
Highly complex survey	Given the nature of the Delphi survey, which by its nature is more complex than a regular survey as it contains extensive information on AM, including possible future growth scenarios, some respondents might be intimidated by it. To mitigate this possibility: • The relevant information was summarised in short sentences and visuals. • The number of questions was kept to a minimum by only focusing on the most pressing problems. • The survey was piloted with the core team and national experts allowing to gather recommendations on how to improve it.
Lack of responses in the Delphi survey	• Given that many members of the team know many experts in the field, we used their networks of colleagues to disseminate the survey. • Unlikely the employer and workers surveys, from our experience, experts in the field are more interested in participating in such surveys as it allows them to share their opinions. • Several rounds of follow-up were carried out with respondents to prompt them to fill in the survey.

1.5. WP1 Task 5: Case studies

In the study, we carried out three case studies on AM tools focusing on:

- **Recruitment and hiring** – tools that are used to automate, fully or partially, the hiring process of new workers, as well as profiling them.

- **Employee monitoring and surveillance –** tools that, in some way, monitor employers, such as wearables and presence monitoring systems, keystroke loggers, speech and writing monitoring tools, and emotion monitoring solutions.

- **Employee management** – tools associated with rating, rewarding, profiling (excluding profiling for purposes of recruitment), etc. workers and scheduling their work.

Each case study focuses on the AM tools in the three thematic areas. Relevant information was collected from the literature, desk research on relevant tools, and quantitative data. To ensure that the cases provide deeper insights than what was collected in other tasks, each case explored the relevant tools, as well as going deeper into one of them for each thematic area. The case studies can be found in *Annex 7: Case study reports on AM tools* Each case study was written employing a four-step process:

Step 1: Selection of tools for analysis

During this step, a diverse sample of AM tools covering one, or several, of the three areas outlined prior was identified. It is important to note that when selecting tools, we focused on those that have a strong presence in the EU or that are created by the EU companies. However, in many cases, this was impossible given that a large number of AM tool developers come from the USA. For a list of tools analysed for each case see *Annex 7: Case study reports on AM tools*.

Step 2: Preparing a case study pilot

The core team first prepared a pilot case study focusing on employee management, which was shared with others of other cases. The pilot was also discussed with the core team before being shared. The pilot was carried out using the same methodology outlined in Step 1 as well as what is outlined below in other steps.

Step 3: Data collection

The case studies were drafted employing both quantitative and qualitative data, as well as secondary and primary data. The following data sources were used:

- **Academic and other trustworthy literature**. This includes peer-reviewed literature, working and discussion papers from trustworthy sources (e.g., International Labour Organisation (ILO), Institute of Labour Economics (IZA), National Bureau of Economic Research (NBER), etc.), and EU and EU adjacent organisation reports, evaluations, and studies.

- **Grey literature.** Given that, not a lot of academic literature provides information on the selected tools, grey literature was also explored, including company reports, news articles, national government documents / communications, company reports, etc.

- **Interviews with the tool creator, users (i.e., employers), and workers or their representatives**. Representatives of the creators of the analysed AM tools and a company that uses these tools were interviewed, as well as the workers who had experience with the tool (if possible) or relevant worker representatives to gather the worker's perspectives. In total 7 semi-structured interviews were carried out (for the questionnaire see *Annex 12: Interview questionnaires*).

- **Quantitative data**. Though not a lot of quantitative data is available on specific tools, where available quantitative information was also analysed.

Important to highlight that though all case studies employed the same methodology, given that they focused on relatively different topics and predominantly focused on deep dives on relevant topics, they are not directly comparable.

Step 4: Drafting the case studies and verifying the results.

After collecting the relevant information, the case studies were drafted. The cases focus on depth and presenting new information not covered through other tasks. Where possible insights were presented in a visual form, including presenting screenshots of selected tools highlighting how such tools operate, creating infographics showing the functionalities of particular tools, and such.

1.6. WP2 Task 1: Mapping of policy legislations addressing AM and WP2 Task 2: Analysis of EU legislation in relation to AM

The methodology is provided in the main text, chapter 3. Legal and policy context, section 3.1 Methodology.

1.7. WP3: Consultations

Surveys

Objectives of the surveys and their design

In this task two online surveys targeting workers and employers were carried out to collect insights on algorithmic management. The overall **objective** of the surveys was to obtain first-hand information from workers and employers regarding AM, it's use in the EU, their views towards AM usage including what opportunities and challenges AM creates, as well as the need for improvements.

Process

The surveys were piloted and launched in all Member States between February 24 and March 1 (for some countries the survey was launched later due to lags in translation of the questionnaires) and ran until May 10, 2023. The surveys were carried out via the Alchemer platform, which is compliant with the relevant GDPR rules. The survey was carried out in 22 EU languages so that respondents in each MS have an opportunity to respond in their national language. To summarise, the two surveys were carried out following a four-step process:

- **Step #1: Preparing the survey questionnaires.** The survey questionnaires were drafted to cover the objectives outlined prior. They were prepared in close collaboration with the Client. It is important to highlight that in the surveys we did not use the concept of "algorithmic management" as it might confuse some respondents. Instead, we ask the respondents to share their experience with algorithms that automate some managerial functions. The questionnaires were translated by national experts into 22 EU languages. Final survey questionnaires in English can be found in *Annex 9: Workers survey questionnaire* and *Annex 10: Employers survey questionnaire*.

- **Step #2: Piloting the survey.** After finalising the survey questions, it was piloted with national experts and several representatives of the employer and worker associations. Based on the comments the surveys were modified and streamlined.

- **Step #3: Identifying potential respondents, disseminating the survey, and follow-ups.** A multifaceted approach of identifying potential respondents and disseminating the survey to them was employed:

    - Around **1900 employer and 1700 worker representatives at the Member State level**. We contacted them via email written in their national language asking them to disseminate the surveys to their members. The disseminated surveys also opened in the individual's national language, but respondents had the ability to change the language to another if they wished. The representatives were reminded about the survey in several rounds of follow-up emails. After the follow-up emails, several members of the team contacted via phone representatives from countries where we had the most gaps urging them to disseminate the survey. Around 400 employer and worker representatives were contacted this way.

    - **Disseminated the survey to around 10 main EU-level employer and employee representatives (social partners). We also communicated via email with them asking them to disseminate the surveys.**

    - **Asked the national experts who are part of the team to disseminate the survey across their networks.**

    - **Purchased the contacts of around 27 thousand HR managers from companies in the EU**, to whom we sent the survey and asked them to fill in the survey on behalf of their companies, share it with relevant managers, and share it with their employees. Follow-up emails were also sent to urge the companies to fill / disseminate the survey.

- **Step #4: Closing the survey and analysing the results.** After the survey was closed, the data was cleaned and analysed. Results from the surveys were used throughout the study report using different visualisations or mentioning the main insights from the surveys. Given severe issues with the survey results, which are explored in the next subsection, they were used predominantly as a supporting tool for other sources of data.

For the synthesis of surveys and other consultation activities see *Annex 3: Synopsis report covering all stakeholder consultation*, while for a factual summary see *Annex 13: Factual summary of the workers' survey* and *Annex 14: Factual summary of the employers' survey*.

Challenges and limitations

The table below discusses the challenges and limitations of the surveys.

Table 9: Challenges and limitations, and their mitigation strategies

Challenges and limitations	Explanation / mitigation measures
Low response rate	• As was discussed many strategies were employed to battle the low response rate, which helped with the worker's surveys, but did not help much with the employer's survey.

Challenges and limitations	Explanation / mitigation measures
	• Hence, when using the results of the survey in the main text we specify these limitations and use the results mainly to corroborate, validate, or build upon the findings from other sources.
Self-selection bias / Uneven representation of different countries, sectors, etc.	• We tried to spread the surveys wide to mitigate this issue and also to reach out to individuals from countries where we had the most gaps. • To some extent, we mitigated this as we received answers from almost all sectors and the majority of countries, especially in the case of workers. • Nevertheless, the survey results are still biased towards professionals working in IT-heavy sectors and some countries are heavily unrepresented. • Hence, we do not claim that the results are representative of the whole sample and they should be used only as supporting material.

Interviews

Objectives

The **overall objective** of the semi-structured interviews with EU-level experts and national stakeholders is to tap into existing policy and academic knowledge, collect in-depth insights on algorithmic management, fill in the gaps in the literature and contextualise the analysis of the regulatory framework, as regards to four broad issues:

- Past and likely future trends related to AM.
- Challenges (e.g. impact on worker autonomy, job control, loss of social support/relationships with peers or managers, lack of ability to take breaks when needed, impact on ergonomics, safety, stress, mental health issues, impact of such systems not taken into account into the workplace risk assessment, incl. aspects such as ethics, data protection, worker consent, consultation and involvement of workers and their representatives in the choice of systems or decision-making process that may be relevant to OSH etc.) and opportunities posed by AM (for example, AM solutions could ease compliance with health and safety measures, they are sometimes perceived less biased than humans with assignment of tasks, evaluation of workers, such solutions more accurately take into account the physical capabilities of workers when assigning physical tasks), as well as success and failure factors.
- National stakeholders' views on the expected outcomes of the policies, legislation and other agreements at the national and/or sectoral levels, and, subsequently, inputs into country reports case studies, and conclusions on the relevance and effectiveness of national policies and social partners' agreements.
- Relevance and effectiveness of the existing EU labour *acquis* as well as perceived needs for change (potential future outlook).

The final interview questionnaires are provided in *Annex 12: Interview questionnaires*. While the broad list of topics is largely the same for each group of respondents, each interview was tailored to cover specific issues in which the informant is the most knowledgeable.

Process

The interviews were carried out through the following five-step process:

- **Step #1: Identify potential interviewees.** The potential interviewees were identified based on preliminary results of desk research and from proposals of thematic and national experts. In the selection, we tried to ensure a thematic, geographic and gender balance. We have included experts and scholars covering a variety of perspectives related to AM, including but not limited to: AM tool development, data protection, OSH, non-discrimination, workers' involvement, liability, etc. For the list of individuals and organisations that were interviewed see the table below.

- **Step #2: Develop the questionnaires.** Questionnaires were developed by high-level experts in the team based on the gaps in the existing literature and other sources. The interview questionnaires are provided in *Annex 12: Interview questionnaires*.

- **Step #3: Piloting.** Given that different members of the team had to conduct the interviews, several pilot interviews were carried out by the core team members to get a better understanding of how they have to be carried out and what issues interviewers might encounter. After the pilot interviews were carried out lessons learned were shared with other members of the team, including national experts, who were tasked to carry out the remaining interviews.

- **Step #4: Implement the interviews.** Interviews with EU-level stakeholders were carried out in English, while other interviews were carried out in one of the EU27 languages. They were implemented by the core members of the team and national experts, all fluent in relevant languages. Each interview was summarised in a write-up.

- **Step #5: Using the interview results.** The core team collected all the write-ups and integrated the outputs from them into the final interim report.

Respondents

The following **groups of respondents** were targeted for interviews:

- EU-level stakeholders: EU-level experts and selected social partners (as agreed with the Client, representatives of EU institutions were not interviewed).

- National stakeholders: employers and worker representatives, enforcement agencies, trade unions, and other relevant national stakeholders. In some cases, as employer or worker associations could not provide any insights about AM, we interviewed employers who use such technologies.

- Interviews for the AM tools and country case studies with representatives of employers, tool creators and workers and/or worker representatives. The interviews will be used to gather in-depth information for the case studies and to assess the experience, attitude, and outcomes from the perspective of employers and workers vis-à-vis AM.

Systematic academic/policy work in the field was the main criterion for the selection of informants. The potential interviewees were identified based on preliminary results of desk research and/or proposed by the thematic experts. In their selection, we tried to ensure (at least to some extent) a thematic, geographic and gender balance. We have included experts and scholars from a broad variety of perspectives (OSH, non-discrimination, data protection, workers' involvement, liability, etc.) and jurisdictions to complement our backgrounds.

In total 71 interviews were carried out. **Table 10** below summarises the 15 EU-level experts who were interviewed, while **Table 11** summarises other types of interviews that were carried out, Highlighting the distribution of interviews by country, type of national authority and sector.

Table 10: Overview of EU-level interviews

	Name surname	Affiliation and short description of relevance	Interview data	Expertise
1.	Philippa Collins	Philippa's expertise lies at the intersection of labour law and human rights. Her research examines how rights are enforced and conceptualised, as well as the implications of workplace technology for our human rights. Co-author of Worker voice and algorithmic management in post-Brexit Britain.	28/02/2023	Labour Law, AM
2.	Giovanni Gaudio	Post-doctoral Researcher in labour law at Ca' Foscari University, Venice. Author of Algorithmic Bosses Can't Lie! How to Foster Transparency and Limit Abuses of the New Algorithmic Managers.	24/03/2023	AM, Labour Law
3.	Stefan Gran	European Trade Union Confederation Senior advisor working on the dossiers of Artificial intelligence, Company Law and corporate governance, Corporate Social Responsibility, Digitalisation, and Platform Economy.	30/03/2023	Labour Law, AI, Industrial Relations
4.	Adél Holdampf-Wendel	Head of Labour Law and Work 4.0. The focal points of her department include the effects of digitization on employment and the labour market, "New Work" concepts and working models as well as legal developments in labour law regarding legislation and case law. She has been with Bitkom since 2011; initially as head of media and network policy, competition, and consumer law and since August 2016 in the current position.	13/03/2023	AI, Industrial Relations
5.	Barbora Holubová	A researcher at Central European Labour Studies Institute (CELSI) in Bratislava, currently involved in several international research projects on integrated social sciences research infrastructures, social dialogue, and collective bargaining in CEE region. She has experience in applied social research in the labour market, social policies, gender inequalities using both the quantitative and qualitative data analysis methods.	29/03/2023	Labour law, Industrial Relations, Other (gender)
6.	Katya Klinova	Head of AI, Labour, and the Economy at the Partnership on AI. Focuses on studying the mechanisms for steering AI progress towards greater equality of opportunity and improving the working conditions along the AI supply chain.	09/03/2023	Labour Law, AI, AM, Industrial relations
7.	Alexandra Mateescu	A researcher in the Social Instabilities in Labour Futures initiative and one of the authors of a highly influential paper titled Algorithmic Management in the Workplace (Mateescu and Nguyen, 2019), as well as the author of Workplace Monitoring & Surveillance (Mateescu and Nguyen, 2019).	24/02/2023	AM, AI, data protection
8.	Nathan Mondragon	Chief Occupational Psychologist at HireVue, responsible for building, researching, and maintaining the AI-driven assessment product.	22/03/2023	AM and AI in Recruitment, AM and AI design
9.	Isaline Ossieur	Adviser at BusinessEurope, the Confederation of European Business, Social Affairs department. She is the contact person for OSH-related affairs at the BusinessEurope. Her professional experience relates to employment, social affairs, and social dialogue.	23/03/2023	AI, Labour Law, Equal Opportunities, and Industrial Relations
10.	Aída Ponce Del Castillo	Senior researcher at the European Trade Union Institute (ETUI), focusing on strategic foresight and on the legal, ethical, social, and regulatory issues of emerging technologies. Co-author of several papers in the area of AM, including Regulating algorithmic management.	14/03/2023	AM, OSH, Labour Law
11.	Maria Luz Rodrigues Fernandez	Professor of Labour Law at the University of Castilla-La Mancha (Spain). Former Spanish Secretary of State for Employment. Her current work is focused on the impact of the technological revolution on employment, labour relations and social protection	09/03/2023	Labour law, AM, AI, OSH
12.	Mona Sloane	Sociologist working on inequality in the context of AI design and policy. Currently running a research project on the use of AI in sourcing and recruiting. Co-author of An external stability audit framework to test the validity of personality prediction in AI hiring.	27/03/2023	AI, Algorithms in recruitment

	Name surname	Affiliation and short description of relevance	Interview data	Expertise
13.	Matthias Spielkamp	Co-founder and executive director of AlgorithmWatch, a member of the Global Partnership on AI (GPAI). An editor of the Automating Society reports, has co-authored and edited several books on automated decision-making and AI, including Automating Society 2020.	06/03/2023	AI, industrial relations, data protection
14.	Alex J. Wood	Research Associate at the Oxford Internet Institute, University of Oxford and author of several articles related to AM, including: Algorithmic Management: Consequences for Work Organisation and Working Conditions (Wood, 2021) and Good Gig, Bad Gig: Autonomy and Algorithmic Control in the Global Gig Economy (Wood, 2019).	07/03/2023	AM, Platform work, Industrial Relations
15.	Jamie Woodcock	Senior Lecturer at the Essex School of Business. Has written extensively on platform work and AI and work, including The Fight Against Platform Capitalism (2021).	24/02/2023	Digital work, AM, industrial relations

Table 11: Distribution of interview respondents

Country (No of interviews)	National Authority	Workers' association Trade Union	Employers' association (Sector)	Company (AM tool creator / User)	Other experts or stakeholders
Austria (2)			Austrian Federal Economic Chamber	Austrian Trade Union Federation	
Belgium (1)		The Confederation of Christian Trade Unions			
Bulgaria (3)		Higher Education Union at KT Podkrepa	BIC Capital market Ltd. (owned by Bulgarian Industrial Association); Chambre de Commerce et Industrie France-Bulgarie		
Croatia (2)		Union of Autonomous Trade Unions of Croatia	Croatian Employers' Association		
Cyprus (1)		Cyprus Workers' Confederation			
Czech Republic (1)		The Czech-Moravian Confederation of Trade Unions			
Denmark (2)		IDA (The Danish federation for Engineers)	Confederation of Danish Employers		
Estonia (2)		Estonian Trade Union confederation	Radisson Collection and Palace hotels		

Country (No of interviews)	National Authority	Workers' association Trade Union	Employers' association (Sector)	Company (AM tool creator / User)	Other experts or stakeholders
Finland (2)		Service Union United PAM	Technology Industries of Finland		
France (2)		French Democratic Confederation of Labour (CFDT)	Mouvement des Entreprises de France (MEDEF)		
Germany (3)				HRForecast, Deltia GmbH, Large German software company (Anonymised)	
Greece (1)		Greek Confederation of Workers			
Hungary (2)		VASAS (Metalworkers' Federation)	MGYOSZ-Businesshungary		
Ireland (1)			Irish Business & Employers Confederation		
Italy (3)		Italian Worker Union (Unione Italiana del Lavoro, UIL)	l'Associazione di Confindustria delle imprese di Information & Communication Technology (ICT) Anitec-Assinform	Assicurazioni Generali S.p.A., Milan (ITALY)	
Latvia (2)		Latvian Education and Science Workers' Union (LIZDA)	The Latvian Chamber of Commerce and Industry (LCCI)		
Lithuania (2)	Lithuanian Police Department				
Luxembourg (0)					
Malta (1)		General Workers' Union of Malta			
Netherlands (4)		Christian National Trade Union Federation (1. With Executive & 2. With Policy advisor),		Textkernel	

Country (No of interviews)	National Authority	Workers' association Trade Union	Employers' association (Sector)	Company (AM tool creator / User)	Other experts or stakeholders
		Workers' Council at Yource			
Poland (4)		All-Poland Alliance of Trade Unions (OPZZ) NSZZ Solidarność	Confederation Lewiatan		Expert in labour law consulted the amendment of The Act on Trade Unions with regard to obligations of the employer to inform on use of AI systems in company
Portugal (2)		General Confederation of the Portuguese Workers (CGTP)	Confederation of Tourism of Portugal		
Romania (2)		National Trade Union Confederation - Cartel ALFA	General Union of Romanian Industrialists (UGIR)		
Slovakia (3)		AZZZ SR (Asociácia zamestnávateľských zväzov a združení SR) Moderné odbory Volkswagen	AVS (Asociácia vodárenských spoločností - Association of Water Companies)		
Slovenia (2)		Confederation of Trade Unions of Slovenia PERGAM	Slovenian Employers' Association		
Spain (3)	The Ministry of Labour and Social Economy	Unión General de Trabajadores - General Union of Workers, Confederación Sindical de CCOO			
Sweden (2)	Swedish Work Environment Authority				Karolinska Institutet
Ukraine (1)				PeopleForce	

Source: Consortium

Challenges and limitations

The table below discusses the challenges and limitations concerning the interviews.

Table 12: Challenges and limitations, and their mitigation strategies

Challenges and limitations	Explanation / mitigation measures
Different levels of engagement and knowledge	• During the initial contact with potential respondents, many of them expressed that they were not familiar with AM. This was particularly an issue with employer and worker representatives, who might know about automation in the workplace, but not about algorithmic management specifically. • We tried to contact a wide array of different stakeholders. If a person in one organisation was not familiar with AM, we asked them to point to individuals who might be familiar. However, if such an individual could not be found in a specific organisation, we contacted a different stakeholder from the same stakeholder type. • If we could not find a relevant interviewee in a particular stakeholder group in a country (e.g., often employer representatives did not know much about AM), we contacted stakeholders of similar types, such as employers instead employer representatives.
Difficulties to arrange interviews with some AM creators, employers, or workers, due to busy schedules, lack of motivation, or fear of "audit"	• We contacted a large pool of potential respondents. • We emphasized to the respondents that their insights will be anonymised and will not be shared directly with their employers or third parties. • Sometimes we allowed them to provide their insights in a written form. • Where relevant interviews with employer presentative were replaced with interviews with employers.

Workshops

Information on the workshops is provided in *Annex 16: Factual summaries of the workshop*.

Annex 2: Literature mapping

Submitted as a separate file titled *Annex 2 - Literature mapping.xlsx.*

Annex 3: Synopsis report covering all stakeholder consultations

3.1. Introduction: objectives and scope of consultation activities

The Consultation work package comprised the following consultation activities:

- Interviews with national stakeholders, EU-level experts, AM tool creators and users
- Employee and employer surveys
- Workshops
- Delphi survey

3.1.1. Interviews

The **overall objective** of the semi-structured interviews with EU-level experts and national stakeholders is to tap into existing policy and academic knowledge, collect in-depth insights on algorithmic management, fill in the gaps in the literature and contextualise the analysis of the regulatory framework, as regards four broad issues:

- Past and likely future trends related to AM.
- Challenges (e.g. impact on worker autonomy, job control, loss of social support/relationships with peers or managers, lack of ability to take breaks when needed, impact on ergonomics, safety, stress, mental health issues, the impact of such systems not taken into account into the workplace risk assessment, incl. aspects such as ethics, data protection, worker consent, consultation and involvement of workers and their representatives in the choice of systems or decision-making process that may be relevant to OSH etc.) and opportunities posed by AM (for example, AM solutions could ease compliance with health and safety measures, they are sometimes perceived less biased than humans with assignment of tasks, evaluation of workers, such solutions more accurately take into account the physical capabilities of workers when assigning physical tasks), as well as success and failure factors.
- National stakeholders' views on the expected outcomes of the policies, legislation and other agreements at the national and/or sectoral levels, and, subsequently, inputs into country reports case studies, and conclusions on the relevance and effectiveness of national policies and social partners' agreements.
- Relevance and effectiveness of the existing EU labour *acquis* as well as perceived needs for change (potential future outlook).

During the study's implementation, a total of 71 interviews were conducted. These interviews encompassed various groups: 15 sessions were held with EU-level stakeholders, including experts and select social partners, adhering to the client's directive of excluding EU institutional representatives from the interview pool. Additionally, 49 interviews were conducted with national stakeholders, ranging from employer and worker representatives to enforcement agencies, trade unions, and other pertinent national actors. The study also involved 7 interviews with creators and users of AM (Additive Manufacturing) tools, primarily focusing on those headquartered within the EU. However, a subset of interviews was conducted with tool creators outside the EU but with a distinct focus on the region, exemplified by an interview conducted with a tool creator based in Ukraine.

3.1.2. Employee and employer surveys

In this task, two online surveys targeting workers and employers were carried out in order to collect insights on algorithmic management. The overall **objective** of the surveys was to obtain first-hand information from workers and employers regarding AM, its use in the EU, their views towards AM usage, including what opportunities and challenges AM creates, as well as the need for improvements.

The survey was distributed via four channels:

- *Distribution through national workers' and employers' organisations*. We identified 1700 sectoral trade unions and 1900 employers' associations and asked them to distribute survey invitations to their members.

- *Dissemination through main EU-level social partners.* We contacted around 10 employer and employee representatives, asking them to share the survey with their colleagues.

- *Distribution through national experts*. Each national expert was asked to disseminate the survey across their networks.

- *Purchased contacts of HR managers from companies in the EU*. We sent around 27 thousand e-mails to HR managers in the EU and asked them to fill in the survey on behalf of their companies, share it with relevant managers, and share it with their employees.

In some countries, the above-mentioned strategies did not provide sufficient responses. Hence, our team tried to reach respondents using alternative strategies, such as reminder letters and calls, and the use of internal networks of the team to spread the message about the survey, among other actions.

3.1.3. Workshops

The overall objectives of the workshops were threefold: a) to obtain feedback and comments on the preliminary results of the study; b) to obtain fresh insights, data and knowledge from experts in the field; c) to disseminate the results. Three thematic workshops were carried out in this study, each of which had its own unique audience and objectives (as outlined in **Table 13**).

Table 13: Workshops

Meeting	Overview
No. 1: **Workshop on Data protection and the exercise of collective rights: challenges arising from monitoring and surveillance tools, and the role of trade unions and workers' representatives** Duration: 3,5 hours	The objectives of the workshop were to a) deepen the understanding of how monitoring and surveillance tools used by employers can challenge the principles of GDPR and/or collective rights of workers b) better understand how employers, trade unions and workers' representatives can effectively navigate the complexities of monitoring and surveillance technologies in AM-driven workplaces. The workshop was structured around two main sessions: • **Session I. Challenges and gaps**. The session started with an overview of interim study findings, including challenges, opportunities and gaps of AM usage in the

Meeting	Overview
Date: 19 July Participants: 25 participants, of which 2 from the European Commission, 7 from the contractor's core team, 3 national experts (from the contractor's team). The remaining 13 participants were invited experts (6), representatives from the employers and workers associations (6), and national-level authorities (1).	workplace. It was followed by 5 presentations of invited speakers which focused on challenges to data protection and collective rights. • **Session II. Looking forward**. The session explored possible measures of how employers, trade unions and workers' representatives can effectively navigate the complexities of monitoring and surveillance technologies in AM-driven workplaces.
No. 2 **Workshop on the Occupational safety and health implications of using AM tools in the workplace** Duration: 3 hours Date: 27 July Participants: 32 participants, of which 4 from the European Commission, 7 from the contractor's core team, 2 national experts (from the contractor's team). The remaining 19 participants were invited experts (5), representatives from employers and workers associations (4), national level authorities (1) and stakeholders from international organisations (9).	The objectives of the workshop were to a) obtain feedback and comments on the preliminary results of the study b) obtain fresh insights from experts and stakeholders concerning the key opportunities and challenges to occupational safety and health (OSH) that the introduction of algorithmic management (AM) technologies at the workplace present for workers, and the potential ways forward. The discussions were structured around two sessions: • **Session I. Challenges and gaps.** The session started with an overview of interim study findings, including challenges, opportunities, and gaps of AM usage in the workplace. It was followed by 4 presentations of invited speakers, which were focused on Occupational safety and health implications of using AM tools. • **Session II. Looking forward.** This session explored key success factors and best practices for occupational safety and health, policy gaps and potential policy responses.
No. 3 **Workshop on the HR and people analytics: fairness and discrimination** Duration: 3 hours Date: 3 August	The objectives of the workshop were to a) obtain feedback and comments on the preliminary results of the study b) obtain fresh insights from experts and stakeholders concerning the key opportunities and challenges to fairness and non-discrimination in HR and hiring that the introduction of algorithmic management (AM) technologies at the workplace present for workers, and the potential ways forward. The discussions were structured around two sessions: • **Session I. Challenges and gaps.** The session started with an overview of interim study findings, including challenges, opportunities, and gaps of AM usage in the workplace. This was followed by 4 presentations of invited speakers on fairness and discrimination in the context of algorithmic management

Meeting	Overview
Participants: 24 participants, of which 3 from the European Commission, 8 from the contractor's core team, 4 national experts (from the contractor's team). The remaining 9 participants were invited experts (2), representatives from employers and workers associations (4), and stakeholders from international organisations (3).	• **Session II. Looking forward**. The session explored factors for properly addressing the challenges and opportunities in the area of fairness and discrimination.
No. 4 **The Final Workshop** Duration: 4 hours Date: 17 October in the final version of report Participants: 13 participants, of which 2 from the European Commission, 7 from the contractor's core team. The remaining 4 participants were invited academic experts.	The objective of the final workshop is to: • To present the study results • To obtain feedback and comments on the study findings • To obtain fresh insights from experts and stakeholders concerning the future scenarios of AM and the likely impacts, identified regulatory gaps and the potential ways forward.

The consultation activities are summarized around five key topics:

- Trends in AM after the Covid-19 pandemic;
- Data protection and the exercise of collective rights;
- Occupational safety and health implications of using AM tools in the workplace;
- HR and people analytics: fairness and discrimination;
- EU labour acquis.

Table 14 below provides an overview of which consultation activities provide insights for each of the five key topics.

Table 14: Scope of the consultation activities

Issue	Type of consultations	Date of consultations
Trends in AM after the Covid-19 pandemic	Expert interviews	24 February – 4 April
	Interviews with national stakeholders	3 March – 17 May
	Employees' and employers' survey	27 February - 18 May
	Expert interviews	24 February – 4 April

Issue	Type of consultations	Date of consultations
Data protection and the exercise of collective rights	Interviews with national stakeholders	3 March – 17 May
	Workshops	19 July – 3 August
Occupational safety and health implications of using AM tools in the workplace	Workshops	19 July – 3 August
	Employees' and employers' survey	27 February - 18 May
	Expert interviews	24 February – 4 April
	Interviews with national stakeholders	3 March – 17 May
HR and people analytics: fairness and discrimination	Workshops	19 July – 3 August
	Employees' and employers' survey	27 February - 18 May
	Expert interviews	24 February – 4 April
	Interviews with national stakeholders	3 March – 17 May
EU labour acquis: Should it be changed?	Expert interviews	24 February – 4 April
	Interviews with national stakeholders	3 March – 17 May
	Workshops	19 July – 3 August

3.1.4. Delphi survey

The Delphi survey aimed to explore likely scenarios of the future evolution of algorithmic management, the drivers behind them, and potential impacts for employers, employees, and wider society. For this purpose, the survey targeted the following groups of respondents:

- Academic / Expert
- Worker representative (association, trade union or similar organisation)
- Employer representative (association or similar organisation)
- Employer / AM tool developer
- Regulator, policy-making institution, agency representative

The survey consisted of five main blocks of questions, including:

1. Part A: Current AM usage (2023)
2. Part B: Drivers and barriers of change
3. Part C: Future evolution of AM
4. Part D: Managerial functions that can be automated through algorithms
5. Part E: Likely impacts of the future evolution of algorithmic management

The survey was distributed using similar channels used for the distribution of employee and employer surveys. In addition, we also distributed the survey through:

1. *Distribution through relevant academic journals.* We identified 26 relevant academic journals (on topics of the labour market and digitalisation (including AI)) and directly contacted the editors of these journals asking them to share the survey with different academics.

2. *Direct contacting of relevant academics.* We identified around 5,000 academics working in the fields of labour market, labour law, and digitalisation and contacted them asking them to fill in the survey and share it with their network members to whom this topic may be relevant.

3. *Direct contacting of relevant policymaking institutions and agency representatives.*

3.2. Findings from consultation activities

3.2.1. Trends in AM after the COVID-19 pandemic

Several sources indicate that COVID-19 accelerated the adoption of AM. Based on the employers' survey results and some of the outputs from the interviews with experts and national stakeholders, **the COVID-19 pandemic fostered a more widespread use of algorithms** in several companies. The **employers** were asked what kind of technologies were included in their organisations during the pandemic and if the same trends in the aftermath of it could be expected. Several answers mentioned information and computer technologies, document management systems, video conference environments, and AI. Some respondents stated that COVID-19 accelerated the digital transition and led to even more developments in the use of technology after the pandemic.

Interviews with national stakeholders and experts also revealed that the **need to work remotely during the pandemic encouraged an increased usage of AM**, which was the only way to monitor workers (e.g., by digitally tracking the duration of breaks, as well as requiring workers to always keep their cameras on, etc.). This view was shared among different stakeholder groups, including managing authorities, representatives of trade unions and employers.

Moreover, according to the Delphi survey results, the adoption of AM tools is going to further increase. Based on the Delphi survey results, the main drivers for this are as follows:

- **Technological development** is expected to improve AM tools and make their adoption cheaper. Hence, companies will be more willing to adopt these technologies, which may help them speed up the processes and ensure higher efficiency and productivity of their work. In the Delphi survey, technological development emerged as the predominant catalyst for change, a consensus shared equally among experts, workers' representatives, and other stakeholders. As one of the experts observed, "The current use of AM has been driven to a large extent by technological developments, and recent rapid growth in AI will be a strong push factor for wider use of AM in a workplace".

- The rise of **telework**, accelerated by the COVID-19 pandemic, is likely to speed up the adoption of AM in the next two years. Remote and hybrid working is expected to increase, leading organisations to seek remote monitoring and surveillance tools like AM to manage their remote workforces effectively. Notably, 6 out of 10 experts and worker representatives, along with 5 out of 10 other participants, cited telework as a catalyst for expediting the adoption of AM within the next two years.

- **Demographic imbalance and labour shortage** may also accelerate the use of AM-based tools. This may occur for the two following reasons. First, this may accelerate the need to employ workers living abroad, and, hence, to apply innovative technologies (such as AM-based tools) to monitor their work remotely. In addition, the adoption of AM-based technologies may also automate some tasks, which otherwise need to be done by employees. Roughly half of the experts, workers, and other participants recognised demographic imbalances as one of the primary drivers of change within the next two years. In the words of an expert: “It has already been reported that in countries in which society ageing is more advanced, technical change and automation has been more intensive. Similar processes are going to be related to AM use”.

- **Know-how** or, in other words, the growing prevalence of discussions on the benefits of AM might speed up AM adoption. Approximately half of the experts and worker representatives who participated in the survey echoed this statement. However, more active discussions may also highlight some potential issues and challenges associated with AM (e.g., data protection or health issues), which may slow down this process. One expert notes, “Much of the discourse on AM highlights the negative risks and implications for workers. I think organisations who appropriately research AM might not be overly eager to adopt these tools in their current format.”

Based on Delphi survey results, key factors expected to hinder AM adoption in the near future include employee preferences, security concerns, regulations, ethics, and a human-centric approach.

- Approximately 4 out of 10 participants of the Delphi survey, across various stakeholder groups, specifically cited **ethical concerns and a human-centric approach** as impediments to AM adoption. As one of the worker representatives pointed out, “AM can raise ethical concerns, particularly related to data privacy, algorithmic bias, and the potential for dehumanisation of work.” The fear of progressing dehumanisation of work is also echoed in the interviews with worker representatives: “Humans must be in control of the final decision. We fear the lack of human management in general and on different levels: it starts with the automatic screening of CVs, then we have management in general, the day-to-day assessment of workers, of performance, etc.”

To avoid these problems, several experts and academics emphasised the necessity for a collaborative, stakeholder-driven regulatory framework for AM in the workplace.

- **Security concerns** were identified as a hindrance over the next two years by 6/10 experts, worker representatives, and AI developers with little variance. Cyberattacks, increased protection costs, and the importance of legislation all contribute to this concern, particularly for larger companies. As pointed out by an AI developer: "Security is important and could have the potential to slow down the process of adoption AM in terms of bigger requirements and guarantee for data security. For employers, this could also be connected with even more costs – for an expert on cybersecurity, for technology equipment, etc."

- Worker representatives strongly emphasised **employee preferences** as a potential impediment to AM adoption. In the Delphi survey, 60% of worker representatives anticipated that employee preferences would hinder adoption over the next two years, compared to only 30% among other participants. As one of the experts observed, “If workers are allowed to have input into organisational decision-making, my expectation would be that workers would prefer to not work under algorithmic structures that closely monitor their activities“.

- 45% of experts and academics participating in the survey believed that AM adoption would be hindered by **regulations**. This view was less common among worker representatives, with 26% of them sharing their opinion.

Despite the mentioned challenges associated with AM adoption, most Delphi survey respondents believe AM adoption will grow further. According to Delphi survey results, 46% of respondents believe in an optimistic AM evolution scenario, which means that AM use will increase significantly (i.e., annual usage will increase by around 4%-6% on top of the current usage). Among experts and academics, the optimistic scenario was deemed the most credible, with 53% endorsing its likelihood. Conversely, a majority of worker representatives (62%) opined that the neutral scenario, featuring 2-4% annual growth, is the most probable outcome. In total, 48% of respondents believe in a neutral/ baseline scenario, which means that AM use will increase moderately (i.e., 2-4% annually on top of the current usage). However, many respondents noted that the factual scale of AM adoption will depend on various factors, such as introduced AM targeted regulations, adoption costs, employer/ employee perception, as well as other social and economic conditions.

To obtain feedback, the findings from the Delphi survey conducted as part of this study were showcased during the 4th workshop, which saw the active participation of 13 individuals, comprising members from the European Commission and distinguished experts in the field of AM (hereafter referred to as "4th workshop participants"). Given its current upward trajectory, some of these experts expressed the view that maximum growth in AM adoption is highly likely. This trend is akin to many technologies, such as ChatGPT, a relatively new tool widely used in various sectors, including education. Similarly, AM tools are rapidly evolving, experiencing increased uptake, and are expected to continue on this path. Furthermore, the participating experts provided several valuable suggestions that could improve the accuracy of monitoring and prediction of AM uptake in the future:

- Compare current data with results from the Delphi survey conducted under the Horizon project "Pillars" to address data limitations. The "Pillars" survey collected insights from experts regarding technologies with high adoption potential and anticipated tasks.

- Conduct additional scenarios and simulations, both with and without a regulatory framework, to assess the need for regulatory modifications.

- Develop a systematic approach for conducting surveys related to AM, considering its dynamic nature.

- Provide incentives for companies to share information on AM.

3.2.2. Data protection and the exercise of collective rights

In addition to interviews and the Delphi survey, the challenges and opportunities related to data protection and the exercise of collective rights have been further explored in the 1st workshop. The 1st workshop gathered 25 participants (hereafter the participants of the 1st workshop), including members of the European Commission, experts, representatives from the employers and workers' associations, and national-level authorities.

Participants in the consultations nearly unanimously emphasised the critical importance of guaranteeing **transparency and accountability in automated decision-making processes involving workers' personal data**. Almost all experts and national stakeholders interviewed considered transparency of monitoring procedures and data use to be one of the key factors of success when mitigating AM-related challenges and maximising positive effects.

Meanwhile, **multiple indications suggest that the current level of transparency and the availability of information are insufficient**. In the workers' survey, around half of respondents who answered the question (provided “yes” or “no” answer) indicated that their employer provides clear information on how their personal data is used. Furthermore, the survey of workers showed that approximately half of the respondents believe their employers have clear policies for accountability in place, provide training on algorithm usage, and ensure transparency regarding how algorithms are used. Besides that, the workers' survey results indicated that a quarter of respondents believed AM would harm their privacy.

Interviewed stakeholders, including workers' representatives and experts, underscored that **inadequate transparency and uncertainty surrounding the use of AM, particularly the**

collection of personal data, curtails workers' capacity to defend their collective rights. Two types of problems regarding transparency can be identified:

- Firstly, employers are not consistently aware of AM implementation. An interviewed worker representative highlighted, "As a union, we have the right to pose questions and make demands within the company's consultative bodies, especially when it affects workers and their conditions. However, it's not always easy to detect the use of AM if employers do not disclose it."

- Secondly, not all information concerning the purpose and procedures of data collection, aggregation, and processing is readily available to employees. Moreover, as highlighted by participants in the 1st workshop, even when such information is provided, understanding and explaining the utilisation of data in the context of AM can be notably challenging for individuals who aren't experts in the field.

The lack of information hampers workers and their representatives from collectively safeguarding their data protection rights. Hence, bridging the information gap is essential, and several countries have already taken steps in this direction. For example, the Maltese employment legislation now includes a clause, allowing employees and the National Data Authority to access platform economy algorithms. As highlighted by the interviewed Maltese labour representative, this is a step toward ensuring data protection and addressing algorithmic discrimination.

Moreover, Delphi survey respondents, multiple interviewees and 1st workshop participants stated that **the issue of the 'black box' should not be an excuse or grounds for avoiding accountability**. AI or AM systems should be made explainable because having inscrutable systems is a design choice, not just technology's nature. One of the interviewees representing a trade union vocalised the importance of the role of well-informed workers and their representatives as follows: "Workers' representatives should be able to monitor the algorithm. Therefore, they have to become 'AI-literate'. That is why, in the work's council, someone from ICT should come and explain the working and functioning of the algorithm(s) in an understandable manner. It is too easy to say: "It is too complicated; it is technical". Or employers claiming they themselves do not understand how it works. Employers should explain, and if they do not understand it themselves, have someone explain it, for instance, from the ICT dept". Once adequately informed, **worker representatives should actively participate in defining the essential parameters for the design of AM systems**. This notion found favour with both interviewed worker representatives and experts in the field.

As noted by interviewed experts, understanding the algorithms is pivotal not only to workers and their representatives. **Employers may struggle to comply with data protection regulations if they lack a comprehensive understanding of how the algorithm utilises data**. The discussion also touched upon the issue of legal experts' limited understanding of what AI does on the IT programming level, emphasising the importance of raising awareness about the functioning of technologies.

During the 1st workshop, it was noted that workplace monitoring is an inherent aspect of the employer-employee relationship. However, **the challenge lies in determining the appropriate type and scope of monitoring that can be deemed justifiable**. It becomes problematic when the processing of personal data goes beyond what is required for the performance of the contract. Workshop participants acknowledged that less invasive methods are available to achieve the same goals as the privacy-interfering tools. Some attendees even proposed that extremely intrusive products could be used in the European market only after they are certified. Furthermore, **workers' representatives should be involved** in the certification process alongside data protection authorities. It was also suggested that workers' representatives should assume a new role in designing and enforcing data protection laws in the workplace, as currently, the enforcement is left to data protection authorities who are not labour experts. Strategic enforcement and strategic plans of data protection authorities in Europe do not include employment in their priorities, meaning that the workplace is left behind by supervisory authorities. Therefore, workshop participants proposed that workers’ representatives should have a legal basis and step in to enforce and oversight the data protection of employees.

In the context of data privacy, the experts participating in the Delphi survey expressed apprehensions that **the increased adoption of AM might inadvertently lead to a surge in cybersecurity attacks**, posing a threat to the security of individual data privacy rights. Survey respondents emphasised that organisations would be compelled to make substantial investments in robust data security measures to improve their defences against cyber threats, given the data-centric nature of AM. However, this heightened focus on data security could create a counterbalancing effect, dampening organisations' enthusiasm for adopting AM-based technologies.

Various stakeholders have pointed out that while **GDPR has been instrumental in improving and remains relevant for safeguarding employees against the most privacy-invasive aspects of AM, it has now become insufficient**. As observed by participants in the first workshop, its enforceability has waned in many Member States, as it permits a considerable degree of data processing and provides some assurances. However, it is crucial to ensure that these guarantees are effectively enforceable. Moreover, some employers may selectively interpret and apply GDPR to their advantage, as highlighted by a trade union representative who questioned: “GDPR is often used by employers to refuse to share information on data processed. But does the employer always respect the workers' rights under the GPDR, for instance, the right to information of data subjects on the processing of their personal data?” Given these challenges, some interviewees and 1st workshop participants suggested that an alternative similar instrument tailored to the workplace might be negotiated, as GDPR lacks workplace-specific focus. This notion was also raised during the workshop and was noted by Delphi survey respondents. However, it was recognised that there is no guarantee that such an instrument would offer greater protection against the most harmful and pervasive uses of technology.

The interviewed workers’ representatives, as well as participants of the 1st workshop, also observed that **collective rights are a more effective way to achieve transparency instead of focusing only on individual rights**. It was also mentioned that workers would not be prone to feel surveilled if they could exercise collective rights. The importance of collective action rather than devising exceptional rules for workers was emphasised, as many exceptions made for workplaces were regarded as a way of consenting to something that should not be consented to. Workshop participants acknowledged that some of the collective labour agreements are a form of collective consent, although **consent cannot be a legitimate ground for employees’ data processing in the workplace** (there are guidelines provided by the data protection authorities in Europe, stating that consent cannot be a legal ground). It was recognised how all this is presented to benefit the employee, whose fundamental rights are infringed upon.

Finally, multiple workers' representatives, experts, and participants from the 1st workshop shared the view that **in cases where fundamental employee rights clash with the business interests of employers, the former should take precedence in matters of justice**. While acknowledging the legitimacy of business interests, they emphasized that these interests do not carry the same weight as fundamental human rights, including privacy and the right to data protection. Workshop participants underscored the importance of the concept of proportionality in ensuring the effective enforcement of these rights.

3.2.3. Occupational safety and health implications of using AM tools in the workplace

Stakeholder views on occupational safety and health implications of using AM tools in the workplace were gathered during interviews, the Delphi survey and the 2nd workshop. The 2nd workshop brought together 32 participants (thereafter participants of the 2nd workshop), including members from the European Commission and international stakeholder associations, experts, employers and workers associations, and national-level authorities.

Stakeholders have acknowledged that **the impact of AM on Occupational Safety and Health (OSH) is twofold**:

- On one hand, it can have numerous positive effects on workplace safety. For instance, wearable sensors can provide workers engaged in repetitive tasks with real-time feedback to ensure correct task execution, thus preventing musculoskeletal injuries and disorders, as highlighted by a trade union representative during an interview.

- Conversely, there is a consensus that unregulated and careless use of AM can result in adverse changes to working conditions that harm health, particularly among vulnerable groups. In the words of an interviewed expert, AM "also affects the health and wellbeing. E.g., anxiety caused by constant surveillance, or intensification of the work pace – older workers and persons with disabilities, for example, may struggle with that. A more individualised approach that would be beneficial for these groups is, of course, possible, but it has not been realised so far, unfortunately". As explained by another worker representative, the challenges brought up by AM can be placed within the larger context of challenges brought up by digitalisation: "Digitalisation has heightened the pace of work, creates many disruptions and distractions, and changes the relationship between government and citizen, company and customer, thereby also changing the nature and meaning of work itself. These changes regarding pace, distraction and meaning are known stressors for employees, further amplified by surveillance and digital tracking (e.g. cameras, sensor)."

The worker survey provides valuable insights into the scale of these issues. It illuminates a notable diversity of perspectives, indicating that a **significant portion of employees perceive the use of algorithms as having no discernible impact on their health and well-being**. **Among the remaining employees, there is an almost equal split in opinions**.

As highlighted by an interviewed trade union representative, **the impact of AM tools on employees' mental health and overall well-being is influenced by not only the tool's design and purpose but also by contextual factors like trust**, with the interviewed representative noting, "Trust is a complex issue, not only for tech but also for those applying the technology. If one doesn't have trust in the employer, the same mistrust is felt towards the applied technology... If working conditions are generally bad, then this same dissatisfaction is passed on to other things at work, too. If people are generally happy, then people are happier with tech solutions, too. They perceive new technology as cool, making work easier, and are willing to see how they can increase their productivity now and have maybe more free time. If people are stressed and introduced to new technology, it only increases stress and anxiety."

As noted by numerous interviewees representing each group of stakeholders and 2nd workshop participants, **AM could lead to work intensification**, which encompasses increasing the pace of work and narrowing the requirements for workers down to a specific way that the work must be done, based on statistics and data aggregation. However, the issues associated with data aggregation often tend to be overlooked. Sometimes, data used for AM are of low quality due to disruptions or other problems in collection and aggregation processes, which can lead to problematic practices. For instance, statistics and probability calculations generated based on such data for the purpose of making future projections might not always be accurate. This is especially true when it comes to predictions about the future of employees in companies, as circumstances are not always solely dependent on likelihood, making it difficult to accurately calculate and predict individual human development.

So, while there are opportunities associated with AM in terms of OSH improvement, it is crucial to consider potential risks and challenges as well. Workshop participants emphasised the difficulty of counterbalancing the benefits of AM with the drawbacks, suggesting that **in some cases, the opportunities do not outweigh the risks.** Participants of the 2nd workshop also stated that employees tend to be burdened with challenges, while employers are disproportionately favoured by opportunities, and called for new interventions or rules that would address this imbalance.

Regarding the need for new policies or strategies concerning AM tools and OSH, the views of the stakeholders varied significantly. Some interviewed stakeholders, including representatives of regulatory state institutions, expressed a conviction that existing regulations lay a sufficient foundation for ensuring safe and healthy working conditions, and the remaining problems should be dealt with at the company level. Others, including some participants of the 2nd workshop, mentioned that the concerns related to AM were not addressed effectively enough. Some participants suggested that while researchers are aware of both the positive and negative aspects of AM, **many union members in SMEs or even OSH experts do not have sufficient knowledge** about the specific risks related to it and do not perform AM-specific assessments. Thus, the idea of having institutions responsible for **algorithm auditing has been proposed**. However, there were concerns about the enforceability of the conclusions from the audits. In general, **the importance of having appropriate regulations and strong enforcement** (which lately has been diminishing) was recognised. The participants of 2nd workshop also tried to address this by acknowledging that one of the reasons why proper enforcement remains an issue is that **companies try to lower their costs by saving on OSH regulations**. They suggested that in many cases, OSH regulations are expensive in terms of equipment and productivity, making companies reluctant to comply with them.

The **importance of ensuring high-level worker participation in risk assessment**, in addition to strong regulation and good enforcement, was also discussed. The participants of the 2nd workshop, experts and trade union representatives in the Delphi survey recognised that there is not enough worker participation in risk assessment and management. Workers' participation is important because risks vary across sectors and do not apply identically to all types of 'data subjects' (e.g., workers, consumers, or citizens). The participants of the 2nd workshop emphasised that this pertains not only to AI or AM systems but also to the risks related to chemicals or nanomaterials. It has been suggested that addressing the problem of inadequate risk communication and the lack of sufficient information could obviate the need for additional legislation or enforcement of more laws. In such a scenario, cooperation and mutual decision-making could prevail as the primary mechanisms for resolving issues. However, some participants of the workshop noted that **not all EU countries' labour law includes co-determination rights, and it cannot be a substitute for adequate regulation.**

There were also discussions about the AI Act, within which the field of AM is covered to a certain extent. 2nd workshop participants pointed out several limitations of the AI Act, namely its insufficient influence on OSH. Although the **AI Act sets criteria for bringing different products (including AI) into the internal market**, as well as requirements for OSH (often also referred to as ESHR), it primarily pertains to product specifications. During the 2nd workshop, some participants suggested that Articles 114 and 115 should be amalgamated with the OSH legislation under Article 153. This integration would encompass regulations that extend beyond product requirements to encompass workplace rules and practices. Furthermore, the discussion also delved into the problem of various interest groups that have sought to limit the scope of the AI Act, potentially rendering its requirements irrelevant for many products in a workplace context.

Finally, interviewed stakeholders, experts, and workshop participants commonly held the opinion that if there is a need for a regulatory solution to ensure OSH in the workplace, it should not prohibit the use of technology. It was reiterated that the introduction of technology can be beneficial to many people and might lead to increased productivity, hence, regulations should not only focus on the technology itself but rather on its effects. Some workshop participants proposed that, based on the knowledge from the field of research, **precise criteria for workplace design should be developed** and made mandatory to ensure their effectiveness. Otherwise, an inadequately designed workplace could negatively impact workers' mental health, as it is influenced by the characteristics of a workplace design.

3.2.4. HR and people analytics: fairness and discrimination

Stakeholder views on the key opportunities and challenges to fairness and non-discrimination in HR and hiring that the introduction of AM technologies at the workplace presents for workers and the potential ways forward were covered in interviews, the Delphi survey and workshops, most notably the 3rd workshop. The 3rd workshop brought together 24 participants (thereafter participants of the 3rd workshop), including members of the European Commission, experts, representatives from employers and workers associations and stakeholders from international organisations, such as the International Labour Organization.

Stakeholders with diverse backgrounds **identified the possibilities of using AI and AM tools to improve tedious processes or to tackle the imperfections arising from limited human perception**. For example, automatic systems could help to assess whether people are unintentionally discriminating against and excluding certain job candidates. This was also reflected in the employees' and employers' surveys, which revealed that some employers (30%) and workers (26%) observed a strong, medium, or small positive effect of algorithms on the discrimination level in their workplaces. Additionally, interviewed experts and employers pointed out that as the cost of AM solutions decreases, their significance will grow, particularly benefiting small and medium-sized enterprises with limited HR resources.

However, multiple consultation methods have shown that AM tools can also maintain or increase the level of discrimination. The results of the survey of employers and employees showed that adverse effects are felt at the individual level. In comparison with employers, workers were more inclined to recognise the negative impact of AM on discrimination, with 19% of employees' survey respondents identifying strong, medium, or small negative impact on discrimination in their workplaces.

As explained by interviewees, algorithmic management can introduce bias because **algorithms, programmed by individuals with inherent biases or societal prejudices, can perpetuate and even amplify discriminatory decisions**. In the words of an interviewed expert, "The main problem with algorithms, especially where they are most widespread in the selection of personnel recruitment, is that they naturally tend to be discriminatory. Society is already biased, what happens is that we try to give algorithms a kind of infallibility, or at least that is what they are trying to sell us. That is a big mistake. If an algorithm is poorly programmed because the person who programmed it has certain prejudices or collective prejudices, the algorithm will make unfair decisions." The limitations of the introduction of AM technologies in the workplace in terms of fairness and discrimination were also discussed during the 3rd workshop. There was a broad consensus that, because of unfair social reality and the problem of real historical inequality encoded in any system, highly accurate systems could also reproject and reproduce highly uneven outcomes, suggesting that there might be a **trade-off between the accuracy and fairness of AI or AM systems**. These issues were also acknowledged in the interviews with national stakeholders, including representatives of employees and employers, and experts.

During the 3rd workshop, participants highlighted a related potential issue: **the discriminatory impacts of AM in the hiring process could potentially undermine and work against affirmative policies**. Some participants expressed an opinion that no decisions on people who automatically fall under protected groups should be made by algorithms. The reasoning can be illustrated by taking disability as an example. The notion of disability in the context of discrimination has been evolving throughout the years. Nowadays, it is more dynamic and not attached to the specific criteria used in the past. Thus, only a certain percentage of all people with health issues are recognised as having a disability, leaving others unprotected. The variables and criteria based on which the scores (e.g., a job seeker score) are generated for such workers are unclear, causing uncertainty about whether to apply these affirmative policies. The interviewed national stakeholders, however, did not raise concerns regarding the potential effects of AM on affirmative policies.

Another fairness concern raised by interviewed experts, employers, and employees pertains to **disciplinary actions and contract terminations**. The issue stems from algorithms not considering objective contextual factors affecting employee performance. Compounding this, remote oversight teams handling appeals lack knowledge of workers' specific situations, leading to a disconnect in understanding individual contexts and dissatisfaction among workers regarding the fairness of the process.

Regarding the notion of fairness, the 3rd workshop participants agreed there were some difficulties in defining it. The concept of **fairness may have many different meanings** and manifestations in legal principles, depending on the type of data subject and the object itself, and goes beyond the notion of discrimination. Currently, discrimination is the most concrete notion available in the law for tackling the inequalities and biases in the employment context, as there is a specific definition for it from a legal perspective, unlike for biases. It was also discussed that expanding the perspective of discrimination by considering vulnerability would allow more focus on the structures and elements in the system that recognise the susceptibility of specific groups rather than solely focusing on the assessment of discrimination itself. In addition, it was recognised that **developing a more specific notion of fairness could prove beneficial**, as various procedures (e.g., impact assessment tool which could fit well to the EU regulation approach) must be informed and guided by overarching principles, definitions, and notions.

Another important point raised by several interviewed experts and workshop participants was that often, **AM procedures and their effectiveness in the workplace are not questioned enough.** In some cases, technologies are introduced into the workplace for the mere sake of doing so and without the actual need for their implementation. Furthermore, there is a possibility that the growing affordability of technologies could lead people to question their utility even less. Relying on them to make workplace procedures faster without proper consideration if they are necessary and effective can increase the risk of reduced accuracy and the effectiveness of AI and AM systems, and lead to bias and discrimination.

The interviewed experts and participants of the 3rd workshop also underscored the **significance of technology's "intended function"**. Many AM tools are designed with specific purposes in mind, and developers are expected to provide manuals to the companies purchasing these technologies. In compliance with the AI Act, companies should adhere to the intended purpose outlined in the manuals. However, AM HR tools are frequently repurposed for various uses, such as making subjective management decisions. This practice can pose challenges in safeguarding against unfair practices and discrimination, as inferences from these tools are difficult to detect and regulate due to their subjective nature. Workshop participants concurred that current equality law provisions struggle to effectively address and capture these inferences.

Regarding regulations, generally, there was a **lack of consensus among the stakeholders on whether the existing legal framework is suitable**. Some 3rd workshop participants concurred that labour, equality, and data protection laws are the most suitable sources for fighting against discrimination and ensuring fairness. Nevertheless, it was recognised that there are still some gaps, such as the **fragmented approach of the EU law and insufficient enforceability**. The participants discussed the issue of having different rules in different files or legislative acts, which does not always ensure a coherent and consistent system. Furthermore, they stressed the necessity for improved enforcement mechanisms within the framework of EU equality law, proposing the establishment of enhanced public enforcement, monitoring, and compliance systems. In addition, some participants suggested that having more than fewer procedures in the context of anti-discrimination law might help ensure no mistakes are made. Throughout both the interviews and the 3rd workshop, there were suggestions that **some distinctive aspects related to AM within the workplace context might necessitate more context-specific rather than generic interventions**, given the specificity of certain AM-related challenges.

Interviewees representing various interest groups and participants of the 3rd workshop also stressed the importance of several factors:

- **Social dialogue** (although, in some cases, social dialogue could be associated with a lower technology adoption because of strong divergences in the perspectives regarding it).

- **The balance between the interests of workers and employers.**

- The need to carry out a **proportionality test** to strike a balance between the functionalities of AM tools and the consequences in terms of equality and non-discrimination.

Interviewed experts and representatives of state institutions, as well as workers' and employers' associations, widely **acknowledge the critical issue of inadequate information on AM, hindering workers' ability to combat discrimination**. The matter of limited understanding regarding the functioning of algorithms was highlighted, as it was believed that the lack of comprehension could result in fewer chances to respond to discrimination. To be more exact, if workers do not know how and why they are rejected by the algorithms, their ability to address such issues becomes constrained.

In response to this challenge, **some countries have taken steps to improve workers' access to information with the aim of addressing algorithmic discrimination**. For example, in Spain these measures include clearly defining the information that workers should have access to. An interviewed representative from the Spanish government expressed the belief that these new legislations will enable legal representatives of workers to rely on experts and published guidelines, ensuring that the implementation of company AI or AM tools does not result in unjustified discrimination or differential treatment.

During the 3rd workshop, participants also highlighted instances showcasing the **challenges stemming from a current shortage of expertise in analysing algorithmic discriminatory effects**. The workshop delved into several examples where non-discrimination cases transformed into data protection cases due to this expertise gap, such as the Siri case in the Netherlands involving social fraud and the Austrian public employment profiling system. Hence, the necessity to place a stronger emphasis on education and training concerning the implications of AI and AM tools, as well as the **need to understand what AI and AM tools are doing at scale**, was recognised.

Lastly, the participants of the 3rd workshop recognised that within the context of equality and non-discrimination, many procedural rules still **associate the responsibility and liability predominantly with employers** when it comes to AM. However, the system of stakeholders in AM is broader and goes beyond the classical dichotomy between employers and workers because there are third-party providers of technology. Hence, it is **important to take different stakeholders into consideration**. Many small and medium-sized enterprises would be willing to adopt technical solutions to streamline some processes, but **vulnerability and exposure to legal uncertainty and risks could result in limitations regarding the adoption of technology.**

3.2.5. EU labour acquis: Should it be changed?

In the interviews with national stakeholders and experts, interviewees were asked about the existing EU labour acquis. More specifically, they had to answer questions about the current legal framework's suitability, the need for new policies, strategies or initiatives on the EU level, and other relevant questions regarding regulations. To a certain extent, this topic was also covered during the workshops. Generally, there was **a lack of consensus on whether the existing legal framework is suitable**, as stakeholders had differing perspectives concerning this topic.

There were some workshop participants and interviewees who doubted the appropriateness of the current EU legal framework and believed that there was **a need for more demanding legislation to address the risks of AM**. Several interviewees with diverse backgrounds, including representatives of employers, employees, and regulatory institutions, mentioned that the existing legal framework does not address all the relevant challenges related to AM and that it should be improved. Some interviewees, workshop participants and Delphi survey respondents proposed a need for legislation, **exclusively targeting AM and ensuring that AM is implemented in a worker-centric fashion** (e.g., focusing on employees' data protection in the workplace). As highlighted by one of the experts in the Delphi survey, "regulatory framework is needed to ensure that rights are respected. Once established, ethical norms should be considered, and this should be the guarantor for the introduction of AM".

Furthermore, a point raised by some experts emphasises the need for the European Union to address the **facilitation of AM regulation and its enforcement on continental and global scales**.

As discussed during the 4th workshop, there are multinational corporations operating worldwide. Therefore, the challenges of ensuring compliance with international regulations extend beyond EU regulations.

Conversely, some interviewees argued that **the existing regulations at both EU and MS levels are already too restrictive**. As one representative of employers puts it in an interview, national and European directives restrict certain technologies at the workplace that individuals may freely use in their personal time, such as fingerprint and face recognition. This legal framework poses challenges for employers, leading to limited adoption of automated work-time monitoring and facial recognition systems, as companies often invest in technology they cannot fully utilise due to legal constraints.

Proponents of regulatory changes have pointed out various **shortcomings in the current EU labour regulations, and have identified areas for enhancement**, including:

- **Data Protection.** Multiple stakeholders, including experts, workers' representatives, and employers, have reached a consensus on the critical importance of improved regulation for data protection. While workers' representatives emphasise the need to safeguard workers' rights, employers' representatives recognise the shared interest in this matter. As one interviewed, employee representative highlighted: “Legislation should primarily address security and the protection of private data to prevent companies from encountering issues due to potential misuse, of which they might not even be aware.”

- Although data protection questions are currently covered under GDPR, some participants of the 1st workshop also argued that the **GDPR is too generic**. It was stated that the GDPR applies to many contexts and industries at the same time and lacks the specificity of rules or tailoring for specific concerns in employment relationships. Therefore, some discussions revolved around **the need for more context-specific interventions.** However, as it was recognised during some of the interviews with representatives of employers and members of regulatory institutions, **overly specific instruments can also pose challenges**. For instance, several interviewees considered the EU Platform Work Directive a good tool, although believing it should be broader in scope and encompass not only platforms and a limited segment of workers but also other types of work and issues related to AM.

- **Transparency and Worker Participation**. Multiple stakeholders, such as experts, employee representatives, and trade associations, have underscored the significance of incorporating transparency and worker participation principles into EU law. For instance, a representative of an EU-level workers' association suggested that the Platform Work Directive (e.g., Articles 6 and 7) should be refined to grant employees not only access to information about algorithmic systems but also a mechanism to comprehend the rationale behind these systems. Furthermore, they proposed enabling employees to establish an equitable relationship with their employer, including negotiating the scope of algorithmic decisions moving beyond individual decisions.

- **Implementation and enforcement issues**. The participants of consultations, including interviewed representatives of trade associations and experts, argued that without proper enforcement, there is not much that legislation can do, suggesting that there is a **need to develop a better enforcement mechanism.** As argued by one representative of a trade association, “The EU already has a comprehensive legal framework which puts humans and ethical considerations at the centre of its approach. The harmonised and streamlined enforcement of existing rules are expected to speed the rate of adoption of AM in the workplace“. The participants of the 4th workshop also noted that a critical issue pertains to the existence of established rules devoid of associated sanctions. To enhance the efficacy of regulations and the prevailing legal framework, one essential approach is to supplement these rights with meaningful sanctions and ensure their enforcement when infringements occur.

- **Fragmented approach of the EU law**. Several interviewees, workshop participants, and Delphi survey respondents stated that the legal framework is not sufficient, as it only covers certain aspects of AM and lacks coherence. The need for more coherent legislation was emphasised. Workshop participants also recognised that it is difficult to come up with a new AM directive or other legal instruments because many different aspects need to be covered within supposedly one piece of legislation.

Numerous stakeholders, including participants in the Delphi survey and interviewees, have argued that the new or enhanced **legal framework should be developed and implemented through close collaboration with various stakeholders**, including workers, employers, social partners, and policymakers. Moreover, several interviewees, comprising employer representatives and state institutions, have proposed the creation of a dedicated EU-level policy on Algorithmic Management (AM) that would subsequently be implemented at the Member State level to complement the legal framework.

However, there also were **numerous arguments against changing the current EU labour acquis or devising new policies at the EU level**:

- Some interviewees, including experts, employers and representatives of state institutions, stated that the **existing framework is appropriate** (especially when comparing it to the regulatory approach of the US) and that there is no need to develop new EU-level policies. Several experts, representatives of state institutions and employers' representatives said that the old rules can still work and that only a fitness check would be needed.

- There were some proposals, made by both representatives of employees and state institutions, for **allowing the issues related to AM to be resolved directly at a national level**, without the need to adopt new European initiatives, since the nature of work can be different among Member States and general solutions risk being inefficient.

- Numerous stakeholders interviewed, spanning members of employers' associations and state institutions, consistently underscored the **advantages of collective bilateral or tripartite agreements** compared to EU-level regulations. Collective agreements were highlighted for their remarkable flexibility in accommodating the diverse requirements of individual countries and specific sectors.

- Some interviewees representing employers, industries and state institutions suggested that **guidelines and recommendations instead of new legislation** and directives should be provided, arguing that it would help the companies understand how to implement AM ethically and comprehensively. They also recognised that creating a legal framework specifically for AM can be challenging in the sense that AM is a very dynamic phenomenon.

Lastly, as pinpointed by one of the interviewed experts, if further regulation is to be considered, it should respond to clearly identifiable gaps and problems that current regulation does not and cannot sufficiently address in a way that is consistent with existing requirements in order to ensure legal clarity and certainty and avoid regulatory overlaps.

Delphi survey respondents also noted that the **introduction of laws targeted at the use of AM may reduce AM uptake** as its adoption will be more difficult and require higher accountability. The opinion that regulations will slow down AM uptake over the next 2 years was shared by 45% of experts and 47% of other respondents in the Delphi survey, excluding workers. For instance, a representative of a trade association has voiced concerns about the potential hindrance of poorly designed regulation to AI innovation and workplace adoption in the near future: "If not well designed, regulation is mainly seen as a factor that will slow down innovation and the adoption of AI in the workplace over the next two years. Indeed, the rapid pace of legislative and regulatory activity in the EU is creating legal uncertainty for businesses (both developers and users). Overlapping or conflicting rules in, for example, the GDPR, the AI Act proposal and the proposed Platform Work

Directive (PWD) could hamper innovation and deprive the EU of beneficial AI capabilities that increase security, promote efficiency and reduce costs." The representatives of workers were less likely to believe regulations would challenge the spread of AM, with 26% sharing this opinion.

On the other hand, some experts noted that **a temporary slowdown of AM uptake should not be considered a negative effect of potential regulations**, as it might be necessary to protect all stakeholders. In particular, "regulatory framework will slow down the use of AM, but on the other hand, this should not be seen as a negative phenomenon. The underlying logic here is to protect all involved in the process - and the ability of companies to improve their performance, but also to protect workers' rights."

Annex 4: Summaries of research projects

4.1. Data subjects, digital surveillance, AI, and the future of Work (Moore, 2020)[12]

The report provides a comprehensive overview of the social, political, and economic implications of the emergence of "new surveillance workplaces." It centres on how institutions have responded to the widespread use of new tracking technologies and their effects on the employment relationship and workers' psychosocial well-being. Drawing on case studies from ten countries, including Belgium, France, Germany, Netherlands, Nigeria, Norway, Slovenia, Spain, Sweden, and the UK, the author weaves together business operations with a sociological framework, underscoring the need for discussions on ethics, social responsibility, and social justice in AI applications. One of the report's main contributions is that it conceptualizes data privacy and protection as a fundamental human right.

The rise of algorithmic management, which automates managerial decisions such as hiring, firing, and promotion, has created **new possibilities** for predictive analytics, forecasting, and data mining. It also allows companies to monitor employee performance, engagement, and productivity. However, the report highlights significant issues regarding the ownership of data, power dynamics of work-related surveillance, human resource practices, and workplace pressures. Although all of these developments seem like an exciting new world of possibility, the report underlines that they also pose **challenges** to workers' well-being regarding the ownership of data, power dynamics of work-related surveillance, human resource practices, and workplace pressures.

Surveillance is a central concept in the report, with the workplace monitoring software industry projected to reach 3.84 billion USD by 2023. The top methods of workplace surveillance are phone logs and calls, recording calls, monitoring emails, files, and browsing histories, and Closed-Circuit Television Cameras (CCTV). Facial recognition technology is also being trialled to automatically recognize and record workers' emotions, while apps rely on data collected by accelerometers in employees' mobile devices, and systems gather and organize staff's social media usage. All these tools reflect changes to the standard employment relationship, creating uncertainty or other psychosocial discomforts, such as workers feeling their managers no longer trust them, data being used for other purposes than it was first collected for, or competition between workers intensified.

The report provides evidence about the two-way impacts of monitoring on productivity, highlighting that surveillance practices can have the opposite effect of increased productivity and may lead to hostility, mistrust, and feelings of being treated like children among workers. Moreover, it raises the risk of discrimination if big data is used to replace subjective decision-making by managers. Employers may also be challenged in terms of job control, as algorithmic tools can lead to a lack of autonomy when making decisions and a lack of transparency as to how decisions are made. There is also a potential for legal and ethical risks, as employers must ensure that the data used to inform algorithmic decision-making is gathered ethically and legally, and that they respect the data privacy of their workers.

The report also conceptualizes "algorithm" as an entirely new actor introduced to the workplace with its agency. The management of this new actor is a critical point in **policymaking**. In the European Union and Member States, the General Data Protection Regulation (GDPR) governs how companies collect, use, and store personal data. The GDPR also requires companies to provide individuals with the right to access and rectify the data held about them. However, how informed consent can be gained from workers is a matter of discussion. In line with the GDPR, the author argues that consent to data collection from a worker must be freely given and cannot be coerced. Therefore, silence or

[12] Moore, P. V. (2020). Data subjects, digital surveillance, AI and the future of work. Available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2020/656305/EPRS_STU(2020)656305_EN.pdf

pre-ticked boxes should not constitute consent, and consent is only possible when the data subject is provided with a real choice. New ways of thinking about consent must accommodate collective rights that are a "fundamental tool to rationalize and limit the exercise of managerial prerogatives" over individual workers. Therefore, trade unions hold a key position in ensuring **collective rights** for informed consent.

Along with GDPR, the report looks at various policy mechanisms that have implications for algorithmic management. The ePrivacy Directive requires companies to obtain consent from individuals before processing their data. The European Commission recently proposed a Digital Services Act (DSA) which would require companies to be transparent about their data processing practices and algorithms and to provide customers with meaningful information about the use of their personal data. The DSA would also give individuals the right to challenge automated decisions made about them and to access data about how companies use their data. Furthermore, the DSA would require companies to report data breaches and to ensure that their algorithms are secure and comply with the GDPR. In addition, the European Commission is proposing a Digital Markets Act (DMA) to regulate the digital markets, by introducing a new set of rules to ensure that companies do not abuse their dominant positions in the market. The DMA would also create an independent authority with the power to investigate companies and issue fines when necessary.

When it comes to **gaps**, there is a lack of clarity on how to implement data protection and privacy regulations, as well as a lack of guidelines on how to ensure data accuracy and fairness in algorithmic decision-making. Additionally, there is a lack of transparency in the development of algorithms and a lack of accountability for those responsible for developing, deploying, and using algorithms. Furthermore, there is a lack of oversight and enforcement mechanisms to ensure that algorithms are not biased. Finally, there is a lack of legal protection for workers whose jobs are replaced or augmented by algorithms. In conclusion, the author suggests policy options where worker representation and co-determination through social partnerships with unions, and more commitments to collective governance.

4.2. AI and digital tools in workplace management and evaluation: An assessment of the EU's legal framework (European Parliament, Panel for the Future of Science and Technology (STOA), 2022)[13]

The report comprises three key parts that scrutinize the implications of algorithms in the world of work, the relevant EU policies, and potential policy options across different EU legislative files. The report's methodological backbone is a desk-based legal analysis of AI-enabled and algorithmic-management systems, and studies of management, HR, economics, and sociological research have also been utilized. The legal analysis primarily focuses on EU law rather than the domestic legislation of Member States.

Algorithmic management **automates** several managerial functions, such as recruitment, staff appraisal, task distribution, and disciplinary processes. These technologies make it possible to replace forms of intellectual work. In the future, AI will be integrated into businesses in various ways, both through hardware and software applications. Far-reaching AI technology may become more prominent in some industries, such as logistics, than others. Indeed, AI has gained crucial importance in businesses across the world as it promises **opportunities** regarding consistency, objectivity, and, in some instances, explicability. AI can be used to improve working conditions, such as powering smart robots, augmenting workers' capabilities, and identifying physical dangers. AI can also be used to provide personalized and targeted upskilling and reskilling programs, enabling

[13] De Stefano, V., & Wouters, M. (2022). AI and digital tools in workplace management and evaluation: An assessment of the EU's legal framework. Osgoode Legal Studies Research Paper Forthcoming.

workers to quickly acquire new skills and boost their career prospects. Finally, AI-driven analytics can help employers identify areas for improvement and optimize operational processes.

However, the promise of AI also comes with its own **set of risks** which usually outweigh the opportunities. These challenges include the datafication of work; increased precarity and surveillance capabilities invading workers' private spaces, the potential for businesses to not invest in AI applications designed to increase workers' safety; the risk of AI-determined training opportunities steering workers in certain directions; the risk of algorithms recording low ratings during interviews or performance reviews and affecting future recruitment or review processes; the risk of algorithmic discrimination in the workplace being in restraint of trade and at odds with privacy regulation; and the potential for algorithmic tools to propagate bias beyond the single instance in which it occurs. Moreover, algorithmic tools have the potential to threaten **fundamental rights at work**, including collective ones as they can be used to frustrate union activities or to make it more difficult to collectively govern working conditions by shielding 'proprietary' AI from collective bargaining and consultation practices. When AI-powered tools are used to determine training opportunities and generate electronic resumes, this could wire the competition law and labour market in undesirable ways. This could potentially lead to discriminatory outcomes and restrain trade.

The authors argue that businesses that wish to rely on AI will have to carefully reflect on how AI could best serve their HRM needs without infringing workers' fundamental rights. This presents an opportunity for **law and policy**. EU law will likely play a significant role in shaping the future usage of AI at work. Indeed, with the necessary adjustments, much of the existing regulation can continue to function and steer the changes in the right direction. The General Data Protection Regulation, EU Directive 2002/14/EC, Occupational Safety and Health (OSH) framework, and non-discrimination laws can be used to address AI risks. However, there is a need for regulatory changes and investments in enforcement mechanisms to effectively govern AI in various fields of labour and employment legislation.

The GDPR creates a framework to protect personal data, while the proposed Directive sets out rules on the use of algorithmic systems in platform work. In the future, the proposed Digital Services Act, Digital Markets Act, Machinery Regulation, and proposed Regulation on liability for the operation of AI systems will help to regulate algorithmic management in the EU and Member States. The Digital Services Act sets out harmonised rules in the internal market about the provision of digital intermediation services, while the Digital Markets Act aims to regulate platforms' 'gatekeeper' function. The Machinery Regulation looks to replace the 2006 Machinery Directive, with an emphasis on workplace safety for advanced machines, such as collaborative robots or cobots. The proposed Regulation on liability for the operation of AI systems targets both the 'frontend' and 'backend' operators and advances joint and several liabilities between the two types of operators. The proposed Directive on platform work limits personal data algorithmic systems can process and requires platforms to evaluate OSH risks, including psychosocial ones, and offer a mechanism to overturn automated decisions. The ePrivacy Regulation preserves the confidentiality of electronic communications. Employers must perform risk assessments and take appropriate measures to protect workers against OSH risks, which includes the use of AI. The Working Time Directive protects the right to rest, and breaks and limits the duration of work, while the Equal Treatment Directive prohibits discrimination based on sex, race, religion, or disability.

The European Union's response to AI at work needs to primarily focus on fundamental and human rights, and any rethinking of the EU's secondary law in response to AI should pay due regard to the tension between certain AI applications and those rights. The potential benefits of AI do not justify infringing these rights. It is up to the European institutions and the Member States to keep AI from endangering decent and just working conditions. The **gaps** in policymaking persist, mainly regarding employer duties such as data protection OSH, and other labour and employment rights, as well as ethical considerations, the right to contest automated decisions, and transparency for users and AI subjects. The AI act proposed by the European Commission might succeed in regulating AI better. However, the AI act could draw on different areas of law. The study concludes with the policy options. These options include increasing transparency not just for users but also for AI subjects, forcing providers to make a thorough assessment of their AI's potential discriminatory effects and broader consequences for fundamental rights before bringing it to the market, and containing a vital right to redress if providers neglect their duties under the regulation.

4.3. Algorithmic management consequences for work organisation and working conditions (No. 2021/07). JRC Working Papers Series on Labour, Education and Technology (Wood, A., 2021)[14]

Algorithmic management refers to the use of computer-programmed procedures to transform input data into a desired output for the purpose of controlling an organization. This type of management has replaced traditional organizational functions carried out by human managers. Examining various industries, such as platform work, warehousing, retail, manufacturing, marketing, consultancy, banking, hotels, call centres, journalism, law, and police, this study highlights the potential consequences of algorithmic management in terms of work organization and working conditions.

Algorithmic management is already common in platform work and is rapidly growing in conventional employment settings, **automating a range of functions**. These functions include scheduling and task assignment, evaluation mechanisms by customer-generated ratings, disciplining workers by restricting access to the best shifts, and deactivating workers with low ratings. Wearable devices, AI-equipped cameras, and workforce management software are commonly used to ensure these functions. Despite all these developments, human managers and supervisors remain important elements in the managerial circuit.

Algorithmic management has the potential to transform the role of human managers by curtailing their scope for decision-making and confining their organizational function to offering workers encouragement and support. This study makes a significant contribution by offering a new framework for differentiating algorithmic management from algorithmic assistance. Algorithmic assistance requires managers to continuously use their judgment to review, ignore, and overrule the system, whereas algorithmic management functions without the need for human input unless a manager chooses to intervene. However, full automation is yet to be realized.

Algorithmic management has serious **drawbacks**. One of them is the automatic disciplining of workers. The use of algorithmic management in the workplace has been found to reduce managerial agency and dispossess workers of the knowledge necessary to carry out their jobs, potentially leading to an acceleration and expansion of fissured employment relations. Moreover, algorithmic management can reduce employee well-being by restricting opportunities for intrinsic skill use and discretion, intensifying work, and creating informational asymmetries. It also carries the potential to displace the need for low-level managers and supervisors, lead to job losses, raise a need for new skills, and undermine individual privacy and equality rights. Algorithmic tools can also lead to increased surveillance, with data-driven decisions potentially leading to unfair outcomes and a lack of job security. For employers, algorithmic tools can lead to increased complexity in managing employee performance, as well as the potential for mistakes and errors made by automated systems. Additionally, algorithmic tools can lead to difficulties in maintaining a secure and reliable system, as well as ethical considerations in the use of data.

While algorithmic management has the potential to displace the need for low-level managers, the situation seems more to constitute a general transformation of the role of human managers. This transformation has significant **policy implications** as the continued role of human managers may partially result from legislative rather than technical requirements. For instance, article 22 of the GDPR states the 'data subject shall have the right not to be subject to a decision based solely on

[14] Wood, A. J. (2021) *Algorithmic Management: Consequences for Work Organisation and Working Conditions*, Seville: European Commission, 2021, JRC124874

automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her.' Therefore, algorithmic management that entails fully automated decision-making that has significant effects on individuals without input from human managers would be illegal in the EU and the UK. Indeed, the Data Protection Act dated 2018 in the UK is also in line with EU regulations that humans must be the active reviewers of automated decision-making processes. In short, even where technically feasible, algorithmic management is more likely to take the form of a systematic and integrated assemblage of human and algorithmic actors.

These adverse impacts of algorithmic management and **policy gaps** regarding the involvement of humans can be addressed through collective rights and collective bargaining agreements. Although in many countries, union membership in the private sector is low, trade unions are highly influential to advocate for policies such as co-determination laws, consultation and veto rights for unions and works councils, and new rights to a shorter working week. Thanks to a 'human-in-command' principle, workers would be involved in the implementation of algorithmic management to ensure they retain autonomy and control, self-fulfilment, and job satisfaction.

4.4. What If Your Boss Was an Algorithm? Economic Incentives, Legal Challenges, and the Rise of Artificial Intelligence at Work (Adams-Prassl, 2020)[15]

The paper focuses on the rise of algorithmic management considering the future of work. It examines the implications of algorithmic management for labour markets in terms of reshaping the firm, automating employer decisions, concentrating control, and diffusing responsibility. Some of the issues brought by algorithmic management, such as the rules of privacy and data protection, can be addressed through the careful adaptation and development of existing standards. However, the key point is that AI-driven changes focus on augmenting and eventually replacing human control over the workplace. Therefore, workplace decision-making and management accountability may require a fundamental rethink of existing norms regarding employment law and labour market regulation.

Algorithmic management is mainly **utilized** for tracking employee performance and productivity and for monitoring compliance with workplace rules and regulations. The starkest illustration of algorithmic management currently could be seen in the gig economy, with platforms relying on sophisticated rating mechanisms to manage their workforce. Algorithms are also used to inform decisions regarding team structures, and the arrangement of physical spaces, and even to identify and respond to unproductive team behaviours. Algorithmic management is capable of automatically generating warnings or termination notices for employees who do not meet certain performance thresholds. In the future, the rise of people analytics will reach every single aspect of organizations and automate more managerial decisions to reduce the need for human supervisors.

The author points to the **dangers** of "technological unemployment". Given the exponential growth of machine learning and artificial intelligence, the gig economy is a transitional phenomenon, with most low-skill platform-based work soon to be handed over to algorithms and robots. With the advent of self-driving cars and laundry robots, emerging business models will leave large swathes of the workforce unemployed. The employment law standards might even create additional pressures to hasten this transition as it facilitates decreasing the cost of employing people, harming the bottom of the labour market. Big-scale replacement is the first main challenge of the rise of algorithms. However, many aspects of the modern labour market are much harder to automate than we assume. Human intuition is crucial across the labour market.

[15] Adams-Prassl, J. (2019). What if your boss was an algorithm? Economic Incentives, Legal Challenges, and the Rise of Artificial Intelligence at Work. *Comp. Lab. L. & Policy J.*, 41, 123.

There are many more **challenges** associated with algorithmic management. Even when the information is anonymous, big data collection might have adverse effects on data processing consent and privacy laws in jurisdictions such as the European Union. Wearables and monitoring increase workplace stress with potentially detrimental effects on productivity and retention. Monitoring is not only confined to employer-imposed tools. Self-monitoring and tracking are becoming increasingly popular, blurring the line between personal and professional life for the worker.

A combination of real-time data collection and machine-learning analysis allows employers to monitor and direct their workforce continuously – whilst dispersing responsibility to algorithms. From a **legal policy** perspective, "control" is a key factor in determining protective norms in employment law. Yet, the diffuse responsibility resulting from algorithmic management makes it difficult to ascribe liability. Traditional tools of employment law, such as sham contracting or piercing the corporate veil, can be used to restore responsibility. However, the rise of people analytics poses a different challenge as algorithmic management relies on diffuse and potentially inexplicable control mechanisms that make it difficult to evade responsibility.

In terms of data protection, the European Union's General Data Protection Regulation ('GDPR') may provide some level of protection for employees across the Union's member states, as explored in Article 29 Data Protection Working Party's extensive documentation, including Opinion 2/2017 on data processing at work ('Opinion'). The WP29's Opinion provides guidelines on the collection of data during the recruitment process and the use of keystroke logging and screen capture technology to monitor remote working. But what remains unclear is how these boundaries can be drawn given the fluidity between contexts.

Finally, the author points to the **gaps** in existing legal categories that might be insufficient to hold employers accountable for algorithmic control resulting in discriminatory outcomes. Data protection literature, such as The Black Box Society and the GDPR, provide important inspiration for understanding legal accountability. However, the GDPR is limited in its ability to address the inherent contradictions of algorithmic management as employers must show a legal ground for the collection, recording, organization, structuring, and storage of data. Consent may not be a valid legal ground where there is a clear imbalance between the data subject and the controller. In the employment relationship, employers will need to rely on another legal ground, such as the necessity to process data for their legitimate interest, which is not sufficient to override employees' rights and freedoms. Counterfactual explanations cannot provide the evidence needed to assess algorithms for fairness or racial bias, and the GDPR is unlikely to address the challenges due to privacy expectations and other procedural requirements.

4.5. Your Boss is an Algorithm: Artificial Intelligence, Platform Work and Labour (Aloisi and De Stefano, 2022)[16]

The book gives a comprehensive overview of the effects of robots, algorithms, and online platforms on the world of work. The main argument is that elements of digital transformation might be fundamental tools for growth, welfare, solidarity, and development only if they are governed better with awareness and accountability. It is discussed how technology can be used to positively change our lives and work, while warning of the risks of invasive surveillance and the need for regulation to protect fundamental values, rights, and freedoms.

Technological tools are **implemented** in the workplace **to** remedy internal flaws, finetuning expensive processes as well as improve efficiency and competitiveness. Yet, there are several limits to automation including the difficulty of unpacking and programming activity that require a

[16] Aloisi, A., & De Stefano, V. (2022). *Your boss is an algorithm: Artificial intelligence, platform work and labour*. Hart Publishing, an imprint of Bloomsbury Publishing.

considerable deal of expertise and the fact that human labour is still preferred over algorithms when the costs of automation are high.

The **opportunities** and **challenges** of algorithms are intertwined. New technologies perform more efficient actions, but they can also lead to intrusive managerial practices, contractual precariousness, and erosion of job autonomy and skill depreciation. The authors unpack the mainstream assumption that algorithms are pioneers of objectivity, an idea especially applies to the usage of AI in recruitment through facial and speech analysis to track emotions, personality traits, and behaviour. However, the authors argue that such flawless objectivity of AI is too good to be true, and AI-based recruitment processes are not exempt from discriminative practices.

In addition to recruitment, managers use tools that enable the monitoring of workers' behaviours when there are reasonable grounds to do so, for instance, to track productivity, protect a company's assets (including intellectual property), ensure compliance with occupational health and safety, manage risks, mitigate responsibilities, and prevent detrimental activities. This is allowed by employment laws in many countries. Hence, a certain degree of control is embedded in the employment relationship. However, the problem is that it is not so easy to distinguish between surveillance tools and any other equipment that is critical to a worker's performance and thus does not require any collective or public authorisation. Another challenge is that any complex project is interdependent with other colleagues' jobs and 'therefore individual performance is hard to disentangle from group performance'. In addition, surveillance-related stress increases problems with the result that collective welfare and profitability both get squeezed by high turnover rates (which in turn disperse the knowledge accrued over time), occupational diseases and reduced productivity. The constant threat of disciplinary action also discourages out-of-the-box initiatives and unplanned endeavours, thus impairing creativity and promoting subservient behaviours in monolithic workplaces. Furthermore, especially in the freelance work relationship contexts, the absence of a direct employment contract between the company and the worker is a legal intervention that erodes **worker rights** and the **collective exercise** of these rights.

The book revisits **labour law** in various contexts. Informed by principles of transparency, equal treatment, due process, accountability, valid reasons for termination, and effective remedy, many legal frameworks constrict how managers can go about taking workplace decisions. Employers may exercise their prerogatives to organise, control, and discipline the workforce, but in almost all legal systems they may not do so in an abusive or discriminatory manner. Process-based law is a shared trend in all EU countries' legal orders. For instance, redefining the tasks for which a worker has been hired is permitted, but regulation in many countries aims at avoiding this results in harming their professionalism through demotion practices. Remote monitoring and data collection may be allowed, but many European countries do so only provided that works councils have been informed of the means of surveillance and that the most invasive forms of monitoring are banned. It may be lawful to unilaterally dismiss a worker, but never, at least in principle, on a whim. Specifically, an important aim of the EU Directive on platform work is to promote 'transparency, fairness, and accountability in algorithmic management in platform work and by improving transparency in platform work'. The information duties regard digital surveillance tools and automated decision-making. The text strengthens the gold standard set in the GDPR. It strengthens the gold standard set in the GDPR and explicitly provides for a right to an explanation for any decision taken by automated systems that significantly affect working conditions. Workers have the right to challenge decisions made by data-driven instruments, which must be presented in an accessible way. The processing of data regarding the mental and emotional states of workers, their health, or private conversations is banned. This directive debunks the myth of "algorithmic impenetrability" and guarantees workers a pre-emptive right to understand the consequences of certain conduct.

The authors conclude by suggesting that discussions on the transformation of work should consider the content, place, and value of jobs. Technology is increasingly putting a strain on these factors, leading to the depreciation of tasks' abstract components, making workers interchangeable, and undermining social safety nets and welfare systems. Therefore, it is essential to develop novel business models as well as a new social contract, grounded in a better appreciation of the complexity of human and organizational systems, with the aid of a powerful toolbox that includes not only economics but also psychology, sociology, anthropology, and design.

4.6. Algorithms at work: The new contested terrain of control (Kellogg et al., 2020)

The article explores the intersection between emerging technologies and the changing nature of work and control. Drawing on labour process theory which describes organizational control as a "contested terrain", the authors analyse algorithms as a major force in allowing employers to reconfigure employer–worker relations of production. While the literature on management and economics focuses on the **economic benefits** of algorithmic technologies that improve allocation and coordination in complex markets, facilitate efficient decision-making within firms, and improve organizational learning, the authors aim to go beyond this analysis of economic value and underline how algorithmic control potentially reshapes the relations of production.

According to the labour process theory, managers implement new production technologies and control mechanisms that maximize the value created by workers' labour. Workers, in turn, resist and defend their autonomy in the face of tighter employer control. However, algorithmic control is distinct from previous forms of control, like technical and bureaucratic control. The authors demonstrate that algorithmic control can be more comprehensive, instantaneous, interactive, and opaque than prior forms of rational control. For example, various devices can now record workers' bodily movements and speech. Accelerometers from smartphones can be used to gauge worker movement. Biometric data can be used to verify identities, screen for drug and alcohol use, and collect feedback on emotions and physiology in real-time. Text data, video-based recognition techniques, and natural-language-processing algorithms can monitor emails and chats in real-time. Algorithms can instantaneously compute, save, and communicate real-time information with workers and managers.

Algorithmic control in the workplace operates through **six main mechanisms**, which the authors call the "6 Rs". Employers can use algorithms to direct workers by restricting and recommending, evaluate workers by recording and rating, and discipline workers by replacing and rewarding them. Although the hope is that algorithms will improve the accuracy of managerial decisions, these forms of algorithmic management have negative effects on workers. The **challenges** brought by algorithmic direction tools are frustration, bias, overriding workers' conceptions of well-being, reduced voice, and precarity. Examples include Uber's personalized data to analyse drivers' performance, and Uber's real-time nudging to encourage drivers to go home. Algorithmic evaluation tools lead to loss of privacy, data accuracy issues, discrimination, and rating-related biases in hiring processes. Lastly, disciplining tools bring about precarity (especially for low-skilled workers who work for organizations that allow for automatic replacement), frustration, and stress.

The value of the article's labour process perspective is that it enables understanding of algorithmic systems not as neutral tools that facilitates merely efficiency, but as contested instruments of control that carry specific ideological preferences. Algorithmic control increases transparency, reliability, and predictability of organizational systems, but not necessarily **workers' rights**. However, due to its dialectical understanding of employment relations, the article looks at how occupational developments may affect the control-resistance dialectic. Employers may develop new tools to strengthen algorithmic control, but this work may also become an active area for worker agency. Hence, the authors highlight three kinds of occupational work emerging as part of the dialectic of algorithmic control and resistance: algorithmic curation, algorithmic brokerage, and algorithmic articulation. These new types of occupations open space for worker agency and pushback on employer control.

Algoactivism is another significant insight of the article regarding the exercise of collective rights. The concept encompasses individual and collective tactics of resistance to algorithmic control. The authors map out the four main forms of algoactivism to resist algorithmic control. The first one is an individual action, collective platform organizing, discursive framing around algorithmic fairness, accountability, and transparency, and finally, legal mobilization around employee privacy, discrimination, worker classification, and data ownership.

- Individual tactics of resistance include non-cooperation (such as ignoring algorithmic recommendations, ignoring interactive gamification, and disrupting algorithmic recording), leveraging algorithms, and personal negotiation with clients.
- Collective platform organizing refers to online forums and platforms for workers to empower themselves and share knowledge. For example, rating and flagging requesters who have treated them unfairly; helping each other learn new systems, anticipating or avoiding discipline, and reclaiming access when locked out of platforms.
- Discursive framing includes engaging in a public critique of algorithmic systems to resist control and highlight potential inequalities.
- Legal mobilization workers and labour organizers have advocated for the workplace and legal policies to protect employee privacy, limit managerial surveillance, prevent discrimination, and reclassify independent contractors as employees.

As the name suggests, legal mobilization has **legislative implications**. Activists have begun to engage in regulatory initiatives related to pressing for worker data ownership and workers have begun to resist algorithmic control. Legal regulations in the European context are of importance here. The Data Protection Impact Assessment (DPIA) clause of the European Union General Data Protection Regulation (GDPR) requires pre-emptive assessments of the potential impact of high-risk algorithmic systems on "the rights and freedoms of natural persons" (GDPR, Art. 35). **Yet**, the actual implementation of the DPIA and GDPR frameworks remains unclear. Legal scholars have called for a reconceptualization of workers' privacy rights along the lines of "contextual" or "relational" privacy, which requires an articulation of a set of context-specific norms that constrain employers regarding the information they can collect through websites, with whom they can share it, and under what conditions it can be shared. These legal discussions raise questions for future research regarding how employer algorithmic control and worker resistance coproduce new work dynamics in the EU and beyond.

4.7. The law and policy of people analytics (Bodie et al., 2016)[17]

The article addresses the employment law or business ethics implications of people analytics. People analytics is "a method of human resources management based on the use of "big data" to capture insights about job performance". Technological advancements have unlocked the potential for collecting and analysing this data to assess talent and create human resources policies. The data is collected by innovative computer games, monitoring employee electronic communications and activities, and new devices, such as ID badges that record worker locations and the tone of conversations. Data may also be collected from sources outside the employer like real estate records, or for undefined purposes, like Google searches. The article seeks to fill the gap in the common discussion on the uses of people analytics, by highlighting its effects and interactions with workplace law, particularly in the US.

The implementation of people analytics helps employers make more informed HR decisions. Data may help firms determine which candidates to hire, how to help workers improve job performance, and how to predict when an employee might quit or should be fired. Moreover, people analytics could provide insights on more quotidian issues like employee location and more productive use of break times. In terms of **opportunities**, applying big data to workplace situations could lead to more

[17] Bodie, M. T., Cherry, M. A., McCormick, M. L., & Tang, J. (2017). The law and policy of people analytics. *U. Colo. L. Rev.,* 88, 961.

effective work outcomes as it could help employers discover the traits and behaviours that lead to better products and services. It also contributes to developing better job descriptions, measuring merit, and avoiding relying on stereotypes or other problematic criteria for hiring or distributing rewards. Moreover, reliance on a broader range of data could generate a deeper commitment to diversity. The use of games and other novel technologies to shape employee behaviour may allow for greater empathy, collaboration, and connection for diverse employees.

The article has an important section where the recent trend toward the "gamification of work" is discussed. Gamification and people analytics are being used to measure skills and aptitudes, as well as to screen job candidates, increase worker engagement and potentially reveal a candidate's "true colours" in an interview. Based on their experiments with some of these games, the authors conclude that such games raise important privacy questions for workers in terms of information collection, processing, and dissemination. The collection and aggregation of personal data can be seen as a privacy concern unless federal regulations and employers do not take precautions against data disclosure. People analytics pose various other **challenges** in terms of discrimination and equal opportunity. Data gathered from the internet and smartphones is not equally distributed among all groups, which can lead to skewed data and a lack of access to certain opportunities. The data used for predictive analytics can contain problems such as sampling bias, incomplete data, and subjective labels which can lead to discriminatory decision procedures. Data analytics and profiling can create new stereotypes and discrimination, and the quality of data used for employee engagement, performance assessment, or training can vary widely and be subjective. This situation overall runs the risk of homosocial reproduction, or replacement of workers with workers that look like them, on a grander scale. People analytics may also threaten a sense of autonomy when critical decisions are handed over to data analytics.

Another key insight is the concept of employee voice which has implications for **worker rights.** One of the critical justifications for unionization has been the opportunity for workers to participate in the life of the business. Voice is a specific method for employees to exercise collective voice over their terms and conditions of employment. The National Labor Relations Act (NLRA) in the US provides a specific method for this. Employee voice is important for both instrumental and non-instrumental reasons. On an instrumental level, employee input can lead to better decision-making by people analytics, while on a non-instrumental level, it is valuable for procedural justice and the perceived legitimacy of people analytics.

The authors finally resort to a case study and suggest that when employees consider people analytics as merely a tactic to further reduce costs or a ploy to extract more work, such attributions relate negatively to workers' affective commitment to the organization. On the other hand, when employees consider people analytics to improve quality for customers or to enhance employee well-being, such attributions relate positively to their affective commitment. Further, when employees are concerned with how the organization handles their private information and consider the organizational information privacy practices to be less legitimate, such concerns also translate into a lower commitment to the organization. Likewise, employees viewed HR analytics more negatively if they found about their adoption from co-workers rather than from direct channels, such as supervisors or HR. In conclusion, identity and autonomy are important values that need to be considered in people analytics design. The values of employee voice, disclosure, transparency, identity, and autonomy should be at the forefront of the regulatory discussion.

4.8. Algorithms as work designers: How algorithmic management influences the design of jobs (Rocheleau & Parker, 2021)[18]

Drawing on existing literature and the work design theory, the article attempts to understand the impact of algorithmic management (AM) on work design. Work design refers to "the content and organization of one's work tasks, activities, relationships, and responsibilities". While algorithmic management (AM) is "a system of control where algorithms are given the responsibility for making and executing decisions affecting labour, thereby limiting human involvement and oversight of the labour process". The current and potential future AI-related transformations show that a work design approach that promotes human well-being is significant.

AI algorithms, largely powered by machine learning, differ from previous automated decision-making devices in their high level of autonomy, self-learning capacities, potential for interconnectedness, and ability to handle massive and heterogeneous data. AI algorithms have various essential **applications** in HR and management. The authors identify six management functions: monitoring, goal setting, performance management, scheduling, compensation, and job termination. They analyse how each of these functions affects job resources (autonomy, complexity) and job demands (workload, physical demands), which influence worker motivation and well-being.

- Algorithmic monitoring involves collecting and analysing data about individuals' or groups' actions or performance. A key **advantage** of monitoring is the ability to analyse and process automatically and rapidly massive amounts of heterogeneous data about workers including emotions, movements, sleep time, physical and health condition, social media activity, internet browser history, stress levels, posture, ergonomics and safety threats during work, real-time workspace usage or desk usage, cognitive or physical workload and engagement in their work. However, algorithmic monitoring poses **challenges** including workers focusing more on the tasks being monitored, reducing task variety and autonomy, and hampering problem-solving opportunities. Monitoring customer information is also becoming more prevalent in workers' management. Monitoring is also viewed as a pervasive form of surveillance that can correspond to a stress-related emotional demand.

- Algorithmic goal setting is found in gig work and traditional work sectors like electronics, public transport, and parcel delivery. It is used for setting both task assignments and performance targets. But the **drawbacks** are that the algorithmic process is highly contingent on demand or customer satisfaction scores, and workers have little freedom to accept or decline algorithmic assignments, resulting in job insecurity and increased workload as observed in both gig and non-gig work settings, with examples of physically demanding jobs in hotels and warehouses.

- Algorithmic performance management (PM) has the **potential** to revolutionize the way employee performance is measured by introducing a multitude of metrics to quantify various facets of employees' actions, emotions, performance, behaviours, attitudes, and physical state. Predictive artificial intelligence algorithms, like IBM Watson, can also be used to forecast future performance, set goals, estimate training needs, determine pay raises, or promote employees to managerial positions. However, gig work researchers have reported that workers often react **negatively** to the feedback provided by the algorithm, which can result in confusion about the employer's expectations and reduce the quality of feedback and role clarity. The use of instant and short-term performance metrics can also result in the perception of being perpetually evaluated, and the increased use of customer monitoring and

[18] Rocheleau, X., & Parker, S. K. (2022). Algorithms as work designers: How algorithmic management influences the design of jobs. *Human Resource Management Review*, 32(3), 100838.

data in worker management can lead to emotional demands, a climate of competition between co-workers, and work intensification.

- Algorithmic scheduling determines the best match between labour requirements and supply for a specific timeframe based on various factors such as customer traffic, deadlines, real-time monitoring of demand, weather forecasts, and previous occupancy. The scheduling decision is based on worker availability, performance scores, customer ratings, location, or skill set. Algorithmic scheduling may **limit** worker autonomy by reducing their active role in the determination of their schedule. This can occur through direct scheduling decisions or through nudges that encourage workers to work at specific times. Algorithmic scheduling may also lead to workload pressure, physical demands, job insecurity, and reduced social support. In some cases, it may facilitate the implementation of an organizational strategy towards the zero-hours contract, resulting in lower job stability.

- Algorithmic compensation refers to the use of algorithmic systems to determine workers' pay based on their performance metrics, customer satisfaction ratings, and algorithmic predictions of hypothetical future performance. While it can **facilitate** a performance-based and demand-based management strategy, it also has **potentially negative effects** on workers' autonomy and motivation. Performance-based compensation may lower workers' perception of autonomy and generate a controlled and extrinsic type of motivation. Algorithm-based pay decisions may be perceived as reductionistic and alter task significance, and algorithmic compensation may encourage workers to internalize a logic of efficiency and productivity, leading to higher workloads. Many gig-work platforms rely on algorithmic systems to compute workers' compensation, and some workers have complained about sudden drops in their wages or tips displayed by the app.

- Algorithmic job termination involves the decision to terminate the employment of a worker and automatically notify the employee. It is mainly found in the gig economy but also applies to traditional work contexts. This can **lead to** increased job insecurity perceptions, especially in highly quantified contexts or for workers who struggle to meet increasing quantitative standards.

While the impact on workers' autonomy is consistently negative across these six functions, the effect of each AM function on other job resources and demands is highly variable. To mitigate AM's negative effects and enhance its positive effects, a moderate voluntaristic approach is needed. This approach recognizes that the consequences of AM are primarily the result of organizational choices and strategies behind technological implementation and that stakeholders can shape these consequences. To ensure well-designed jobs, organizations should focus on increasing job resources and reducing job demands through AM. Additionally, people should be able to shape the impact of AM on work design. Thus, transparency, fairness, and human influence are potentially important moderating factors between the AM and work design. While not specifying any legislative attempts, the authors conclude by suggesting a further systematic investigation of the effects of AM functions on a range of pertinent job demands and job resources.

4.9. Artificial Intelligence at work: an overview of the literature (Özkiziltan & Hassel, 2021)[19]

The paper provides an overview of the actual and likely labour market transformations caused by the increasing use of AI technologies across advanced economies, with a special focus on Germany. It starts with a discussion of job replacement: AI applications, compared to previous digital workplace technologies, can displace labour across most of the skill and wage spectrum. Although AI's labour

[19] Özkiziltan, D., & Hassel, A. (2021). Artificial intelligence at work: An overview of the literature. Available at SSRN 3796746.

markets effects remain largely unclear, many experts agree that it will not bring the end of many jobs. Rather it will require the re-allocation of skills and tasks between humans and machines, triggering two opposite changes in the skills and tasks composition of jobs, deepening inequalities and discrimination in the job market.

The authors offer valuable insights into the repercussions of AI for the future of employment relations. Designed to automate or semi-automate managerial decisions, algorithmic management tools have the potential to offer some tangible **benefits** including better health and safety precautions and increased productivity at the workplace, shift schedule optimisation reconciling the needs of the workers with workplace requirements, and more accurate personality judgements leading to more objective hiring, firing, and promotion decisions and more commitment to diversity at work.

However, a critical approach maintains that AI-powered HR decision-support tools often perpetuate and aggravate **a range of problems** in employment relations. Firstly, it maintains and even exacerbates inequalities and discrimination at work based on gender, sexuality, race, nationality, or other categories. Secondly, it raises two serious privacy concerns. The first is the blurring of boundaries between work and private lives. The second privacy concern pertains to the use of collected data. It is widely reported that current technologies allow for the collection of individual data from numerous sources, such as keyboard and mouse movements, call logs, screenshots, webcams, application logging activities, wearable devices, and wellness programmes.

Furthermore, algorithmic management has **adverse implications** for **worker rights and collective resistance**. It has further tipped the balance of power towards employers, as these systems are designed to serve their interests, rendering them opaque to workers. The use of such systems also diminishes the possibilities of worker resistance and creates power imbalances in the case of platform work, where platform companies have sole discretion to determine how their algorithms function and alter the rules and regulations governing the platforms, enabling them to shape the behaviours of platform workers towards desired directions. The increasing power of platforms to extract more value from the work done within the platform ecosystem, combined with the lack of awareness among service providers, challenges the future possibilities of solidarity between them and gives the upper hand to digital platforms in their dealings with independent contractors.

The potential negative impacts of AI on labour markets, privacy, discrimination, and power asymmetries have been addressed in a growing body of ethical guidelines aimed at curbing these harmful effects, with accountability, privacy, and fairness as common foundations. However, most of these guidelines lack enforceable mechanisms, and organizations are often unprepared to manage the ethical challenges associated with the adoption of AI in the workplace in both Germany and beyond. A more holistic approach is needed to operationalize and govern the combination of humans, machines, and algorithms working together to address the ethical challenges associated with the adoption of AI in the workplace.

The authors argue that there are significant gaps in our understanding of the subject at empirical, methodological, and theoretical levels. These gaps leave us with a limited understanding of how AI tools and technologies impact work and employment relations. Among the issues that require deeper empirical understanding are worker perceptions of AI-enabled tools, the extent to which workers accept the use of AI-related technologies, the impact of AI deployment on workers' performance and productivity, and the new tasks and jobs that will be created in AI-driven workplaces. Other topics that require further scrutiny include how AI will impact different groups of workers, how workers can cope with the pressures of AI-driven change, and the impact of legal, regulatory, and political environments on the utilization of AI in the workplace.

The paper concludes by addressing two far-reaching implications of increasing the utilisation of AI-enabled tools in labour markets. First, in the case that the current trends remain unchanged, the AI-driven future of work is likely to perpetuate and aggravate work-related inequalities and discrimination, diminishing further the prospects of decent work, fair remuneration, and adequate social protection for all. Second, predictions provided by current studies only point out one possibility among many. Thus, we still have choices as to the advancement, adoption, and utilisation of workplace AI technologies in a way that brings benefit to all.

4.10. Algorithms, artificial intelligence, and automated decisions concerning workers and the risks of discrimination: the necessary collective governance of data protection (Todolí-Signes, 2019)[20]

The article gives an overview of the AI-based technologies in the workplace that assess and monitor workers, and analyses the protections established in the EU General Data Protection Regulation (GDPR) for safeguarding employees against discrimination. The author starts by mapping the **fundamental changes in the use** of assessing and monitoring technologies. Firstly, tools such as video surveillance, GPS, or wearables (e.g., bracelets that monitor a worker's heart rate and his or her attention and activity status) have led to an increase in the amount of information available. Secondly, new technologies represent an important step forward in the capacity to process this information. For example, face and shape recognition systems now allow the automated signalling of any irregularity, making video surveillance easier and cheaper than in the past. And the third important dynamic is the increase in the capacity for automated decision-making with artificial intelligence taking over HR tasks from simplified (establishing a command in a computer program) to more complex (directly making decisions through AI) levels.

Reduced cost of surveillance is the main **driver** that allows companies to step up worker monitoring. Yet, monitoring has raised concerns about potential violations of the fundamental rights of workers. The **challenge** is that big data and its associated technologies can result in profiles that classify workers through discriminatory categories which can perpetuate existing biases in society. Automated data processing entails great risks of worker discrimination and defencelessness, with workers unaware of the reasons underlying any such decision. Regardless of whether a decision is ultimately made by an HR manager or not, the fact that it is based on automated data processing (e.g., the profiling or rating of workers by an algorithm) will increase the likelihood of that decision being discriminatory.

European labour legislation grants employers the power to choose forms of worker surveillance and monitoring. The European General Data Protection Regulation (GDPR) applies to the employment relationship, but the protection offered is insufficient. The author focuses on the Article 22 of the GDPR, which establishes the right for a person 'not to be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her'. However, in the employment context, in the absence of internal regulation, the automated decision can only be considered valid if it is necessary for the conclusion or performance of the employment contract.

The biggest **lack** of data protection regulations in labour relations is the inattention to **collective rights**. The European regulation has an individualistic character in which rights are granted exclusively to the person concerned without thinking about the possible existence of collective rights. Besides, Article 22 does not make a clear separation between the worker and the customer, overlooking bargaining power imbalances in an employment relationship, and the specific importance of trade unions.

Article 88 of GDPR calls for national regulations to establish more rights-based safeguards for the protection of workers' data or for such protection to be provided by collective agreements. Following

[20] Todolí-Signes, A. (2019). Algorithms, artificial intelligence and automated decisions concerning workers and the risks of discrimination: The necessary collective governance of data protection. *Transfer: European Review of Labour and Research*, *25*(4), 465–481. https://doi.org/10.1177/1024258919876416

this step, the GDPR should not simply allow such decisions to be monitored externally on behalf of individuals, but it should also be possible to analyse the legality and legitimacy of the actions undertaken by companies. To prevent violations of workers' fundamental rights, social partners need to intervene and establish necessary protections. There is a need for the collective governance of workplace data protection, requiring the participation of workers' representatives in establishing safeguards.

Annex 5: Country case study reports

This annex presents advance drafts of six country reports agreed upon with the client, including: (i) **Lithuania**, (ii) **Germany**, (iii) **the Netherlands**, (iv) **Poland**, (v) **Spain**, and (vi) **Sweden.**

5.1. Lithuania case study

The case explores the application of algorithmic management (AM) in Lithuanian workplaces. The case is based on **three main data sources:**

1. **Literature review and desk research**

2. **Interviews with stakeholders** (Table 15: List of interviewees at the end of the document presents the list of interviewees).

3. **Quantified data from the EU and international surveys (**e.g., ECS-2019, EWCTS, ESENER-3, and DESI).

It is important to highlight that the case study only presents the most important data in Lithuania, however, more data can be found in **Annex 6 – Quantified data for the country case study.xls**. Notably, a part of the quantitative data presented in this case study serves as proxy evidence on the AM use in the workplace to present the background of AM employment, as well as to fill the existing data gaps. Proxy evidence will be noted where used.

The case study has the following structure. The first section explores the background of the AM application in Lithuania, presenting the digitalisation context, public discussion, and some specific examples of AM use. The second section presents quantitative data on AM usage in Lithuanian workplaces, focusing on the broad picture and on the use of AM in various types of companies across different economic sectors and sizes. The third section discusses the employees' perception of AM use, differentiating the results based on the gender, age, and education of employees. Finally, we will present a comprehensive review of the AM-related regulatory context in Lithuania.

5.1.1. The context of AM application at the workplace in Lithuania

The context of the AM application: general digitalisation process, public debates, and economic background

Algorithmic management (AM) is a relatively new phenomenon in Lithuania. Currently, the term AM is simplified by directly linking it to the more general concept of digitalisation (e.g., by presenting simple digitalisation solutions, such as e-collaborative platforms, as an AM approach). In fact, this type of solution essentially only allows simplification of the work through automation of working processes (e.g., automated workflow setting, or filling in of the documents and employees' evaluations, which requires human input at later stages), however, is not capable of making significant decisions such as dismissal or promotion.

To illustrate, the current Lithuanian government has recently foreseen the more active application of digital tools related to AM (and serve as proxy evidence) in public sector workplaces.[21] Specifically,

[21] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/973c87403bc311eb8c97e01ffe050e1c

these digital tools were intended to simplify internal management processes within public institutions by providing collaborative environment platforms for public servants.[22] Furthermore, digital tools were also expected to assist civil servants in ensuring more effective delivery of public services.[23] This approach can be most noticed in the healthcare service provision, whereby citizens using the e-health platform can register themselves for an appointment, which then automatically forms the doctors' workflow. In fact, the application of such digital AM-related solutions fostered during the COVID-19 pandemic allowed for an effective continuation of public services in the crisis context.[24]

The available quantified data confirms that the application of AM is a relatively new phenomenon in Lithuania. To illustrate, according to DESI data, only 4.5% of Lithuanian companies use at least some AI technologies (as a rough proxy for AM use). Comparatively, on average 7.9% of companies use AI in the EU. However, when looking at the percentage of enterprises using AI technologies specifically for human resource management (HRM) or recruitment, in Lithuania, this percentage is 0.5%, while in EU-27 it is 0.7%. This indicates at least AI-powered AM technologies are still in their infancy not only in Lithuania but also across the EU.

The relatively sparse use of direct AM tools and the ongoing debate are also reflected in Lithuania's academic literature. The very first academic publications, exploring the concept of AM in Lithuania, appeared in 2014-2015. They were focused on innovative trends of HRM in the public sector, including digital public service provision (a.k.a., e-government platforms), which intended to simplify the work of civil servants.[25] According to Paražinskaitė (2014), such AM-related (digital) solutions in public sector workplaces enable faster and more accurate working processes.[26] Meanwhile, Bilevičienė et al. (2015) noted that the application of AM tools (i.e., online collaboration platforms) in government institutions allows them to solve routine administrative work by reducing (i.e., automating) monotonous tasks, and hence reducing costs.[27] This way, the application of AM, according to Macijauskienė and Stankevičiūtė, can lead to increased efficiency and cost-effectiveness.[28] However, other academics argue that the application of AM can also present challenges related to data protection,[29] social isolation of workers,[30] and there might also be some policy / legal gaps in addressing these challenges.[31]

The sparse application of AM (and the loss of this term in the broad concept of digitalisation) can be partially explained by the economic background of Lithuania. More specifically, based on economic data (see **Figure 5**), Lithuania has an average level of preparedness to apply AM approach in the workplace. To illustrate, although Lithuania has quite a high level of digitalisation (compared to EU average indicators), lower economic indicators and relatively low spending on R&D may pose significant barriers to AM application. In particular, the application of AM may require high investments and the government's active role in supporting this process to ensure a sufficient legal

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[22] Škudienė, V., Vezeliene, G., & Stangej, O. (2020). Transforming human resource management: innovative e-HRM value creation for multinational companies. In Innovation Management. Edward Elgar Publishing.

[23] https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/973c87403bc311eb8c97e01ffe050e1c

[24] Pūraitė, A., Zusevičiūtė, V., Bereikienė, D., Skrypko, T., & Shmorgun, L. (2020). Algorithmic governance in public sector: Is digitisation a key to effective management.

[25] Bilevičienė, T., Billietite, E., & Paražinskaitė, G. (2015). Innovative trends in human resources management. Economics and Sociology, 94-109.

[26] Paražinskaitė, G. (2014). Informacinių technologijų taikymas inovatyviam žmogiškųjų išteklių valdymui: Lietuvos Respublikos ministerijų lygmens analizė.

[27] Bilevičienė, T., Bilevičiūtė, E., & Paražinskaitė, G. (2015).

[28] Macijauskienė, I., & Stankevičiūtė, Ž. Artificial Intelligence Solution in Human Resources Management: Case Study of Chatbot's Implication. STRATEGICA, 517.

[29] Žekevičius, A. (2021). Algoritminė valdysena: implikacijos, priešinimosi strategijos ir santykis su biogalia. Athena: filosofijos studijos.

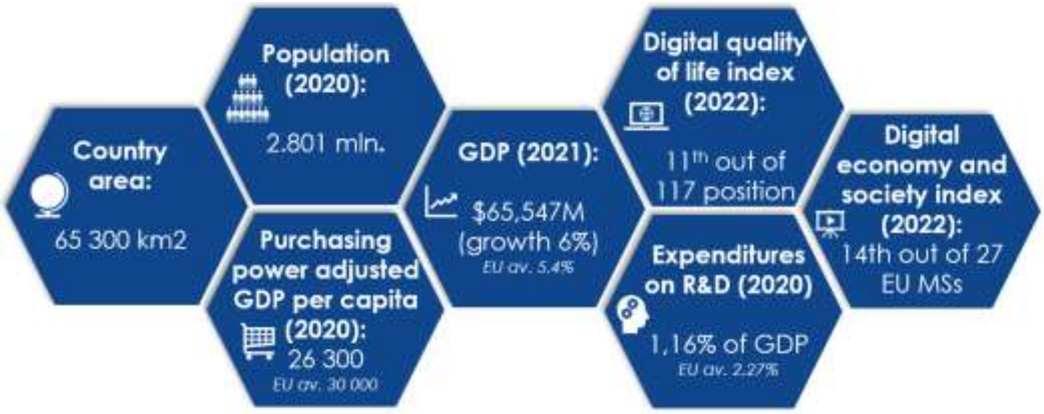
[30] Macijauskienė, I., & Stankevičiūtė, Ž. Artificial Intelligence Solution in Human Resources Management: Case Study of Chatbot's Implication. STRATEGICA, 517.

[31] Paražinskaitė, G. (2014). Informacinių technologijų taikymas inovatyviam žmogiškųjų išteklių valdymui: Lietuvos Respublikos ministerijų lygmens analizė.

base for it. However, despite these indicators, the Lithuanian labour market has some prominent evidence of the AM application in both public and private sector workplaces.

The following sub-section will present direct evidence of the AM application in the Lithuanian workplaces (i.e., specific use cases). Afterwards, we will present quantified indicators that illustrate the broader picture of the AM application in different types of companies, as well as the perception of AM by employees.

Figure 5: General quantified indicators about Lithuania



Source: Authors' own elaboration, based on the official data sources.

The use of AM in Lithuania

More concrete and illustrative examples of the use of AM can be observed in the Lithuanian public sector in the management of police forces. According to the interview with representatives of the Lithuanian Police Department, their use of AM is predominantly for automation of the following HR-related processes:

- **Candidates' assessment.** The Lithuanian Police Department uses a tool developed to automate the reputation assessment of candidates (by automatically collecting information and filling-in documents).
- **Employees' information collection.** A developed self-service portal for employees through which information is collected on employee health, salaries, leave entitlements, and working time schedules.
- **Working time arrangement.** Automated timesheets allow employees to see their working hours (shifts), holiday balances, and leave periods.
- **Employees' appraisal model.** Automated data collection on employees' performance, which is based on manual assessment but automated report generation.

Notably, interviewed Lithuanian police representatives stressed that AM does not create specific (automated) decisions or recommendations in the above-mentioned processes. Rather, it provides assistance to personnel managers in the performance of routine tasks that are too time-consuming to be performed manually.

In recent years, some private companies also started to use AM. For example, Macijauskienė and Stankevičiūtė (2021) found in their research that some companies apply chatbots to answer employees' frequently asked questions (FAQs) and assist them in their daily tasks.[32] According to them, chatbots managed to reduce the workload for HR managers, allowing them to focus on higher-level tasks and generate greater added value.[33] However, despite the positive outcomes of chatbot usage, the authors also highlight that relying on such a tool can lead to a reduction in human interactions, which can be especially harmful to employees who prefer to communicate with real people.[34]

As can be seen, AM is used in some companies in Lithuania. However, to get a better understanding of the overall use of AM by different types of employers (companies) and workers' perception towards it, a quantitative analysis was carried out, which is covered in the next two sections.

5.1.2. The use of AM by employers

This section explores the extent to which AM is being used in Lithuanian companies. It is important to note that some of the data refers to digital (AI) tools, rather than strictly to AM-based tools. This is because, on the national level, there is almost no data specifically about the application of AM, mainly due to the novelty and complexity of AM. However, the available data on the usage of digital tools, presented in this study, directly includes AM features, such as employee monitoring, determination of the pace of work, use of robots in the working process, and others.

In addition, most data come from 2019, before the COVID-19 pandemic, which strongly affected the usage of some AM technologies, such as those that monitor workers when they telework. Nevertheless, it gives good (preliminary) indications of how prominent AM is in Lithuania.

Quantitative data was collected through different EU wide surveys, including European Company survey (ECS-2019), European Working Conditions Telephone Survey (EWCTS-2021), and Third European Survey of Enterprises on New and Emerging Risks (2019). These surveys were selected as they contain weights that were used to extrapolate how many employers, as well as workers, in Lithuania use AM adjacent technologies. For more information on how the data was weighted see **Annex 6 – Quantified data for the country case study.xls**.

Overall usage of AM in companies / organisations

Based on ECS-2019, around 38.1% of companies that have more than 9 employees (i.e., 5838 of such companies) use data analytics[35] to monitor employee performance. This is higher than the EU-27 average, which is around 27%. Similarly, according to ECS-2019, for around 56.2% of employers (i.e., 7974), the pace of work is determined by machines or computers for at least some workers, while in EU-27, this percentage is 45.7% (see **Figure 6** below). In addition, based on ESENER-3, which provides information on companies that have 5 or more employers[36], 4.32% use robots that interact with workers, 8.62% use machines, systems, or computers that determine the content and pace of work, 20.47% use technologies that monitor worker performance, and 7.07% use wearables

[32] Anonymised in the academic publication

[33] Macijauskienė, I., & Stankevičiūtė, Ž. (2021) Artificial Intelligence Solution in Human Resources Management: Case Study of Chatbot's Implication. Strategica, 517

[34] Macijauskienė, I., & Stankevičiūtė, Ž. (2021)

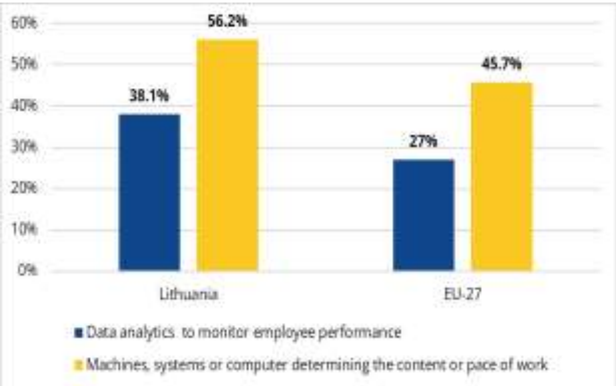
[35] Data analytics is the collection, transformation, and organization of these facts in order to draw conclusions, make predictions, and drive informed decision making. Companies need data analysts to sort through this data to help make decisions about their products, services or business strategies.

[36] In total there were around 42028 enterprises in Lithuania of such type.

(see **Figure 7** below).[37] In the EU-27 these percentages are 3.69% (robots), 11.77% (pace of work), 8.24% (monitor workers), and 4.83% (wearables).

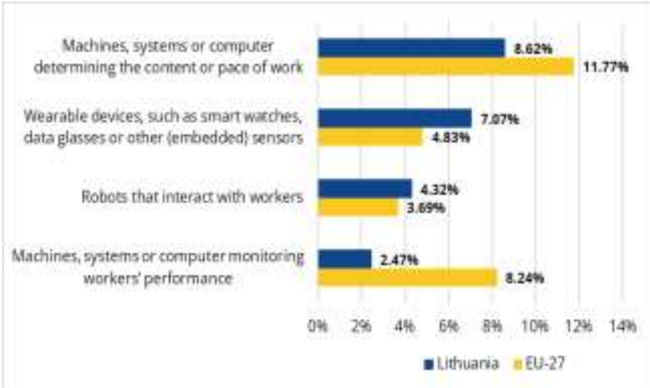
It is important to note that this data contradicts the DESI data, which states that only 0.5% of Lithuanian enterprises (for EU-27 it is 0.7%) use AI technologies for human resource management or requirement. There are two possible reasons for this. First, the different period of these surveys may indicate these differences (i.e., DESI data are from 2021 and ECS data are from 2019). Although a higher application of AM may be expected in 2021 (i.e., after the pandemic, but the data show otherwise), the concept of AM may evolve in two years and companies may indicate different processes in the survey. Second, the DESI survey implies data only about AI technologies, while the concept of AM may be broader and, hence, show a higher level of application.

Figure 6: Percentage of companies (with more than 9 employees) using specific AM tools



Source: Authors' own elaboration based on ECS-2019 data.

Figure 7: Percentage of companies (with 5 or more employees) using specific AM tools



Source: Authors' own elaboration based on ESENER-3 data.

Data show that although the use of AM-related technologies is higher in Lithuania when compared to the EU average, its application is still limited. According to the interviewed representative of the Lithuanian Police Department, the application of AM in Lithuania, as well as in other EU Member States, may be limited due to legal gaps. For example, based on the interview, there is uncertainty about the application of AM and related data protection requirements. More specifically, the current legal framework outlines that employees have the right to choose whether their personal data would be used for data analytics purposes. This in turn means that investments in AM tools may not pay off, as many employees may not give their employer permission to process their private data for analytical purposes.

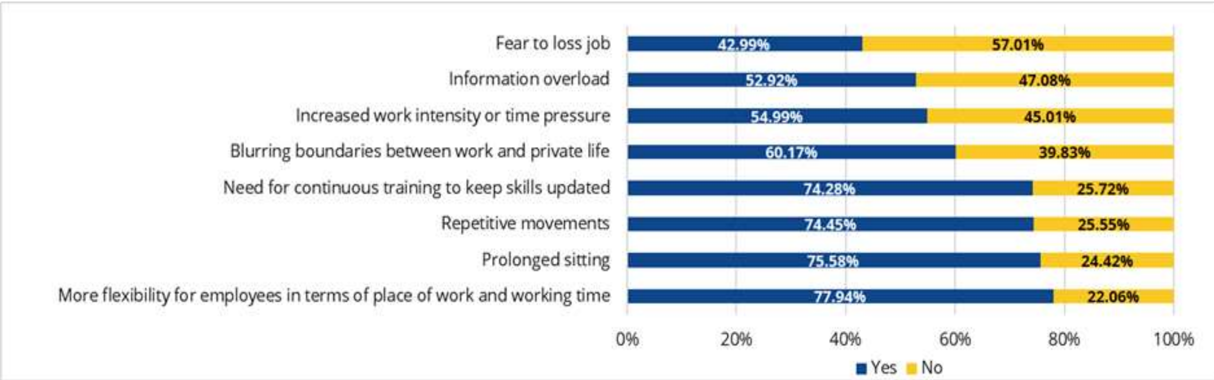
The fact that not all Lithuanian companies and public institutions pay much attention to discussing AM-related impacts indicates that AM implementation is still in its early stages in Lithuania. For example, only around half (in some cases around 60% in some sectors) of Lithuanian workplaces have discussed issues related to the introduction of new technologies, such as fear of job loss, information overload, increased work intensity and time pressure, and blurring of work-life boundaries in their institutions (see **Figure 8**). However, it should be noted that a large proportion of respondents did not answer this question at all (around 37 thousand companies based on the question), implying that a much larger share of companies likely does not discuss this.

[37] The discrepancy between ESENER-3 and ECS-2019 on some questions could be attributed to the fact that companies of different size and not from the same sectors. were covered in the two surveys, and that the formulation of the questions is a bit different.

According to the interviews with Lithuanian stakeholders, the impact of the application of AM is usually discussed during the testing phase of the introduction of a specific AM tool, when workers have the opportunity to give feedback or express their concerns about the introduction of particular AM-based tools. For example, according to the interviewee, the most common concerns regarding the impacts of AM are uncertainty about process changes or lack of digital skills to use AM-based technologies. However, these doubts are usually temporary and, in many cases, can be seen as a normal reaction of employees to digital innovations.[38]

When comparing this situation to the EU-27 level average data, the share of companies at the EU level that discussed these types of questions with their employees is even lower (see **Figure 9**). This situation may be generally affected by the lower level of AM application. In addition, at the EU-27 level, companies more often discuss the need for continuous training rather than other AM-related issues.

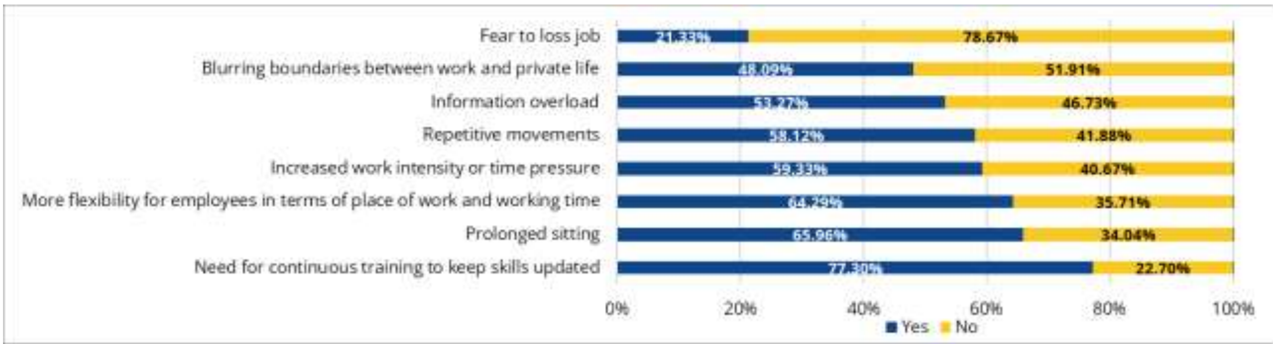
Figure 8: Percentage of enterprises in Lithuania discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 9: Percentage of enterprises in EU-27 discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

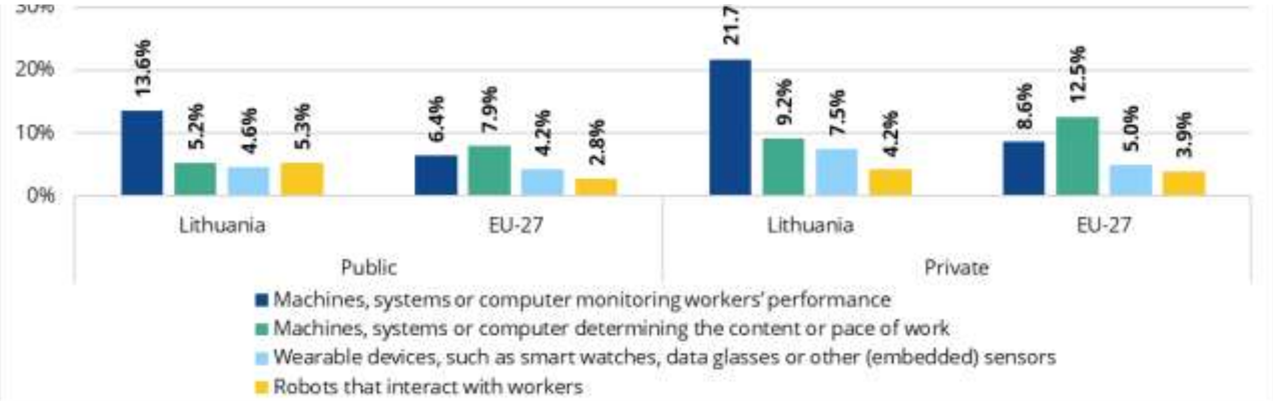
Usage of AM by type of company (public/private)

[38] Paražinskaitė, G. (2014). Informacinių technologijų taikymas inovatyviam žmogiškųjų išteklių valdymui: Lietuvos Respublikos ministerijų lygmens analizė.

When it comes to the usage of technologies associated with AM in public and private sector organisations, some interesting differences can also be observed. First, as shown in **Figure 10**, private companies in Lithuania, but also in the EU, use AM more prominently than public ones. The only exceptions are related to the use of machines, systems or computers determining the content or pace of work as these technologies are more frequently used by public entities. There are a few possible explanations for this. First, private companies are usually in a better position to make larger investments in the application and use of such tools (mostly due to the for-profit approach and hence higher financial capabilities). Moreover, private companies are generally more flexible than public ones. They can make decisions more quickly and are not as bound by bureaucracy or micro-monitoring, allowing them to take more risks and experiment with new ideas. Finally, according to an interview with a representative of the Lithuanian Police Department, public workplaces are subjected to stricter monitoring regarding data protection, which in turn can slow down the uptake of AM in public workplaces.

Second, Lithuanian companies use machines, systems, or computers to monitor workers' performance much more frequently than the EU-27 average in both private (21.7% and 12.5% respectively) and public (13.6% and 6.4% respectively) sectors (see **Figure 10** below). Third, private companies in Lithuania also use wearables more frequently than the EU-27 average (7.5% and 5% respectively), but there is no big discrepancy between the usage of wearables in the public sector. Finally, on average, machines, systems, or computers determining the content or pace of work are used more frequently in the EU-27 than in Lithuania. The difference of usage between Lithuania and EU can be partly explained by the fact that Lithuanian enterprises are more often industry-focused (e.g., electricity, gas, steam, and air conditioning supply) and education-oriented. Meanwhile, private companies tend to be more service-oriented. A more detailed discussion of the economic sector dimension is provided in the next sub-section.

Figure 10: Percentage of public and private enterprises using different technologies associated with AM



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

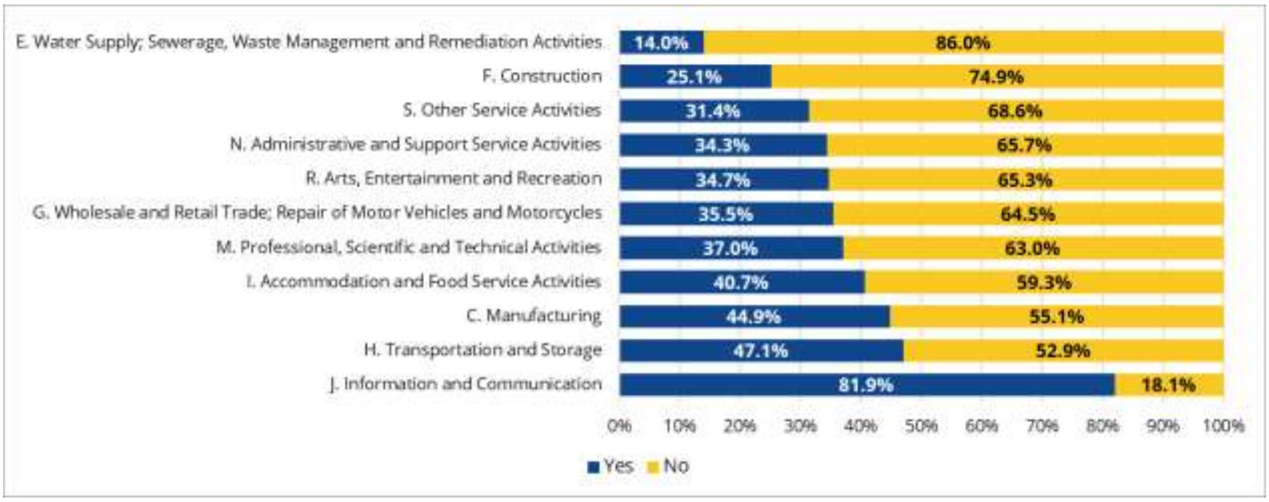
Usage of AM by economic sector

The use of AM technologies varies considerably between economic sectors. According to the ECS-2019, companies in the ICT sector are much more likely than companies in other sectors to use data analytics to monitor employee performance. To illustrate, the data indicates that almost 82% of ICT-focused companies use data analytics to monitor employees' performance (see **Figure 11** for details). At the same time, enterprises from the water supply, sewerage, waste management, and remediation activities use such technologies the least (only 14% of them use data analytics). In addition, it is difficult to establish a clear pattern regarding the usage of AM in different economic sector groups. For example, companies in the construction sector are those that comparatively rarely use technologies to monitor worker performance (25.1%), while companies in the manufacturing and transportation and storage sectors do so almost twice as frequently (44.9% and 47.1% respectively).

The existing differences might be explained by several reasons. First, the variations in use of AM can be based on industry-specific needs. Different sectors have different asset types, equipment, and facilities that require varying levels of maintenance and monitoring. Moreover, certain sectors are subject to more stringent regulations that require companies to implement robust AM technologies. Also, the size and complexity of operations within the companies may also affect the need for AM adoption. For example, according to an interview with a representative of the Lithuanian Police Department, in workplaces with 10,000 or more employees, manual HR processes are too expensive, so innovative solutions (e.g., AM-based technologies) are being implemented. Finally, cost consideration should be also taken into account as companies in sectors with lower profit margins or higher competition may be less likely to invest in AM practices. However, there can be some exceptions. For instance, companies operating in highly competitive economic sectors may invest in AM developments to reduce the costs of production and increase their price competitiveness to maintain their market position.

A similar situation can be observed when comparing the Lithuanian data with the EU average. Specifically, companies operating in economic sectors such as transportation and storage (35.9%), information and communication (29.6%) and manufacturing (28.3%) are also among those, that most actively employ data analytics to monitor employee performance (see **Figure 12** below). However, in the case of EU-27, the ECS (2019) also position such economic sectors as financial and insurance activities and professional, scientific, and technical activities (among the most active data analytics users), which were not included in the Lithuanian case due to low response rate.

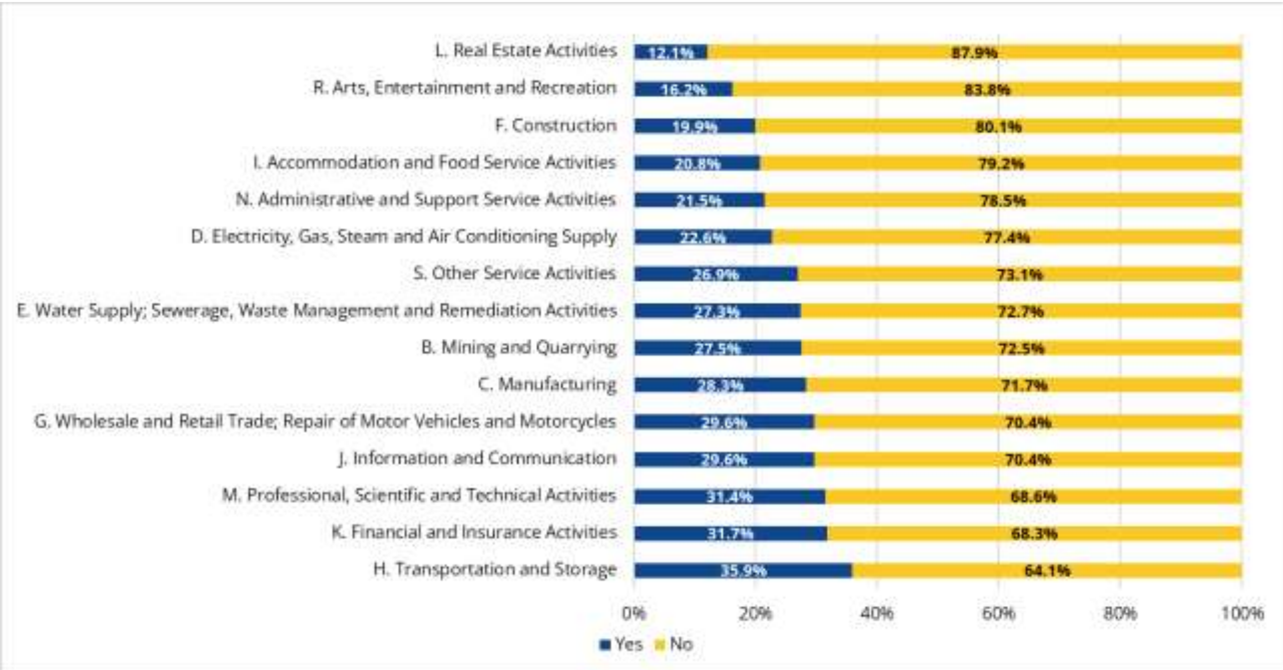
Figure 11: Percentage of companies in Lithuania, by sector, using data analytics to monitor employee's performance



Note: Only companies with over 9 employers are covered.

Source: Authors' own elaboration, based on ECS 2019 data

Figure 12: Percentage of companies in EU-27, by sector, using data analytics to monitor employee's performance



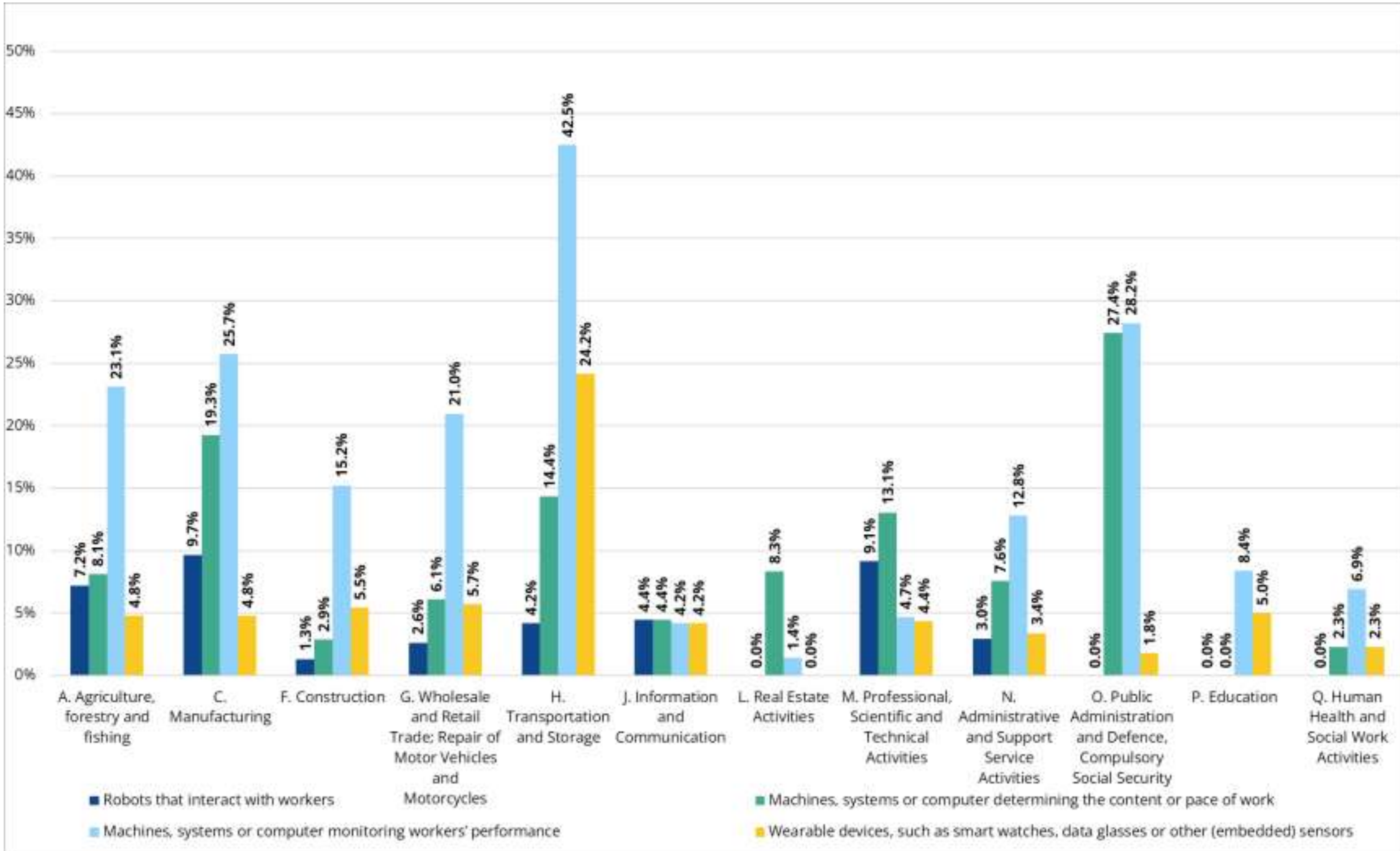
Note: Only companies with over 9 employers are covered.

Source: Authors' own elaboration, based on ECS 2019 data.

In addition, robots that interact with workers are most frequently used in sectors related to manufacturing and to support professional, scientific, and technical activities (9.7% and 9.1% of companies respectively do so) (see **Figure 13**). Regarding the usage of machines, systems, or computers determining the content or pace of work, such tools are most prominent in public administration, defense, and compulsory social security (27.4%). Technologies monitoring worker performance are by far the most frequently used technology in all sectors, but it is used most frequently in the transportation and storage sector (42.5%). Similarly, wearables and similar technologies are predominantly used in the transportation and storage sector (24.2%). These results further highlight the multifaceted nature of AM and the tendency by different types of organisations to focus only on select types of technologies in Lithuania, which better address their particular needs.

When looking at the EU-27 level data, the situation is a bit different there (see **Figure 14**). First, the share of companies using AM-based tools is higher in Lithuania than in EU-27, which confirms the above-discussed data. In addition, there are some differences when looking at the application of specific AM-based tools in different economic sectors. Specifically, machines, systems or computers determining the content or pace of work stand as the most actively applied AM tools with the most prominent share of users in the manufacturing (23%) and agriculture, forestry, and fishing (19.6%) sectors. Meanwhile, robots and wearable devices among companies at the EU-27 level are used less frequently compared with Lithuania.

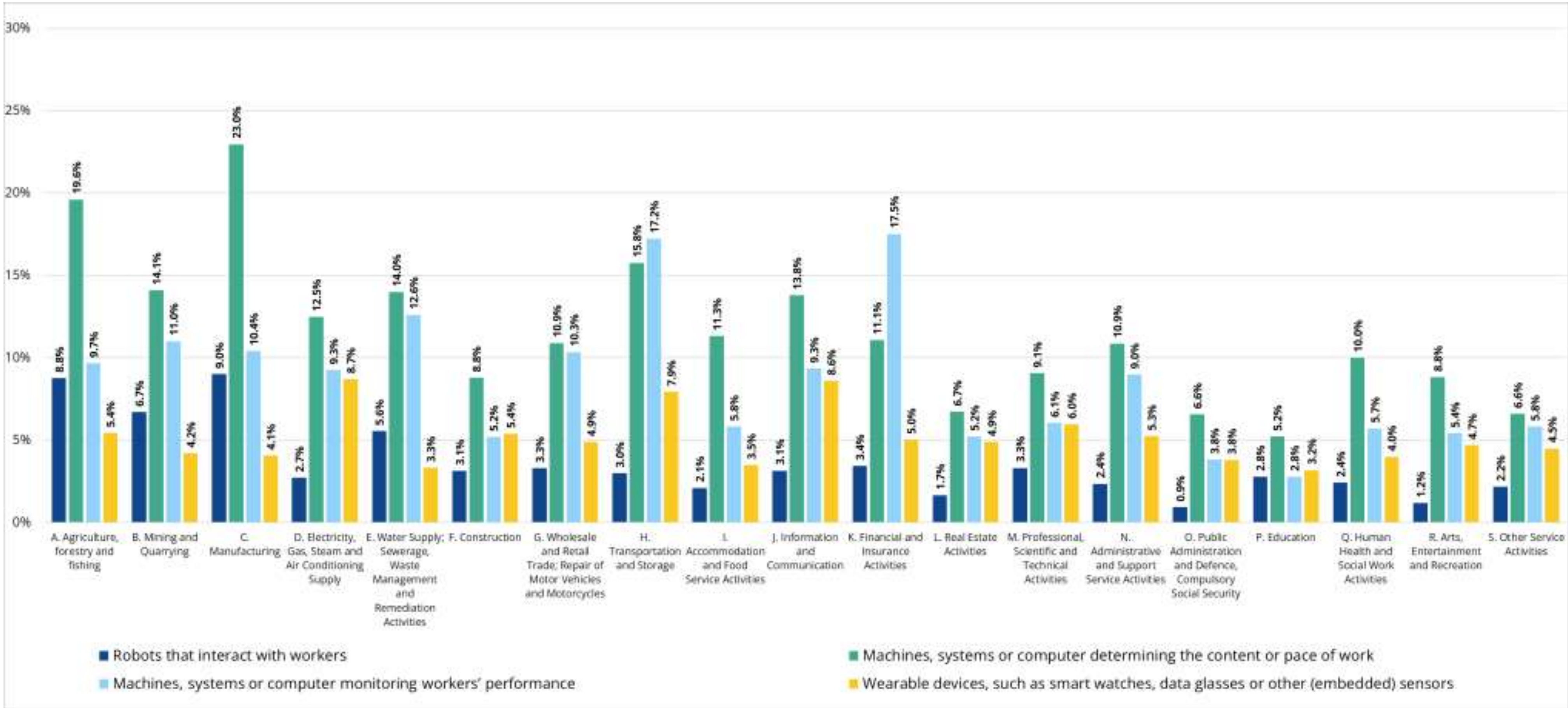
Figure 13: Percentage of companies in Lithuania that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered.

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 14: Percentage of companies in EU-27 that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered.

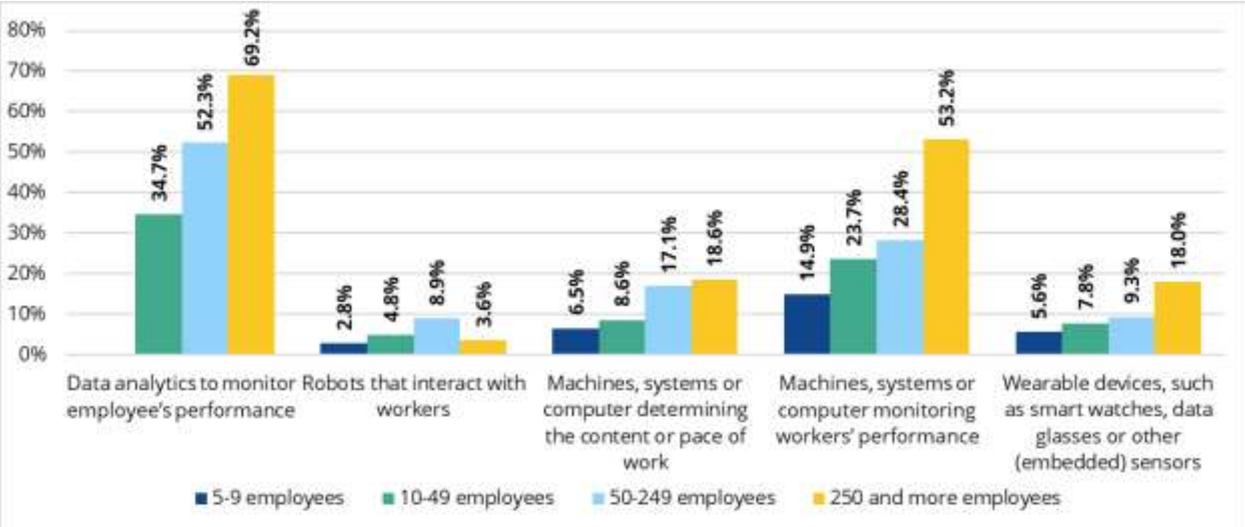
Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage of AM by company size

Regarding the size of enterprises, large companies use technologies associated with AM more frequently than smaller enterprises (see **Figure 15** below). To illustrate, 69.2% of large companies (with 250 employees and more) use data analytics to monitor employees' performance, compared to 0% of the micro (with 5-9 employees) and 34.7% of small enterprises (with 10-49 employees). This situation is consistent for the majority of technologies analysed. The only exception is found in robots that interact with workers as both small and medium-size enterprises use such technologies more frequently. At the EU-27 level, the situations are also very similar (see **Figure 16** below).

One explanation is that introducing new technologies can often be very costly, causing smaller enterprises to prioritise other pressing issues before investing in new technologies. On top of that, larger enterprises have more employees, making manual HR processes costly, whereas for smaller enterprises this is often less of an issue. However, usage of AM in smaller enterprises will also likely grow in Lithuania. As digitization and innovation advance, new technologies (incl. AM-based systems) are becoming cheaper and more affordable.

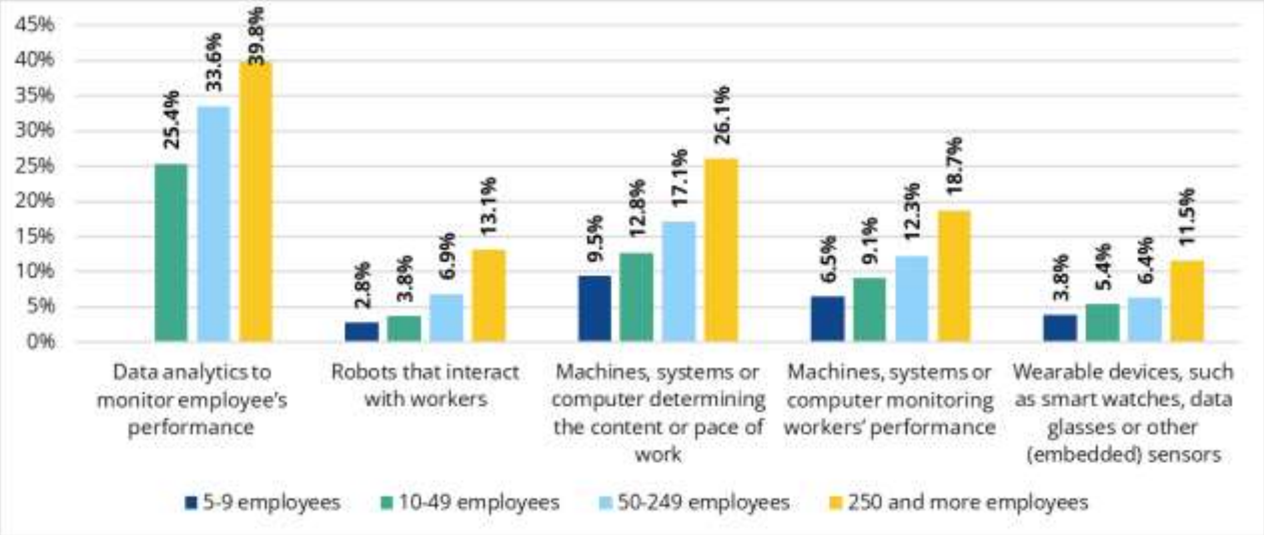
Figure 15: Percentage of companies in Lithuania that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".

Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

Figure 16: Percentage of companies in EU-27 that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".

Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

5.1.3. Employees' experience with AM

Overall experience by workers

According to EWCTS-2021, which covers companies of all sizes, for around 73.2% of employees in Lithuania (around 480 thousand) computer systems influence what they do at work, compared to 57.6% in EU-27. However, this stands as proxy evidence of the AM application, as it may not only refer to the automatic allocation of working hours or the planning of tasks and resources (what is AM-based functionality) but also simple digitalisation solutions which automate working processes.

In addition, when assessing this data, it is also important to note that these percentages do not include individuals, who responded "Don't know" or did not answer this question (around 700 thousand individuals in Lithuania), which implies that in reality the usage may be much lower. The reasons for not including these non-answers in the calculation of the percentage are discussed in the footnotes.[39]

The possible lower usage is supported by ESENER-3 data, which is focused only on companies with more than 5 employees. According to the data:

- 6.01% (around 64 thousand) of Lithuanian employees, working in companies with over 5 employees, interact with robots at work.
- 14.2% (148 thousand) are subject to machines, systems, or computers determining their pace of work.

[39] The reason for not including these non-answers in the calculation of the percentage is related to the fact that a high number of such responses as "Don't know" and refusals distorts the broad picture and does not allow us to assess for how many people computer systems influence what they do at work. In addition, it also would not allow us to compare Lithuania's data with the EU-27 average as the higher response rate at the EU-27 level also implies a higher number of "Don't know" responses or refusals. Considering these arguments, the inclusion of this type of answer does not have an added value here.

- 31.5% (335 thousand) employees are subject to machines, systems, or computers monitoring their performance.
- 9.8% (103 thousand) have to wear wearable devices and similar.
- In contrast, these percentages for EU-27 are 7.3% (interaction with robots), 17.3% (pace of work), 12.2% (monitoring workers), and 7.2% (wearables).

The data presented above shows that the two surveys indicate quite different results. Specifically, the EWCTS-2021 shows much higher estimates of the application of AM to employees than the ESENER-3 survey. There are three possible reasons for this. In particular, EWCTS data in this case serves as proxy evidence of the AM application as it may include not only direct AM tools, but also simple digital solutions, which can imply higher percentage of users. Second, ESENER-3 provides data for 2019 and EWCTS for 2021. This makes the latter survey more reliable (especially since it was conducted in the middle of the COVID-19 pandemic, which may have led to an increase in teleworking and thus the possible increase of AM use). In addition, the EWCTS-2021, in contrast to ESENER-3, covers companies of all sizes, which may also ensure more reliable results.

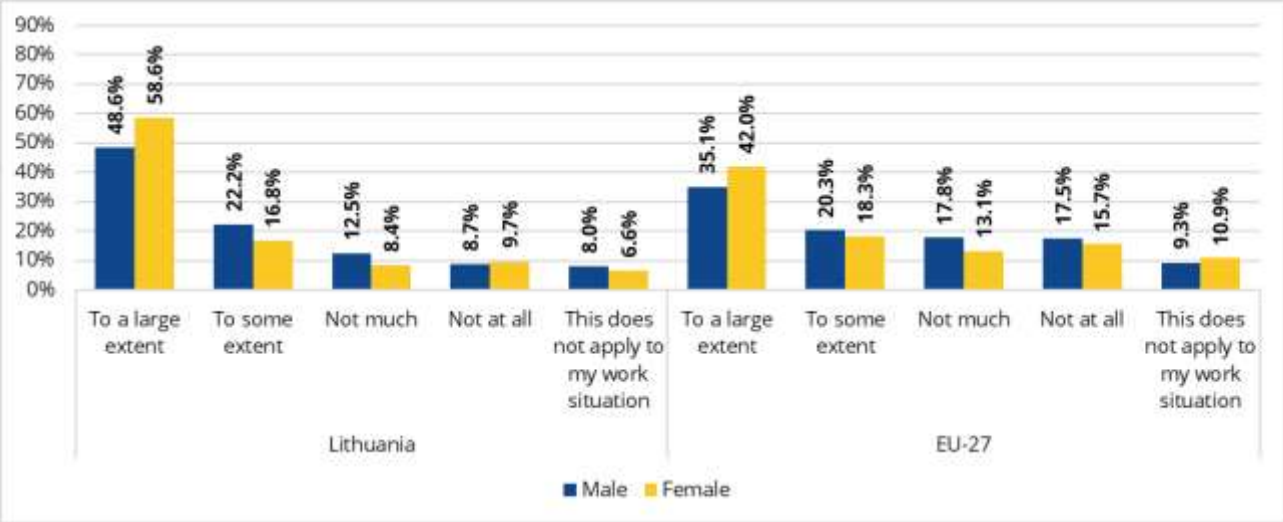
Despite the differences found between the two surveys, this data may serve as evidence that Lithuanian employees use AM-based tools and, according to the ESENER-3 results, AM is more frequently used for the purpose of monitoring workers' performance compared to other kinds of use. Given that monitoring of workers is one of the simplest ways in which AM can be applied, the implementation of specific AM in Lithuania is seemingly still in its infancy.

By workers' age and gender

When it comes to AM usage by gender and age group, available quantitative data is relatively limited as only EWCTS-2021 provides such information. Nevertheless, some insights can be derived from it.

The available data show that both males and females have a similar experience with computer systems influencing what they do at work, both in Lithuania and in the EU-27 (see **Figure 17** below). Notably, more frequent use of the technologies is reported by females than males (58.6% and 48.6% respectively), also implying a greater impact. One possible explanation for this difference is that women are overrepresented in certain industries or occupations that are more likely to rely on AM. For example, women may be more likely to work in jobs that involve customer service or data entry, which are more easily automated and thus more likely to be managed by algorithms. In addition, gender biases in the workplace may also lead to women being assigned to jobs that are more algorithmically managed. For example, if women are perceived as being more compliant and less likely to challenge authority, they may be assigned to jobs that are more strictly managed by algorithms.[40]

Figure 17: Percentage of workers by gender for whom computer systems influence what they do at work



Source: Authors' own elaboration, based on EWCTS (2021) data.

When it comes to the distribution of workers being influenced by computers by different age groups, no strong patterns can be observed. As can be seen from the data, computers strongly influence work-related tasks for around 45-65% of individuals (see **Figure 18** below). Though, for older employees (50-65 years), this percentage is a bit lower than for younger ones (20-29 years). This is particularly evident in the growing percentage of people for whom such technologies have no impact on what they do at all. A similar situation can be also observed at the EU-27 level (see **Figure 19**). The possible explanation for this is that older employees may be less familiar with or more resistant of technology use, including the AM system.[41]

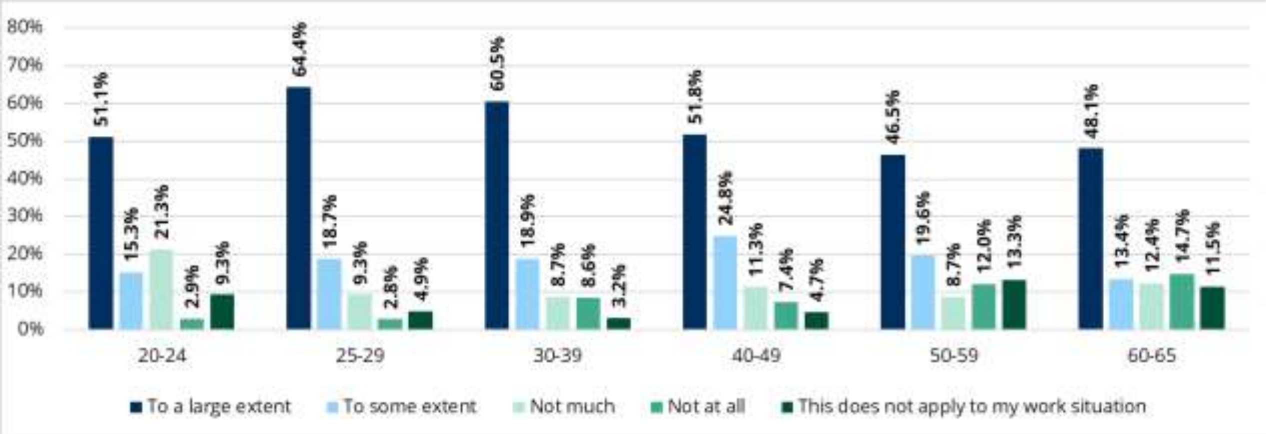
Another interesting insight is that such technologies have a weaker impact on the work of 20-24 years old employees (compared to 25-39 years old workers). This might be because younger people tend to work at entry-level job positions and have limited job responsibilities, therefore may not require the same level of decision-making or independent judgement as their more senior counterparts. Also, younger employees typically have less working experience and may require more hands-on training and supervision, which can be difficult for AM systems to provide. Finally, younger employees may be more likely to leave a job within the first few months or years, potentially making it difficult to justify the investment in algorithmic management systems (e.g., specifically, for AM tools employed in hiring processes).[42]

[40] Gender and Algorithmic Management: A Systematic Literature Review" Authors: D'Ignazio, A., & Klein, L. F. Publication Year: 2021 Source: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems.

[41] Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors predicting the use of technology: Findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). Psychology and Aging, 21(2), 333-352.).

[42] L. Lancaster and D. Stillman, "When Generations Collide: Who They Are. Why They Clash. How to Solve the Generational Puzzle at Work," Collins Business, New York, 2002.

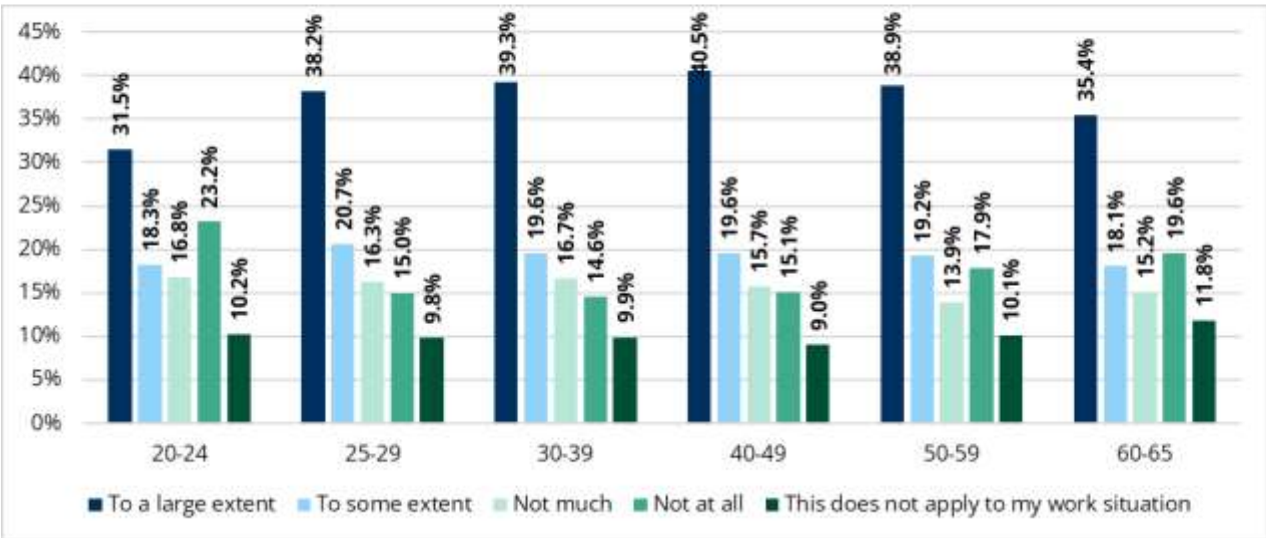
Figure 18: Percentage of Lithuanian workers by age for whom computer systems influence what they do at work



Note: 15-19 and above 65 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data.

Figure 19: Percentage of EU-27 workers by age for whom computer systems influence what they do at work



Note: 15-19 and above 65 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data.

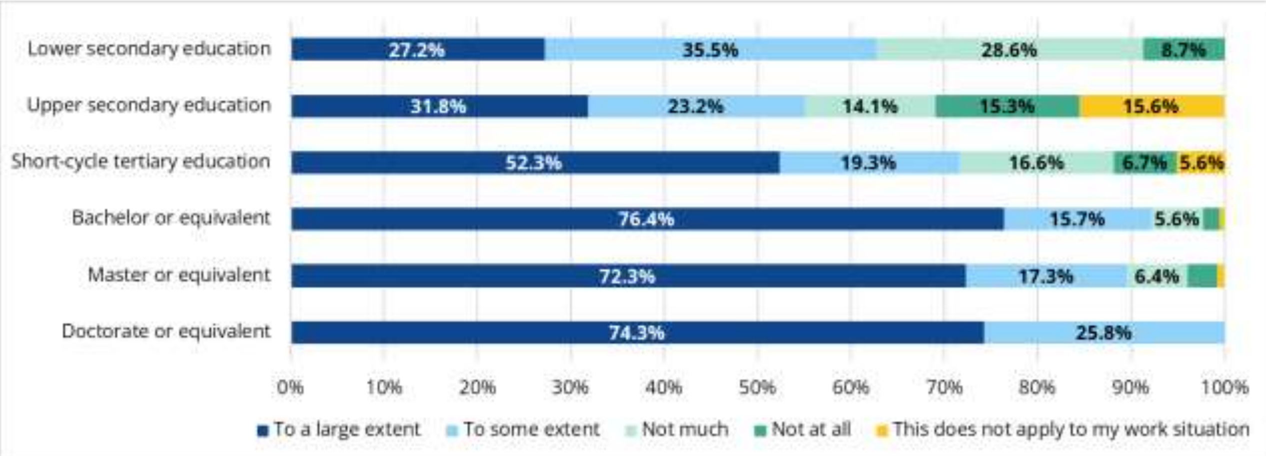
By workers' level of education

According to EWCTS (2021) data, individuals with higher education are more likely to be influenced by AM-based systems in Lithuanian workplaces. For example, for 27.2% of individuals with lower secondary education and 31.8% of those with upper secondary education, computers influence what they do to a large or to some extent respectively. Meanwhile, for individuals with bachelor, master, or doctorate degrees these percentages grow to 76.4%, 72.3% and 74.3% respectively (see **Figure 20**). The similar situation is also observed at the EU-27 level (see **Figure 21**). This implies that in Lithuanian workplaces, AM-based computer systems have a greater influence on people with higher education and what they do at work.

First, people with higher education levels may have more autonomy in their jobs (incl. flexible working hours, independent work scheduling, and teleworking), which can make it more difficult for management to monitor performance using traditional methods. In addition, people with higher education levels may be more familiar with and accepting of technology, including AM systems.

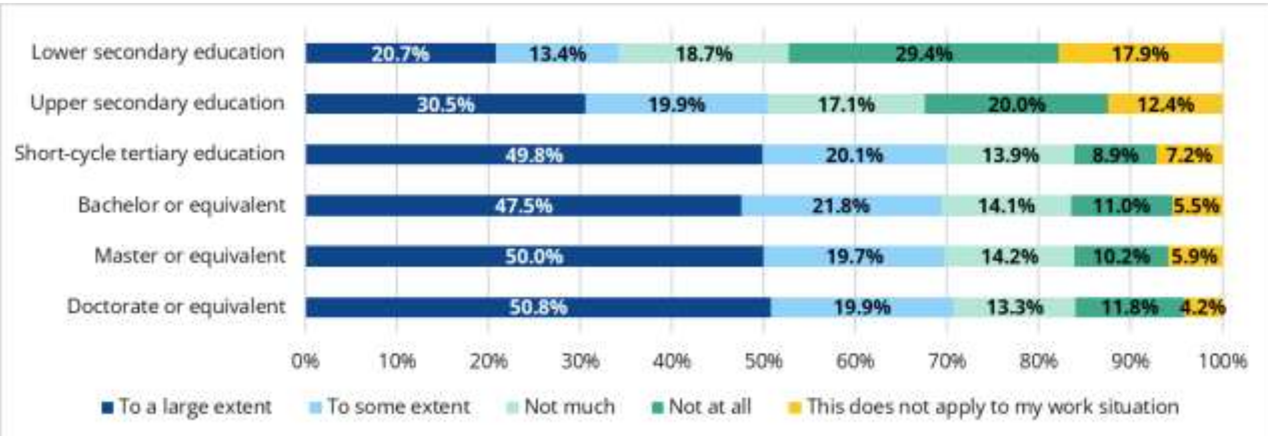
To compare, this situation is similar to the EU-27 average. However, in Lithuania, it is much more pronounced. To illustrate, in EU-27 as the education level goes up, workers are more likely to be susceptible to computer systems influencing what they do at work. However, when an individual reaches a short-cycle tertiary or bachelor's education level, the percentage to which his/her work is influenced by computers does not change and remains stable at around 50% "to a large extent" and around 20% for "to some extent".

Figure 20: Percentage of Lithuanian workers by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.
Source: Author's own elaboration, based on EWCTS (2021) data.

Figure 21: Percentage of EU-27 workers by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.
Source: Author's own elaboration, based on EWCTS (2021) data.

5.1.4. Review of AM-related regulatory context in Lithuania

According to Lithuanian academics, the key challenges related to AM usage lie not in the change of the management practices themselves. Rather, the changes raise new requirements and new challenges that cannot be simply solved due to insufficient public and political support, including the existing gaps in the Lithuanian legislation.[43,44,45]

Currently, in Lithuania, there is no AM-specific regulation. The thematically closest regulation guidelines are outlined in **Lithuanian Artificial Intelligence Strategy**. The strategy presents an analysis of Lithuania's perspective on artificial intelligence systems and outlines the strategic recommendations for government consideration. The presented proposals, which draw the government's attention to the current legal and legislative gaps, represent the patterns of AM usage in Lithuania that have been explored. Specifically, the recommendations are focused on the importance of a clearly established AI-use regulation to ensure transparency and data protection. Moreover, they also highlight the importance of digital skills, research, and the benefits of AI (incl. AM) usage.[46]

Despite the absence of legislation addressing AM specifically, the application of AM tools in Lithuanian workplaces (in both private and public sectors) must comply with the general employment-related and data protection frameworks, including:

- **Labour Code of the Republic of Lithuania:** regulates employment relationships connected with the exercise and protection of employment rights and the fulfilment of employment obligations established in this Code and other regulatory acts. Some articles (relevant to AM) presented in the Code include the requirements for the protection of employment rights, conditions of employment contract, termination of employment contract, and working time.[47]

- **Law of the Provision of Information to The Public of Republic of Lithuania:** establishes the procedure for collecting, producing, publishing, and disseminating public information and the rights, duties and liability of producers and disseminators of public information, their participants, journalists and institutions regulating their activities. This includes the requirements for freedom of information, data collection, rights to privacy, person's rights, honour, and dignity.[48]

- **Resolution on the Implementation of the Law on Cyber Security in the Republic of Lithuania:** regulates the activities of the organisation, management and control of cyber security. Moreover, it discusses the necessary measures to achieve a high general level of network and information security, determining the powers and functions of the competent authorities.[49]

- **General Data Protection Regulation:** GDPR is the main legal instrument applied directly, regulating, and stipulating the general rules for data protection in Lithuania. The rules established under this regulation include requirement for data transparency, law-based data proceed, personal data minimisation, data accuracy, protection, and storage limitation.[50]

[43] Paražinskaitė, G. (2014).

[44] Macijauskienė, I., & Stankevičiūtė, Ž., 2021

[45] Bilevičienė, T., Bilevičiūtė, E., & Paražinskaitė, G. (2015).

[46] Lithuanian Artificial Intelligence Strategy. Available at: https://eimin.lrv.lt/uploads/eimin/documents/files/DI_strategija_ENG(1).pdf

[47] Lietuvos Respublikos darbo kodekso patvirtinimo, įsigaliojimo ir įgyvendinimo įstatymas. Available at:

https://www.e-tar.lt/portal/lt/legalAct/f6d686707e7011e6b969d7ae07280e89/asr

[48] Republic of Lithuania law on the provision of information to the public. Available at:

https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/b90a7c321c7b11ecad9fbbf5f006237b?jfwid=

[49] The Government of the Republic of Lithuania resolution on the implementation of the law of the Republic of Lithuania on cyber security. Available at: https://www.ird.lt/media/force_download/?url=/uploads/structure/docs/41713_5f9f237ff0764f3af0d20bca514ef53d.pdf

[50] Europos Parlamento ir Tarybos Reglamentas (ES) 2016/679 2016 m. balandžio 27 d. dėl fizinių asmenų apsaugos tvarkant asmens duomenis ir dėl laisvo tokių duomenų judėjimo ir kuriuo panaikinama Direktyva 95/46/EB (Bendrasis duomenų apsaugos reglamentas). Available at:

It should be noted that the absence of legislation specifically regulating the application of AM can be partly explained by the fact that there are no court cases on AM in Lithuania, which would form the case law and serve as a basis for AM-related legislation. In addition, the novelty of AM may also have an impact on these legal gaps.

5.1.5. Conclusions

In this case study examined the application of algorithmic management (AM) in Lithuanian workplaces. It relies primarily on quantitative data and provides relevant contextual information and examples of AM usage in Lithuania. The aim is to present an overview of the overall situation of the AM usage in Lithuania, showcase AM implementation examples, and discuss the opportunities and challenges that come with it.

The quantitative data presented in this study, as well as the qualitative insights into the use of AM in Lithuanian workplaces, show that the use of AM is at an early stage. Based on the results of the interviews and the literature review, it seems that the term AM itself is not often used to describe human resource management processes in Lithuania. More commonly, this term is substituted by familiar and established concepts such as digitisation or innovation.

The presented data shows that AM is used by a significant number of companies and organisations in Lithuania. In 2019, 38% of Lithuanian companies used data analytics to monitor employee performance. This is a higher rate than in the overall EU, where 27% out of the surveyed companies use data analytics to this end. Furthermore, in Lithuania, 56% of companies use machines or computers to determine the pace of work; in the EU, this rate is only 47%.

One of the key obstacles mentioned in this study as limiting the progress of AM application is the limited legal framework (i.e., in Lithuania, there is no direct AM-focused legislation). On the one hand, this limitation creates uncertainty for employers on how to implement AM practices in a legally correct way. On the other hand, it creates a risk of potential breach of employees' fundamental rights to privacy and the protection of personal data. This is particularly relevant for those employees who are more frequently exposed to AM (e.g., women, higher-educated people, employees in the private sector or larger companies).

However, despite this limitation, Lithuania still shows higher AM application indicators, when compared to the EU-27 level average data. Nevertheless, the differences of the AM application level among different types of companies (i.e., private/ public, different economic sectors, and sizes) or employees (i.e., gender, education, and age) remain (more or less) similar.

5.1.6. Interviewees

Table 15: List of interviewees

Person		Reason of involvement	Date
1	Anonymised	Representative of Lithuanian Police Department, which applies AM-related technologies	February 23
2	Evaldas Pilipavičius	Head of Management Organising and Planning Division. Police Department under the Ministry of the Interior of the Republic of Lithuania, which applies AM-related technologies	March 7

https://eur-lex.europa.eu/legal-content/LT/TXT/PDF/?uri=CELEX:32016R0679&from=LT

5.2. Germany case study

The case explores the application of algorithmic management (AM) in German workplaces. The case is based on **three main data sources:**

1. **Literature review and desk research**

2. **Interviews with stakeholders** (Table 16: List of interviewees* at the end of the document presents the list of interviewees.

3. **Quantified data from the EU and international surveys** (e.g., ECS-2019, EWCTS, ESENER-3, and DESI).

It is important to highlight that the case study only presents the most important data in Germany. However, more data can be found in **Annex 6 – Quantified data for the country case study.xls**.

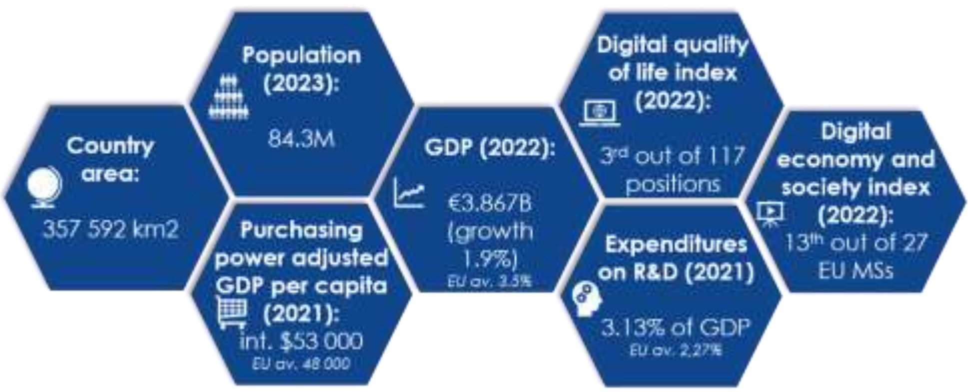
The structure of this case study is as follows. The first section explores the background of the AM application in Germany, presenting the digitalisation context, public discussion, and some specific examples of AM use. The second section presents the quantitative data on AM usage in German workplaces, focusing on the general situation, as well as on AM use in companies of different types, economic sectors, and sizes. The third section discusses the employees' perception of AM use, differentiating the results based on the gender, age, and education of employees. Finally, we will present a comprehensive review of the AM-related regulatory context in Germany.

5.2.1. The context of AM application at the workplace in Germany

The context of the AM application: general digitalisation process, public debates, and the economic background

Based on economic data (see **Figure 22**: General quantified indicators about Germany), Germany shows a comparatively high level of country preparedness to adopt AM tools. It features a strong economy, a high quality-of-life index, significant expenditures on research and development, experienced researchers in digital technologies and both several large companies as well as a vibrant start-up scene.

Figure 22: General quantified indicators about Germany



Source: Authors' own elaboration based on the official data sources.

Nonetheless, the use of AI-based technologies (as proxy evidence for the use of AM) in Germany is currently rather rare. The DESI Eurostat indicator shows that, as of 2021, only 0.6% of German enterprises used AI for human resource (HR) management or recruitment. A significantly larger share, 10.6%, used at least some AI technology within their company. While, in the entire EU, only 7.9% of enterprises used AI in 2021, the percentage of companies using AI specifically for HR and recruitment was almost identical in the EU and Germany (0.7% versus 0.6%). Hence, despite the higher degree of AI application in Germany, companies refrain from using it for AM purposes specifically. Generally, at least in 2021, the deployment of AI for AM was not strongly developed in Germany or the EU.

The hesitance in taking up AI for AM purposes was at the core of a background conversation with a large German IT company. The interviewees pointed to two plausible reasons for the low application rate: concern about ethical backlash / reputational damage; and regulatory risks, not in the least stemming from the incoming AI Act. This is mirrored in the interview with a German start-up offering services in the AM space (for more information, see **Box 1** below).

Box 1: The application of AM tools in a German start-up

The start-up uses AI tools from the field of computer vision to enable clients' work process monitoring in manufacturing and logistics. To this end, videos are recorded and analysed using AI. The purpose is specifically not to monitor individual worker performance, but to streamline and optimize workflows and processes. Furthermore, worker training can be facilitated via video clips.

Three reasons stand out for the use of AI tools:

1. First, AI models present the best and most cost-effective way to analyse visual data and gain granular insights.

2. Second, the companies are motivated by the endeavour to keep high-cost manufacturing jobs in the EU by making them more effective and efficient via AM. The idea is to avoid jobs being outsourced to non-EU countries.

3. Third, rendering workflows, manufacturing, and logistics processes smoother and more efficient is an important desideratum in times of significant shortage of skilled workers, which are in high demand and short supply in Germany.

A key concern for workers and worker councils is fear of surveillance and individual performance monitoring. On the other hand, the use of AI may facilitate feedback and training in the workplace and render the workflow easier to handle and more efficient. If productivity increases, jobs might be saved that otherwise would be cut. For companies, the main advantages lie in productivity increases in stable production processes. Both workers and companies stand to benefit if increased profit is shared with workers (depending on the company policy) and if the use of computer vision enhances the transparency of workplace conditions and of the use of technology itself.

A major challenge for integrating AM in the setting is regulatory compliance and the potential regulatory burden entailed by the upcoming AI Act. Particularly for SMEs, the compliance costs are significant and may, in some cases, be prohibitive, forcing the SME to relocate outside of the EU.

Source: Author’s own elaboration, based on the interview with Deltia GmbH.

A high priority for data protection in German society, influenced by its history of totalitarian and authoritarian regimes in the 20th century, is also reflected in legal scholarship. German contributors have always been particularly active in data protection law, unearthing potential risks in thorough, painstaking detail. This is no different in the realm of AM. A plethora of articles scrutinizes data protection and surveillance,[51] non-discrimination,[52] and related risks[53] concerning the use of algorithms in the workplace. Countervailing voices addressing potential benefits in detail are rare.[54]

The use of AM in Germany

On the other hand, in the interview with another German company (name cannot be provided as the discussion was held on the condition of anonymity) it was noted that, during the past year (2022), AM tools were essential to match a significant number of Ukrainian refugees to open positions in the company. However, the company stressed that, had the AI Act been in place as currently foreseen, the company would not have used the AM tool. The reason for this is that the AM rules proposed in the AI Act, both in the version approved by the Council on December 6, 2022 and in the versions circulated currently in the European Parliament, are considered too cumbersome and vague. Specifically, the regulatory burden is considered so high that, even for a large company, the risk of being fined or caught in the public debate may outweigh the advantages of using AM technology and may, therefore, lead to non-application in the EU.

Furthermore, it was noted that several companies are reconsidering the use of AM tools because of the upcoming AI Act, with the Act being viewed as a severe obstacle to application and deployment. The companies see benefits of AM tools, both for themselves and for workers (e.g., the Ukrainian refugee example), but are reluctant to use AM tools for reputational and compliance reasons. This negative risk assessment also applies to another potential use case that was mentioned: a tool meant to protect workers in high-risk situations that, in order to function, would leverage computer vision tools to determine risk levels in groups of people who represent a potential threat to employees.

To sum up, it is evident that several companies in Germany utilise AM. However, for a more comprehensive understanding of the application of AM by both employers and workers, a quantitative analysis was conducted, which is discussed in the following two sections.

[51] Philipp Hacker, Teaching fairness to artificial intelligence: existing and novel strategies against algorithmic discrimination under EU law (2018) 55 Common Market Law Review 1143, 1170 et seqq.; Christoph Betz, Automatisierte Sprachanalyse zum Profiling von Stellenbewerbern ZD 2019, 148; Clemens Höpfner and Jan Daum, Der "Robo-Boss", Zeitschrift für Arbeitsrecht 2021, 467; Thomas Niklas and Michel Hoffmann, Künstliche Intelligenz (KI) und Algorithmen im Arbeitsverhältnis, ArbRB 2021, 283-286; Friederike Malorny, Datenschutz als Grenze KI-basierter Auswahlentscheidungen im Arbeitsrecht, RdA 2022, 170.

[52] Boris Dzida and Dr. Naemi Groh, Diskriminierung nach dem AGG beim Einsatz von Algorithmen im Bewerbungsverfahren, NJW 2018, 1917; Philipp Hacker, Teaching fairness to artificial intelligence: existing and novel strategies against algorithmic discrimination under EU law (2018) 55 Common Market Law Review 1143; Carmen Freyler, Robot-Recruiting, Künstliche Intelligenz und das Antidiskriminierungsrecht, NZA 2020, 284; Alina Köchling Marius Claus Wehner, Discriminated by an algorithm: a systematic review of discrimination and fairness by algorithmic decision- making in the context of HR recruitment and HR development (2020) Business Research 13, 795; Meike Zehlike et al., 'Matching code and law: achieving algorithmic fairness with optimal transport' (2020) 34 Data Mining and Knowledge Discovery 163; Clemens Höpfner and Jan Daum, Der "Robo-Boss", Zeitschrift für Arbeitsrecht 2021, 467; Friederike Malorny, Auswahlentscheidungen durch künstlich intelligente Systeme, JuS 2022, 289.

[53] Justice Frank and Maurice Heine, Künstliche Intelligenz im Betriebsverfassungsrecht, NZA 2021, 1448; Jasmin Schreyer, Algorithmic work coordination and workers' voice in the COVID-19 pandemic - The case of Foodora/Lieferando (2021) 15 Work organisation, labour & globalisation 69; Vanessa Dorothea Dohrmann, New Work nach der Corona-Pandemie – Implikationen der Pandemie im Hinblick auf Arbeitsort und Arbeitszeit, DB 2022, 664; Gerrit Horstmeier, Ein digitales Upgrade für das Betriebsverfassungsrecht?, BB 2022, 116; Sarah Klachin and Nils, Rauer Praktische Auswirkungen der Digitalisierung im Beschäftigtenverhältnis, BB 2022, 1588; Linda Wichman and Mareike Winkler, Den Einsatz Künstlicher Intelligenz in der öffentlichen Verwaltung partizipativ gestalten: Ein Praxisbeispiel, Arbeitsgemeinschaft für wirtschaftliche Verwaltung e.V. Informationen, 2022 Vol. 68(3), 4.

[54] Philipp Hacker, Teaching fairness to artificial intelligence: existing and novel strategies against algorithmic discrimination under EU law (2018) 55 Common Market Law Review 1143, 1184 et seq.

5.2.2. The use of AM by employers

This section explores how extensively AM is being used in German companies. It is important to note that some of the data refers to digital (AI) tools, rather than strictly to AM-based tools. This is because, on the national level, there is almost no data specific to the application of AM, mainly due to the novelty and complexity of AM. However, the available data on the usage of digital tools presented in this study directly includes AM features, such as employee monitoring, determination of the pace of work, use of robots in the working process, and others.

In addition, the majority of data comes from 2019, before the COVID-19 pandemic, which had a strong effect on the usage of some AM technologies, such as those that monitor workers when they telework. Nevertheless, it gives good (preliminary) indications of how prominent AM is in Germany.

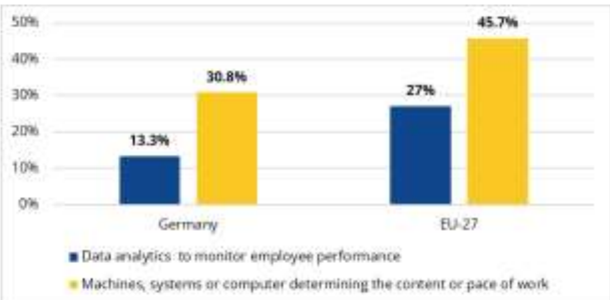
To obtain more relevant estimates of AM usage, survey results from ECS-2019, EWCTS-2021, and ESENER-3 (2019) were extrapolated to determine the number of employers and workers using such tools. This was done by applying relevant weights from each survey. For more information on how the data was weighted, please refer to **Annex 6 – Quantified data for the country case study.xls**.

Overall usage in companies / organisations

In 2019, the ECS-2019 revealed that out of 384,159 surveyed German companies (each with more than 9 employees), 13% used data analytics to monitor employee performance (see **Figure 23** below). This is a strikingly lower rate than in the overall EU, where 27% out of the surveyed 1,976,307 companies use data analytics to this end. This situation of the comparatively sluggish AM application in Germany, as of 2019, is mirrored in the extent to which algorithms dictate the flow of work: the pace of work is determined by machines or computers rather rarely in Germany.

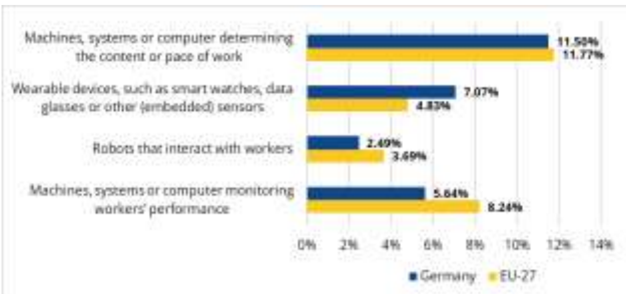
Meanwhile, according to ECS-2019, in 87% of German companies the pace of work is not determined via machines or computers at all. In the entire EU, this is the case for only 73% of companies reported. This difference might be due to the historically high importance of data and employee protection in Germany.

Figure 23: Percentage of companies (with more than 9 employees) using specific AM tools



Source: Authors' own elaboration, based on ECS-2019 data.

Figure 24: Percentage of companies (with 5 or more employees) using specific AM tools



Source: Authors' own elaboration based on ESENER-3 data.

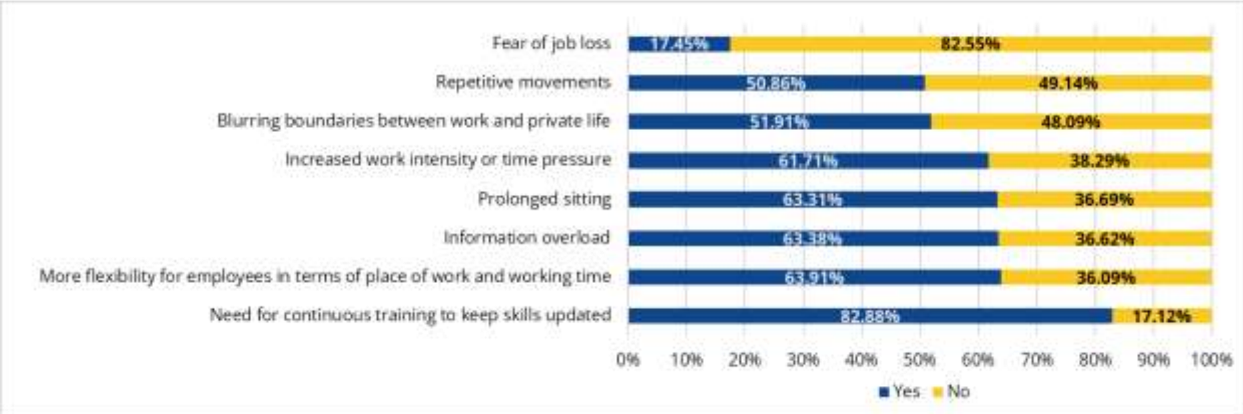
In 2019, a roughly equal number of companies stated that, since 2016, the use of data analytics increased or stayed the same. This holds true both for Germany (20% increased; 21% stayed about the same) and the EU as a whole (26% increased; 24% stayed about the same).

The general dimension of the reluctant use of AM technology by German employers is reinforced in the results of the ESENER-3 survey, which provides information on companies that have 5 or more employees (see **Figure 24** above). Out of a total of 1,206,313 companies surveyed in 2019, 2% used robots interacting with workers (EU rate: 4%); and 7% used wearables or other sensors (EU rate: 5%). In slight contrast to the ECS-2019 results, 12% of German companies harnessed machines, systems or computers determining the pace or content of work; and only 6% reported using machines, systems and computers monitoring worker performance.[55] The EU rates are very similar, with 12% and 8%, respectively.

One specific aim of the inclusive use of technologies would be the discussion of new technologies' (including AM) deployment with workers. However, according to the ESENER-3 survey, only 22% of the companies discussed the possible impacts of the use of AM technologies on employees' health and safety (see **Figure 25** below). This, again, matches the EU rate of 23% (see **Figure 26** below). Those who did discuss AM with their employees broached various topics (as shown in **Figures 25-26** below). Concerns over job displacement, repetitive movements, and the blurring of boundaries between private and professional life are not discussed as frequently as other matters. It bears noting that a significant number of respondents chose not to answer the questions (approximately 95,000 companies, or ca. 79%). Hence, these findings must be viewed as preliminary insights only.

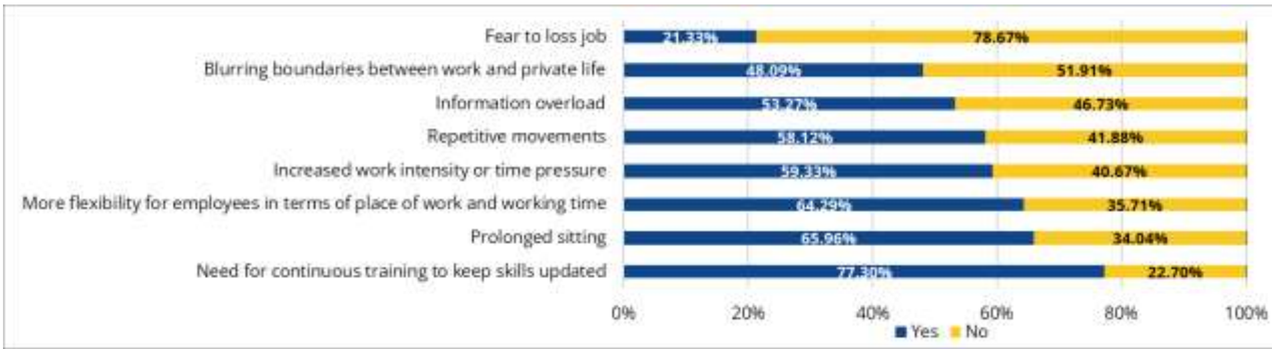
[55] The reason for the difference in responses to certain questions between ESENER-3 and ECS-2019 surveys may be due to several factors, such as the inclusion of companies of varying sizes and sectors in each survey, and differences in how the questions were worded.

Figure 25: Percentage of enterprises in Germany discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered
Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 26: Percentage of enterprises in EU-27 discussing different possible impact of new technologies



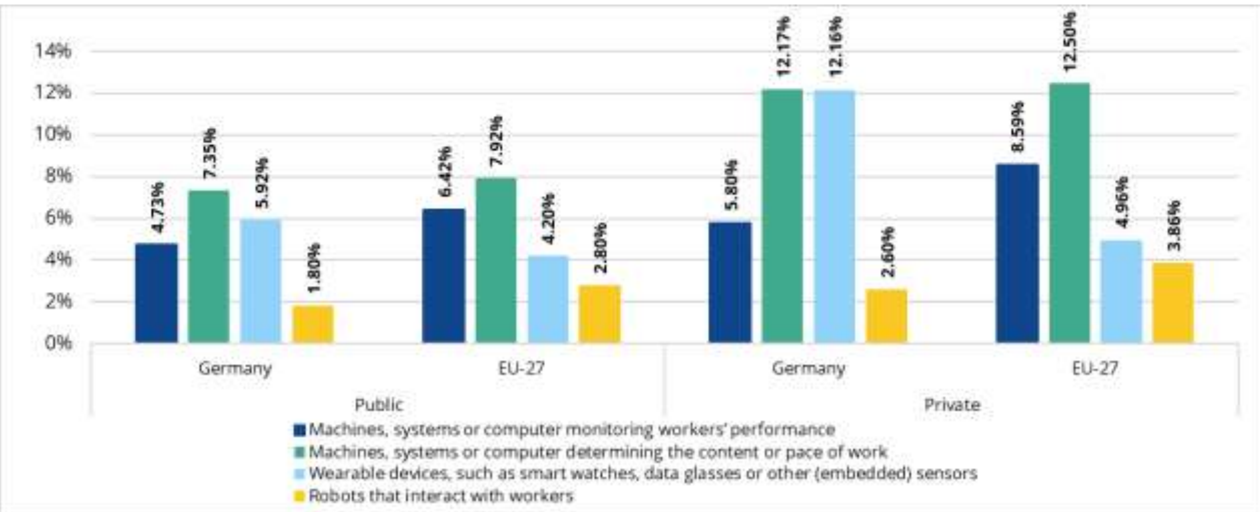
Note: Only companies with over 4 employers are covered
Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by public / private sector

There are notable disparities in the application of technologies related to AM across public and private sector organizations. According to **Figure 27**, private companies in Germany and the EU tend to utilize AM more extensively than their public counterparts. Overall, the breakdown shows that German companies are generally more reluctant than their European counterparts to use AM-based technologies, except for wearable devices and other sensors (both in the public and in the private sector). Technologies determining the pace of work are used at an almost equal rate by German and EU organizations, both in the public (7.35% in Germany versus 7.92% in the EU) and in the private sector (12.17% versus 12.50% in the EU).

These findings suggest that the application of AM-related technologies is not uniform, but German companies tend to be more hesitant compared to the EU average. Private enterprises use AM-based technologies more often than public companies across all domains in Germany, while German enterprises sometimes focus on different technologies than those emphasised in the EU-27 (see **Figure 27**). This variation can be partly explained by the greater focus on industry (such as electricity, gas, and steam) and education by public companies, while a significant number of private companies are found in the service sector. The economic sector dimension is further explored below.

Figure 27: Percentage of public and private enterprises using different technologies associated with AM

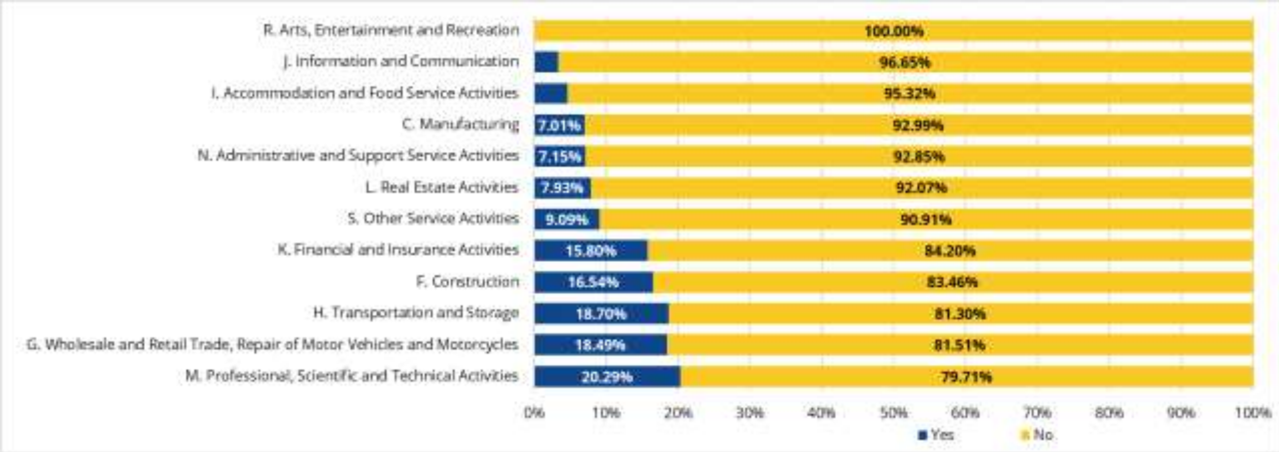


Note: Only companies with over 4 employers are covered
Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by economic sector

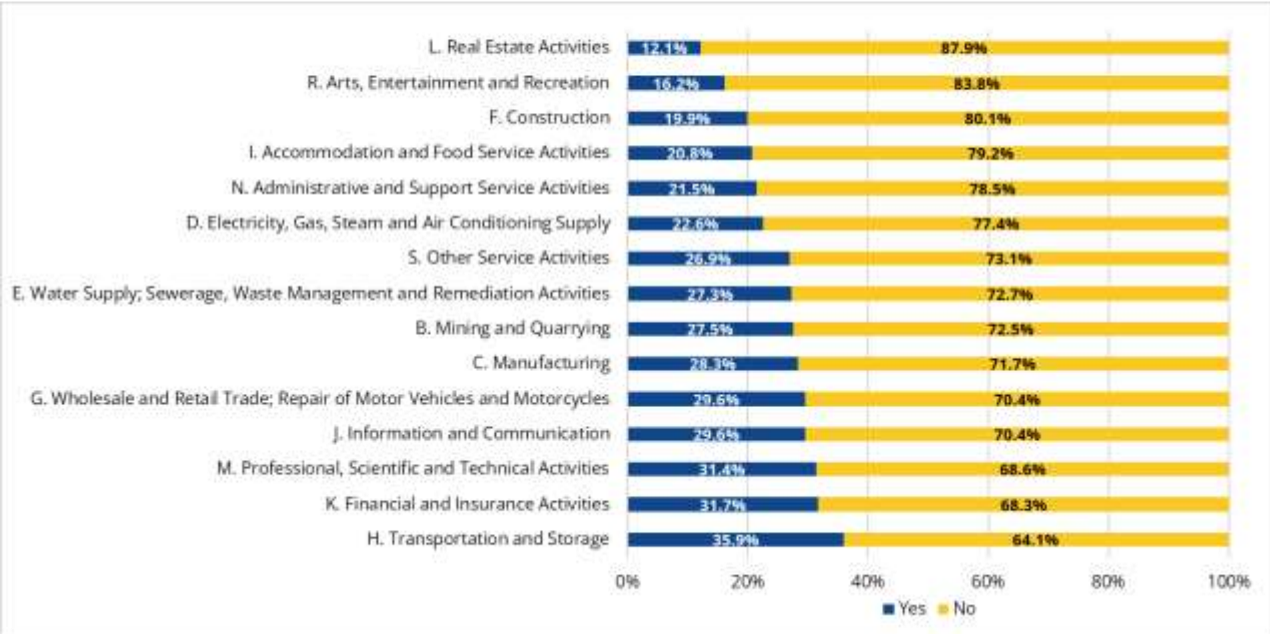
There is also quite a lot of variation in AM usage across economic sectors. According to ECS-2019, in five sectors, more than 15% of German companies use data to monitor employee's performance: professional, scientific, and technical activities; transportation and storage; wholesale and retail trade, repair of motor vehicles and motorcycles; construction; and financial and insurance activities (in descending order, see **Figure 28** below for details). Simultaneously, among those sectors that did report data, arts, entertainment and recreation; information and communication; and accommodation and food services stand out since fewer than 5% of companies use digital performance monitoring tools. Finally, it is difficult to gather clear patterns in terms of the usage of AM in different economic sector groups. For example, companies in the manufacturing sector harness technologies to monitor worker performance to a medium extent, while companies in the construction sector make use of this technology more than twice as often. Meanwhile, when compared to the EU-27 level data, quite a similar distribution of sectors (based on their habits to use data analytics) can be observed. At the EU-27 level, as well as in Germany, economic sectors that utilise data analytics to monitor employee performance the most are as follows: transportation and storage; financial and insurance activities; professional, scientific and technical activities (see **Figure 29** below).

Figure 28: Percentage of companies in Germany, by sector, using data analytics to monitor employee's performance



Note: Only companies with over 9 employers are covered. *Source:* Authors' own elaboration, based on ECS-2019 data.

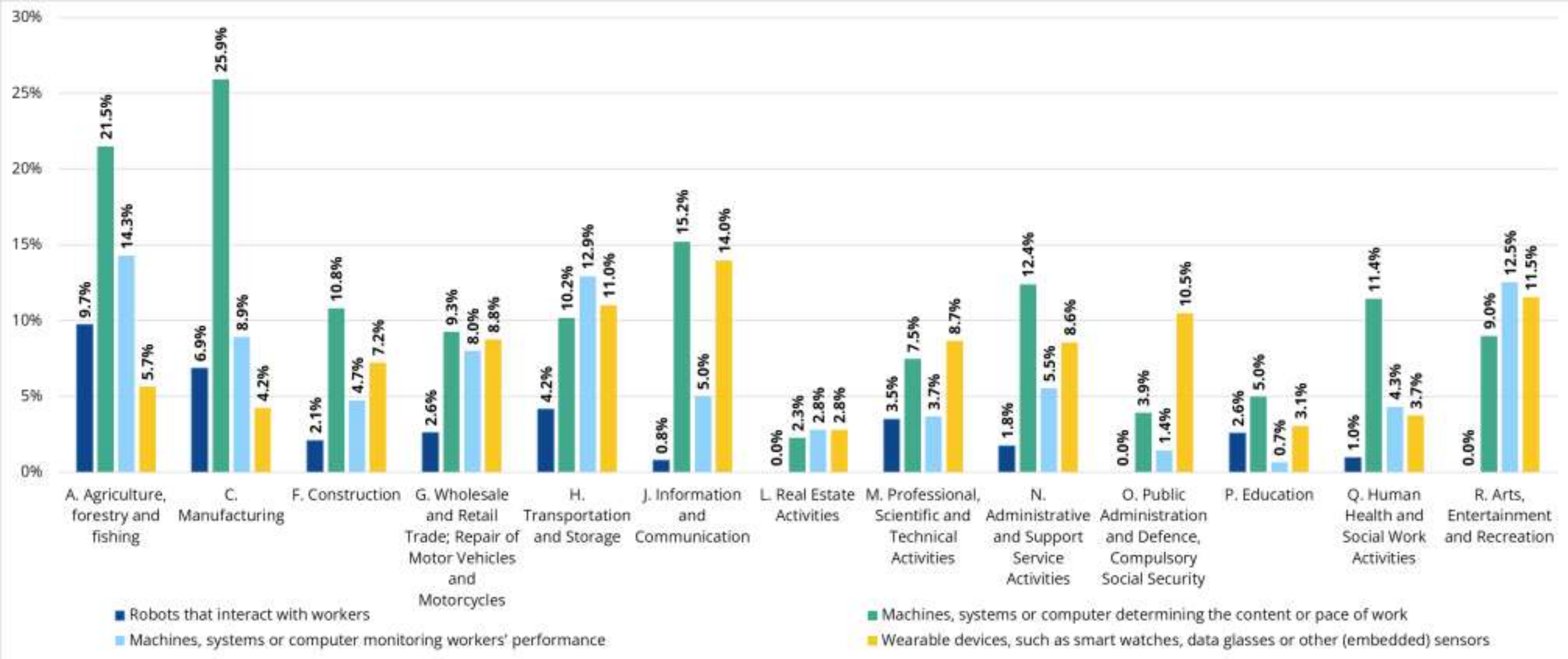
Figure 29: Percentage of companies in EU-27, by sector, using data analytics to monitor employee's performance



Source: own elaboration, based on ECS-2019 data. Note: Only companies with over 9 employers are covered

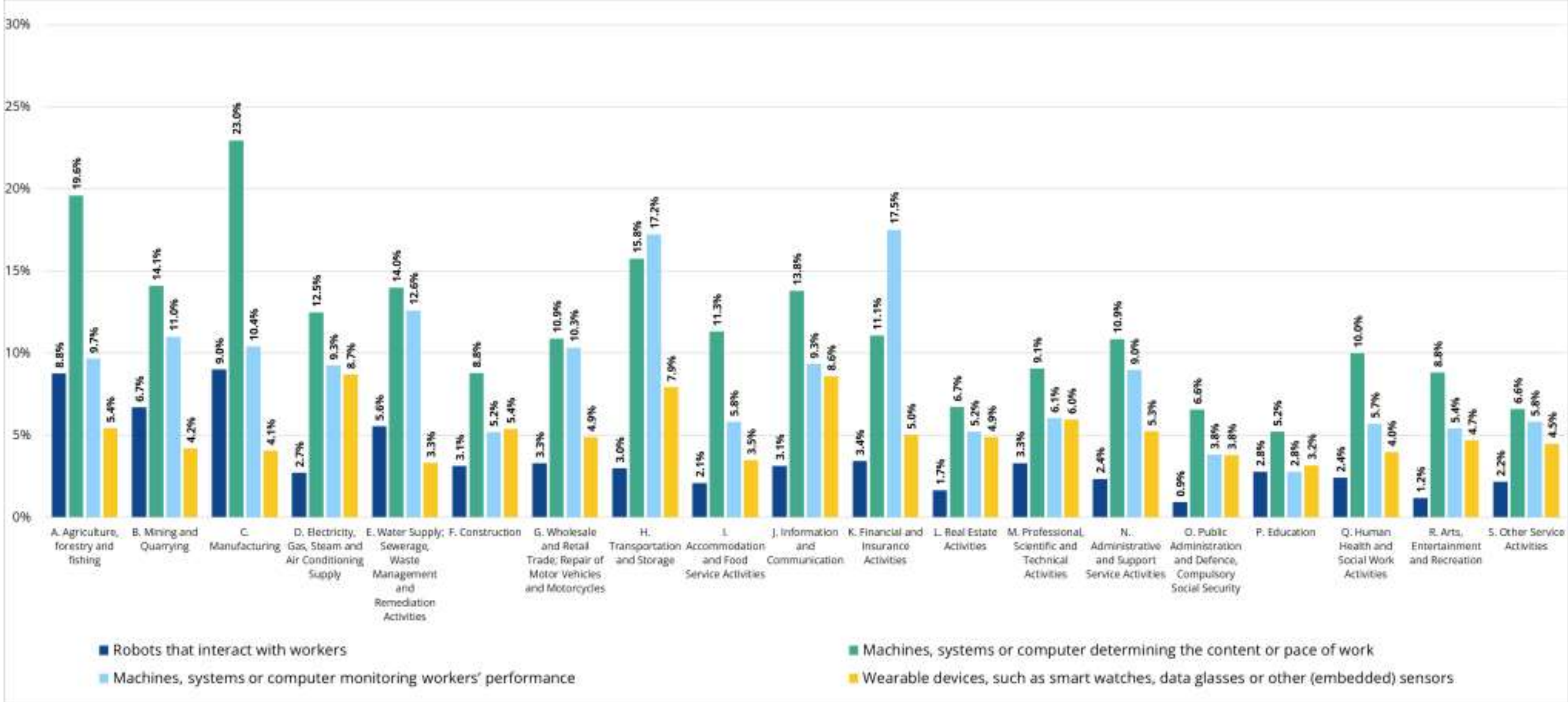
There is also a significant difference in the usage of various technologies across economic sectors (see **Figure 30**). For instance, sectors related to agriculture, forestry and fishing as well as manufacturing have the highest frequency of using robots that interact with workers (as well as at the EU-27 level – see **Figure 31**). Machines, systems, or computers that determine the content or pace of work are most commonly used in these fields as well (21.5% and 25.9%, respectively), followed by information and communication (15.2%). In all sectors, technologies that monitor worker performance are used, but with considerable frequency variance. While, again, agriculture, forestry and fishing have the highest rate (14.3%), education lies at the other end of the spectrum with a mere 0.7%. Finally, wearables and similar sensor technologies are mostly deployed in the information and communication sector, with a usage rate of 14.0%. These findings indicate that AM is a multifaceted sociotechnical arrangement and that organisations in Germany primarily focus on specific types of technologies

Figure 30: Percentage of companies in Germany that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered. *Source:* Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 31: Percentage of companies in EU-27 that use different technologies associated with AM by economic sector

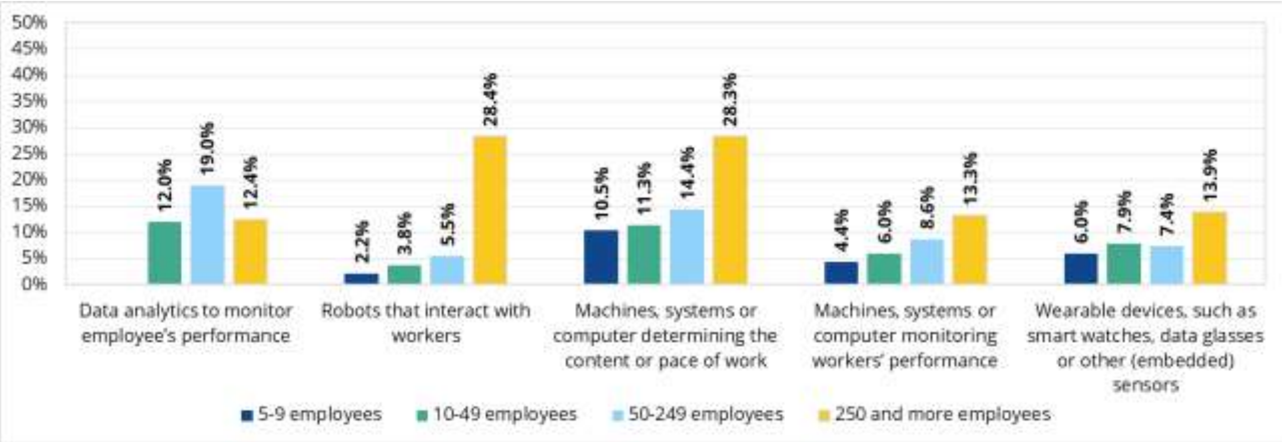


Note: Only companies with over 4 employers are covered. *Source:* Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by company size

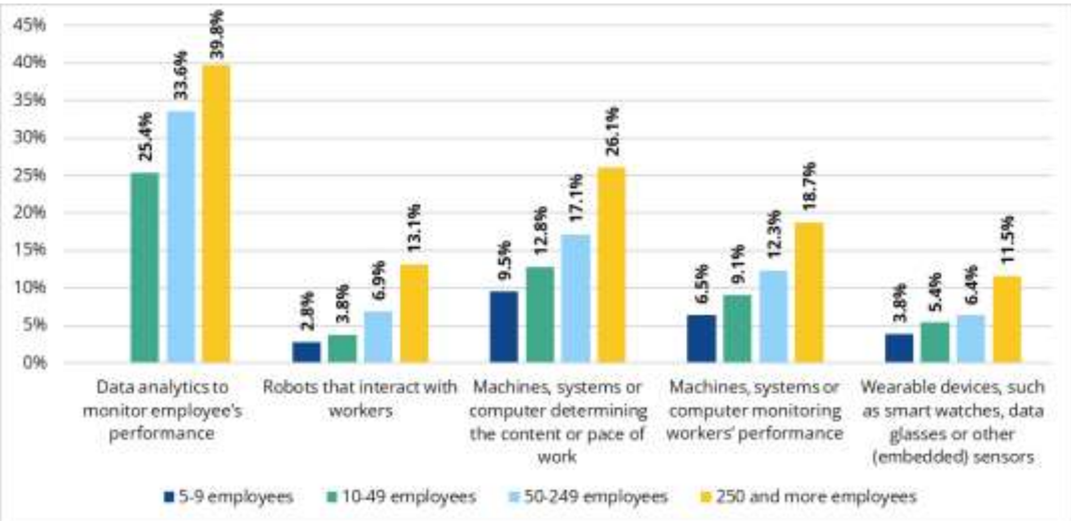
In terms of enterprise size, **Figure 32** below shows that larger companies utilise AM technologies more frequently than smaller ones. This holds true for the majority of the technologies analysed. The only exception to this general rule is individual performance monitoring with the help of data analytics, which is most often employed by companies with 50 to 249 employees. This situation can be attributed to the high fixed cost of introducing new technologies, which can typically be easier absorbed by larger companies. The situation at the EU-27 level is also similar (see **Figure 33** below).

Figure 32: Percentage of companies in Germany that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".
Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

Figure 33: Percentage of companies in EU-27 that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".
Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

5.2.3. Employees' experience with AM

Overall experience by workers

According to data from EWCTS-2021, which covers companies of all sizes, computer systems affect the work of 20% of employees in Germany to at least some extent among those workers whose situation could theoretically be affected by AM (approximately 8.200.000 individuals), compared to 30% in the EU-27. However, this stands as proxy evidence of the AM application, as it may not only refer to the automatic allocation of working hours or the planning of tasks and resources (which is AM-based functionality) but also simple digitalisation solutions which automate working processes.

In addition, given that 51% of survey participants did not respond, these numbers only offer a vague indication. The reasons for not including these non-answers in the calculation of the percentage are discussed in the footnotes.[56]

In contrast, ESENER-3 focuses on companies with more than 5 employees and reports that only 6% of workers (2.3 million) interact with robots at work, while 18% (6.7 million) have their content or pace of work determined by machines, systems, or computers, and 9% (3.3 million) are monitored by such technologies. Additionally, around 9% (3.5 million) are required to wear wearable devices or similar technology. For the EU-27, these percentages are 7%, 17%, 12%, and 7%, respectively.

These findings demonstrate that the popularity of the different technologies varies widely depending on the type of technology analysed. According to EWCTS-2021, 20% of employees report being affected by computer systems at work, which ties in with 18% of employees having their content or pace of work algorithmically determined according to ESENER-3. However, the amount of individual monitoring is much smaller with only 9%. This reinforces the previous findings that worker monitoring and surveillance technologies are relatively rare in Germany, possibly due to its history involving totalitarian and authoritarian regimes in the 20th century and the high value accorded to data protection.

Usage by gender and age group

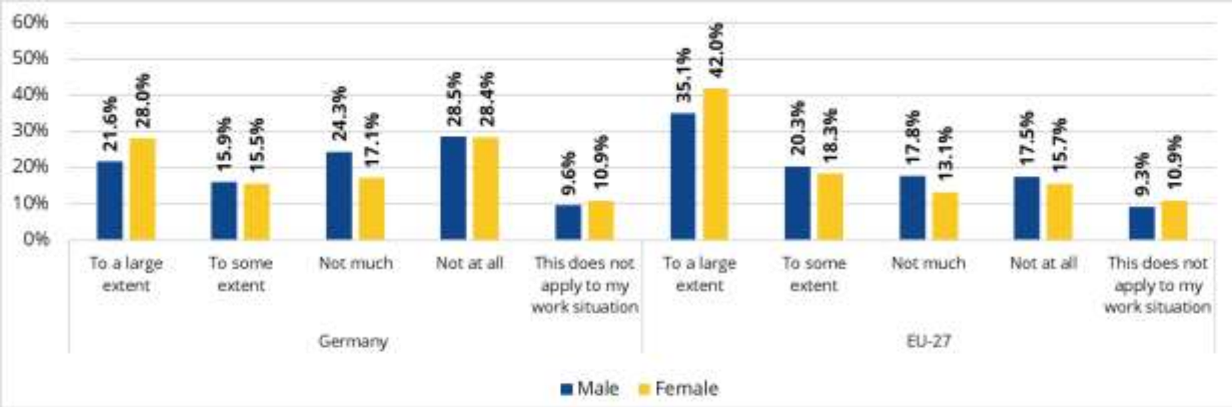
The available quantitative data on usage of AM-based technology by gender and age group is limited, with only EWCS-2021 providing such information. Nonetheless, some insights can be gleaned from this data. Male and female workers in Germany and the EU-27 report similar experiences with computer systems influencing their work (as shown in **Figure 34** below). The only notable difference is that females report a higher frequency of such influence to a large extent, while males state more frequently that it does not affect them much. This discrepancy might be explained by the fact that males are more often employed in industry-related sectors, while females are more commonly employed in service-related occupations.

As mentioned before, however, a significant caveat for this study is that both in Germany and in the EU, more than 50% of survey participants refused to give a qualified answer (Germany: 11.332.718 out of 22.032.433 persons surveyed; EU: 53.664.523 out of 106.486.774 persons surveyed). Hence,

[56] The reason for not including these non-answers in the calculation of the percentage is related to the fact that a high number of such responses as "Don't know" and refusals distorts the broad picture and does not allow us to assess for how many people computer systems influence what they do at work. In addition, it also would not allow us to compare Germany's data with the EU-27 average as the higher response rate at the EU-27 level also implies a higher number of "Don't know" responses or refusals. Considering these arguments, the inclusion of this type of answer does not have an added value here.

the numbers only offer a vague approximation. Excluding these persons, the following distribution arises (**Figure 34** below):

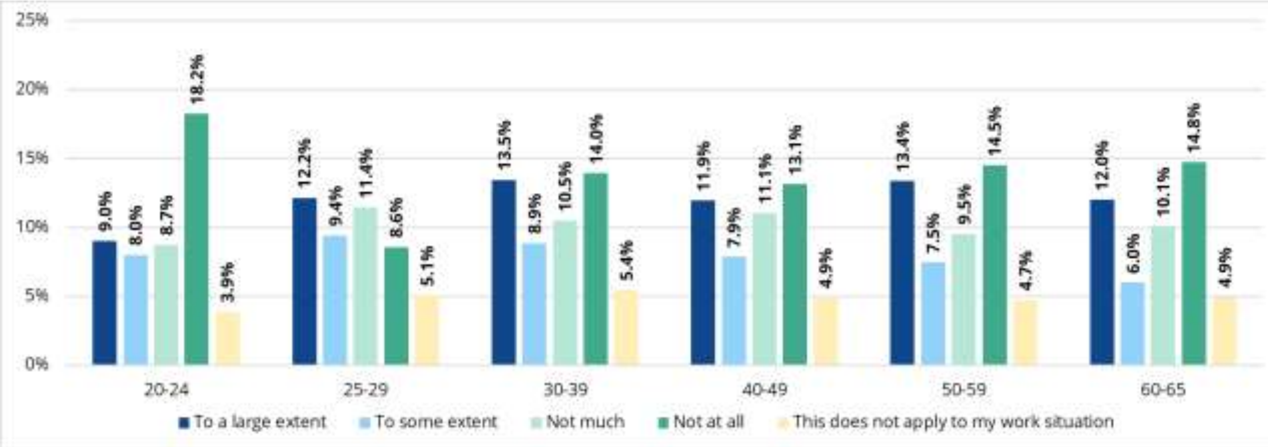
Figure 34: Percentage of workers by gender for whom computer systems influence what they do at work



Source: Authors' own elaboration based on EWCS-2021 data.

There is no clear age-related pattern concerning influence of computers on workers. **Figure 35** below shows that computers influence the work of approximately 25-32% of individuals, regardless of age. However, older workers are slightly less affected compared to younger ones. Specifically, there is a growing percentage of individuals in the older generation for whom these technologies do not influence their work at all. The similar situation can be also observed in the EU-27 level (see **Figure 36**).

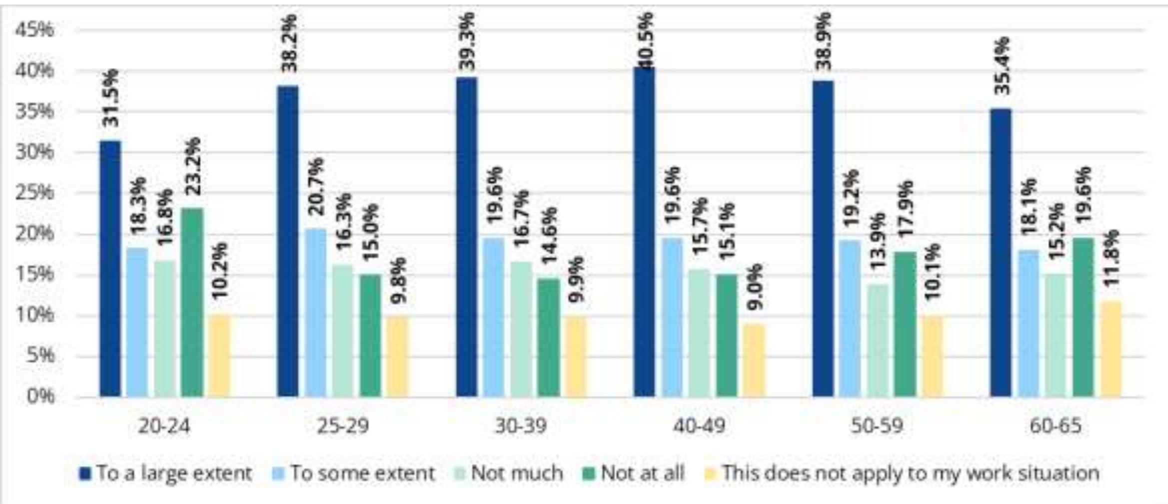
Figure 35: Percentage of German workers by age for whom computer systems influence what they do at work



Note: 15-19 and above 65 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data.

Figure 36: Percentage of EU-27 workers by age for whom computer systems influence what they do at work



Note: 15-19 and above 65 age individuals were removed from the visual due to small sample size.

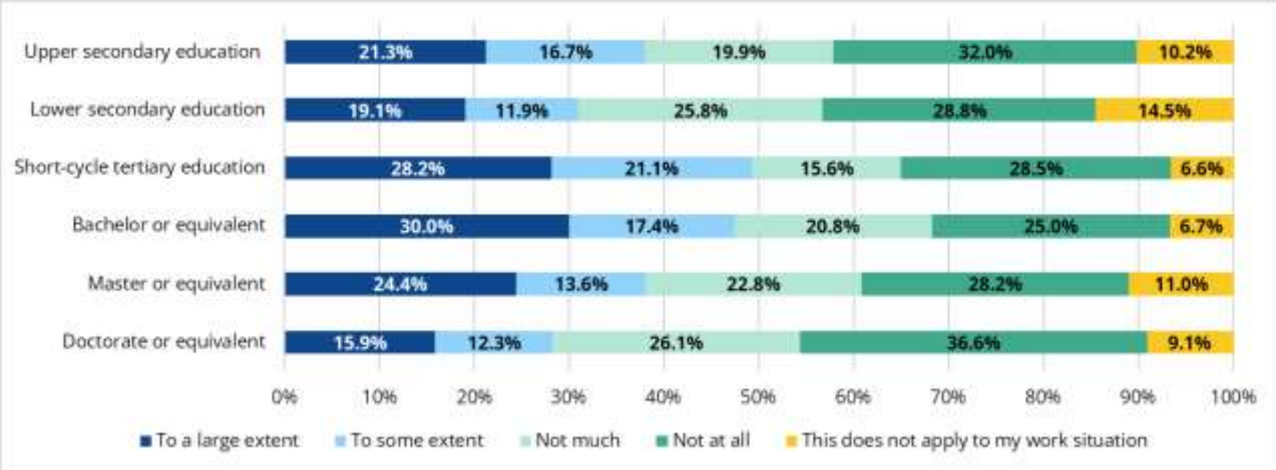
Source: Author's own elaboration, based on EWCTS (2021) data.

Usage by level of education

The influence of AM on work can also be broken down by education levels. In the EU-27, on average, the situation is clear: the more advanced the education of the worker, the larger the algorithmic influence, up to the bachelor level. From then on, further educational attainments such as a master or a doctorate do not make any significant difference anymore, with percentage rates levelling off (see **Figure 38** below).

German workers follow this situation up to the bachelor level, despite the lower absolute level (see **Figure 37** below). However, their susceptibility to algorithmic influence declines from the bachelor (large influence: 30%) to the master (24%) and the doctorate level (16%). It may be speculated whether this downward trend in higher education jobs derives from a higher affinity to data protection concerns in more educated persons in Germany. Further empirical studies would be necessary to corroborate this hypothesis.

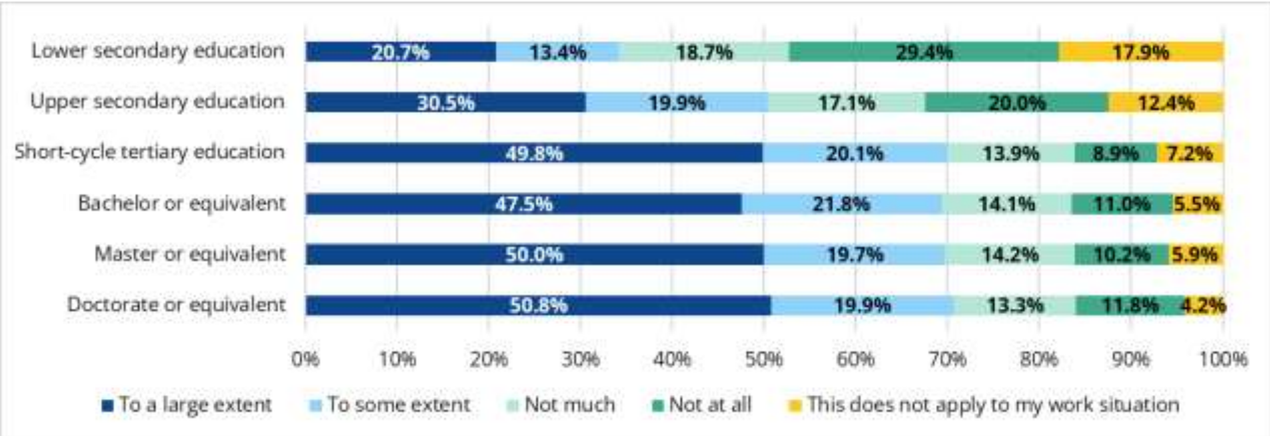
Figure 37: Percentage of German workers by education level for whom computer systems influence what they do at work



Source: own elaboration, based on EWCS-2021 data.

Note: Individuals with early childhood education and primary education were excluded due to lack of data.

Figure 38: Percentage of EU-27 workers by education level for whom computer systems influence what they do at work



Source: own elaboration, based on EWCS-2021 data.

Note: Individuals with early childhood education and primary education were excluded due to lack of data.

5.2.4. Review of AM-related regulatory context in Germany

Although there is no specific legislation regarding AM in Germany, the use of AM tools in public and private workplaces must comply with the general provisions of employment and data protection law, both on the EU and the national level.

EU level

Concerning the EU law framework, the main determinants for AM technologies are contained in the General Data Protection Regulation (GDPR). Meanwhile, the Artificial Intelligence (AI) Act also casts its long shadows on the AM application, and hence companies are starting to factor possible repercussions and constraints into their strategies.

General Data Protection Regulation (GDPR): an overview of GDPR provisions concerning AM transcends the scope of this report. However, there is a significant amount of noteworthy case law from German courts dealing with the GDPR in the AM context. Three law cases stand out:

1. **Law case: Regional Administrative Court of Wiesbaden (January 17, 2022, Case 6 K 1164/21. WI)** - according to the Regional Administrative Court of Wiesbaden, GPS tracking of vehicles in the logistics sector is generally not permitted unless it is done in real-time only and with proper data protection measures in place, including a data protection impact assessment. Live tracking of logistics vehicles is considered a more privacy-friendly approach than storing GPS location data and is therefore required by data protection laws. Companies using GPS systems in their vehicles must conduct a data protection impact assessment to ensure compliance with data protection regulations. Employees may potentially seek compensation for non-material damages under the GDPR.

2. **Law case: Request for Prelim. Ruling of CJEU by the Federal Labour Court (September 22, 2022, Case 8 AZR 209/21)** - the German Federal Labour Court (Bundesarbeitsgericht, BAG) has initiated a preliminary ruling procedure (Case No. 8 AZR 209/21) by referring a question to the Court of Justice of the European Union (CJEU) under Article 267 TFEU. The dispute concerns the interplay of the GDPR with the processing of employee data based on collective agreements. Specifically, the BAG seeks clarification on whether a national legal provision, such as Section 26(4) of the BDSG (Bundesdatenschutzgesetz, Federal Data Protection Act), which allows the processing of personal data of employees for employment purposes based on collective agreements under Article 88(2) of the GDPR, is subject to other provisions of the GDPR, such as Art. 5, Art. 6(1), and Art. 9(1) and (2) of the GDPR.

3. **Law case: Regional Administrative Court of Hannover (Case 10 A 6199/20, February 8, 2023 (appeal pending))** - the Regional Administrative Court of Hannover has declared an order from the State Commissioner for Data Protection (LfD) of Lower Saxony, which instructed Amazon to cease the "uninterrupted, up-to-date and minute-by-minute collection and use of certain employee data", to be unlawful in its decision of 8 February 2023. The LfD argued that Amazon's requirement for all employees at the Winsen (Luhe) logistics centre to use hand-held scanners to record the speed at which they work violated the employees' right to informational self-determination. The Administrative Court declared the order to be unlawful, stating that it did not agree with the LfD's assessment of data protection law. Rather, the court argued, the order was indeterminate, as it was unclear what Amazon was specifically required to do or not to do. The court allowed the appeal against this judgement.

Artificial Intelligence (AI) Act is the main EU law instrument regulating the future use of AM. While the exact content is currently still under discussion, the recent proposals have more concretely dealt with notification duties, such as the following amendment considered in the EP: “Prior to putting into service or use a high-risk AI system at the workplace, users shall consult workers representatives, inform the affected employees that they will be subject to the system and obtain their consent.” The main legal challenge for such rules is the legal basis for any rules concerning employment. The AI Act is supposed to be based on Article 114 TFEU. Article 114(2) TFEU, however, explicitly excludes provisions concerning worker rights. Hence, Article 114 cannot be the legal basis for any rules concerning employment in the AI Act. This leaves the EU legislature with Article 153(1)(b) TFEU, which is also the legal basis for the Platform Work Directive. However, this Article cannot be invoked in the case of the AI Act because it only allows for the establishment of directives (Article 153(2)(b) TFEU). Hence, all AI Act rules concerning employment, including Annex III N. 4, will face a significant legal threat as they may be declared null and void by the CJEU.

National level

Concerning the national law framework, the main determinants for AM technologies are contained in the Civil Code, Employee Data Protection Law, and Co-determination Act, which are further discussed and followed by relevant national-level policy documents.

Civil Code: German Civil Code (BGB) contains ample provisions on employment contract law. Scholars and courts interpret these rules to determine whether algorithmically managed persons enjoy the protections of a formal employment contract or not. Here, too, in recent years has seen multiple rulings offering nuance and guidance in the context of AM technologies. Two law cases stand out:

1. **Law case: Federal Labour Court (December 1, 2020, Case 9 AZR 102/20 (case closed)) -** in a ground-breaking ruling in 2020, the German Federal Labour Court (BAG) held that platform workers, such as food delivery riders or Uber drivers, may and in fact often are classified as employees under the relevant German provision (§ 611a BGB). According to the BAG, when users of an online platform ("crowd workers") perform a significant number of micro jobs through a framework agreement with the platform operator ("crowd sourcer"), this may suggest an employment relationship under the overall assessment required by § 611a(1)(5) BGB. This is especially true if the crowd worker is compelled to perform services personally, the task is simple in nature and its implementation is predetermined, and the "crowd sourcer" exercises external control over the awarding of contract and the specific use of the online platform.

2. **Law case: Regional Labour Court of Hesse, 10th Chamber (Feb. 14, 2019, Case 10 Ta 350/18, ECLI: CLI:DE:LAGHE:2019:0214.10TA350.18.0010 (case closed))** - if there is a disagreement regarding whether a contractor, who was connected through an online platform, should be considered an employee, the standard criteria for classification, especially as per Section 611a(1) of the Civil Code, should be applied. Typically, a short duration of the business relationship and the absence of integration into the client's business operations would speak against the status of an employee (para. 23). This principle can be applied to the case of a bus driver who did not own their own vehicle and only applied for a single bus route with a bus company.

Employee Data Protection Law: concerning employee data protection more specifically, the German government floated early on in its AI Strategy[57] the idea of using the opening clause in Article 88 GDPR to enact a national Employee Data Protection Act. To date, the German Data Protection Act (BDSG) contains provisions in its § 26 for employee data protection. For example, § 26(1)(1) holds that "personal data of employees may be processed for employment-related purposes where necessary for hiring decisions or, after hiring, for carrying out or terminating the employment

[57] Artificial Intelligence Strategy of the German Federal Government, 2020 Update, https://www.ki-strategie-deutschland.de/home.html?file=files/downloads/Fortschreibung_KI-Strategie_engl.pdf&cid=955, 24.

contract or to exercise or satisfy rights and obligations of employees' representation laid down by law or by collective agreements or other agreements between the employer and staff council."[58] Concerning the perennial debate on freedom of consent in employment scenarios, § 26(2)(2) BDSG specifies that consent may, despite the inherent power imbalance between employer and employee, be considered "freely given in particular if it is associated with a legal or economic advantage for the employee, or if the employer and employee are pursuing the same interests."[59] One law case stands out:

1. **Law case: Regional Labour Court of Berlin, 10th chamber (June 4, 2020, Case 29 Ca 5451/19 (appeal pending))** - without the consent of the data subject, the use of a time recording system that utilizes fingerprints for recording working hours is not permissible as it is not necessary under Section 26(1) of the BDSG (Federal Data Protection Act).

Co-Determination Act: in 2021, the German legislator updated the Works Council Act (BetrVG) to include provisions specifically addressing artificial intelligence.[60] Hence, according to the amended § 90(1)(3) BetrVG, the employer has to inform the works council in due time of any plans concerning working procedures and operations, including the use of artificial intelligence. According to § 80(3) BetrVG, insofar as the works council has to assess the introduction or application of artificial intelligence in order to carry out its tasks, it must consult an expert on the topic. Finally, § 95(2a) BetrVG now clarifies that selection guidelines (e.g., for recruitment or dismissal) require the approval of the works council, even if the guidelines are drafted by AI systems. Ex negative, this implies that the works council need not approve job descriptions or requirement profiles generated by AI.[61] Influence of the works council, however, does not end here. Rather, co-determination of AI-related company decisions follows from other provisions of the BetrVG even if AI is not specifically mentioned, e.g., § 87(1) BetrVG. Hence, importantly, the works council must have a say in the introduction and use of technical equipment objectively suitable for monitoring the behaviour or performance of employees – i.e., AM technology (§ 87(1)(6) BetrVG). As Frank and Heine stress, this applies to AI systems that processes personal data of employees, for example, to create individual employee performance predictions, but not to an AI that collects and / or analyses anonymized data (e.g., aggregated at the department level).[62] Two law cases stand out:

1. **Law case: Regional Labour Court of Cologne, May 15, 2020, Case 9 TaBV 32/19 (case closed)[63]**- the works council is entitled to receive various documents under § 99(1) BetrVG for the purpose of obtaining information about personnel recruitment, including electronic documents stored in an application management system. However, a paper-based understanding of "documents" would be too limited given the functionality of such electronic systems. Application management tools provide features for applicant selection that extend beyond merely reviewing stored documents and are critical of the employer's selection decision. Therefore, the works council's right to information would not be adequately addressed if the employer only made printouts of files available without providing documentation of the system's functionalities. The best way to inform the works council is to grant them reading access. Although the wording of § 99(1)(1)

[58] Translation: https://www.gesetze-im-internet.de/englisch_bdsg/englisch_bdsg.html#p0222.

[59] Ibid.

[60] See, e.g., Justus Frank and Maurice Heine, Künstliche Intelligenz im Betriebsverfassungsrecht, NZA 2021, 1448.

[61] Justus Frank and Maurice Heine, Künstliche Intelligenz im Betriebsverfassungsrecht, NZA 2021, 1448, 1449.

[62] Justus Frank and Maurice Heine, Künstliche Intelligenz im Betriebsverfassungsrecht, NZA 2021, 1448, 1452.

[63] See also Olaf Möllenkamp, Commentary, NZA-RR 2021, 80.

BetrVG may seem to preclude comprehensive reading access, the evaluations and comments stored in the application management system are documents that must be submitted to the works council. This is because the information to be provided includes not only essential facts but also subjective assessments that have influenced the employer's selection decision. This applies to comments made by members of the recruiting team, which can affect the selection decision and make it plausible. Furthermore, if predefined skills were used to weight relevant professional, personal, and social aspects for personnel selection, the works council must be informed about how the overall evaluation was reached. The same applies to team chats, which can contain comments relevant to the selection decision, including factual information. Therefore, the personal assessment and evaluation by recruiters, as expressed in scorecards and comments, are essential for the works council to prevent discriminatory selection decisions.

2. **Case Law on Intermediation versus Offering of Services by Platform, Regional Court (January 17, 2019, Case No. 16 O 304/17 (case closed))** - Deliveroo Germany GmbH has been ordered by the Berlin Regional Court to provide information about the allergens and additives contained in its online food and drink orders before they are placed. The court made this decision following a lawsuit filed by the Federation of German Consumer Organizations (vzbv). The company had offered food and drinks from a Vietnamese restaurant on its platform that lacked legally required information about certain ingredients that can cause allergies or intolerances, such as peanuts, shrimp, eggs, and sesame seeds. A cola drink was also offered without proper labelling of the colorant E150d and the acidifier E338. Deliveroo cannot claim that the cooperating restaurants are solely responsible for accurately declaring the food and beverages. The company plays a significant role in the delivery and handling process and therefore operates a food business that is responsible for ensuring compliance with legal regulations on its platform. The company must provide specific information about individual products and cannot simply refer customers to inquire at the restaurants or indicate allergies in their order.

Relevant policy documents at the national level

German AI Strategy (2020). The German AI Strategy, originally dating from 2018 and updated in 2020, mentions the use of AI in work settings as one of the key challenges for regulation, specifically concerning employee data protection, co-determination, and safety requirements.[64] It states that, quite obviously, “the opportunities of using AI must be weighed up against the risks of additional data processing.”[65] Hence, the German AI Strategy calls for a robust regulatory framework which, simultaneously, considers and facilitates the benefits of AM technologies. As noted, the German government, in the strategy, also considered the celebration of a separate Employee Data Protection Act, under Article 88 GDPR.

Report of the independent interdisciplinary council on employee data protection (2022). To determine the need for reform of the German employee data protection framework, an advisory board was created at the German Federal Ministry of Labour and Social Affairs. In January 2022, it

[64] Artificial Intelligence Strategy of the German Federal Government, 2020 Update.

[65] Ibid.

submitted a report on a potential update of German employee data protection law. In its conclusions, the board, inter alia, called for[66]:

- More precise regulatory or legislative guidance for balancing the interests of employers and employees in the field of data protection, particularly concerning covert data processing to detect serious breaches of duty by employees;[67] on freely given consent;[68] and on the use of AI in employment relationships.

- Fostering company-level agreements on specific prohibitions concerning the use of personal data in employment contexts.

- A stronger role of the works councils in matters concerning employee data protection.

- Better law enforcement, by strengthening again the position of works councils, but also of data protection supervisory authorities.[69]

The board, however, remained silent on the creation of a separate German Employee Data Protection Act.

Guidelines for the Use of AI in the Official Practice of Labour and Social Administration (2022). In October 2022, the Network for AI in Labour and Social Administration at the Federal Ministry of Labour and Social Affairs issued self-commitment guidelines for the use of AI in the official practice of labour and social administration.[70] The guidelines focus on human-centred processes, particularly during the initial deployment phase, impact assessments, and risk evaluation.

Opinion by the German Ethics Council (2023). Most recently, on March 20, 2023, the German Ethics Council published a detailed opinion on "Humans and Machines–Challenges of Artificial Intelligence".[71] The opinion considers four use cases in depth: medicine, education, public discourse, and public administration. Even in its discussion of the latter case, though, it does not specifically discuss AM technologies and challenges. In its general recommendations, however, the Council

[66] Report of the independent interdisciplinary council on employee data protection: Theses and Recommendations from the Commission of Experts at the Federal Ministry of Labour and Social Affairs on Moving Forward with Employee Data Protection, 2022, https://www.denkfabrik-bmas.de/fileadmin/Downloads/Publikationen/Report_of_the_independent_interdisciplinary_Employee_Data_Protection_Advisory_Committee.pdf.

[67] The board itself was divided on the legality of such measures, see Report of the independent interdisciplinary council on employee data protection: Theses and Recommendations from the Commission of Experts at the Federal Ministry of Labour and Social Affairs on Moving Forward with Employee Data Protection, 2022, https://www.denkfabrik-bmas.de/fileadmin/Downloads/Publikationen/Report_of_the_independent_interdisciplinary_Employee_Data_Protection_Advisory_Committee.pdf, 7.

[68] Again, the board itself was divided on the factual basis for freely given consent, with the majority holding that, due to the hierarchical relationship between employer and employee, such freedom can only be assumed in exceptional circumstances; see Report of the independent interdisciplinary council on employee data protection: Theses and Recommendations from the Commission of Experts at the Federal Ministry of Labour and Social Affairs on Moving Forward with Employee Data Protection, 2022, https://www.denkfabrik-bmas.de/fileadmin/Downloads/Publikationen/Report_of_the_independent_interdisciplinary_Employee_Data_Protection_Advisory_Committee.pdf, 7.

[69] Report of the independent interdisciplinary council on employee data protection: Theses and Recommendations from the Commission of Experts at the Federal Ministry of Labour and Social Affairs on Moving Forward with Employee Data Protection, 2022, https://www.denkfabrik-bmas.de/fileadmin/Downloads/Publikationen/Report_of_the_independent_interdisciplinary_Employee_Data_Protection_Advisory_Committee.pdf, 9.

[70] Netzwerk KI in der Arbeits- und Sozialverwaltung, Selbstverpflichtende Leitlinien für den KI-Einsatz in der behördlichen Praxis der Arbeits- und Sozialverwaltung, 2022, https://www.bmas.de/SharedDocs/Downloads/DE/Publikationen/a862-01-leitlinien-ki-einsatz-behoerdliche-praxis-arbeits-sozialverwaltung.pdf?__blob=publicationFile&v=2.

[71] Deutscher Ethikrat [German Ethics Council], Mensch und Maschine – Herausforderungen durch Künstliche Intelligenz, 2023, https://www.ethikrat.org/fileadmin/Publikationen/Stellungnahmen/deutsch/stellungnahme-mensch-und-maschine.pdf; English translation soon under: https://www.ethikrat.org/en/publications/.

notes that AI systems should be appropriately supervised to guard against discrimination. It argues for a gradual approach: the greater the depth of the AI intervention and the more indispensable the AI systems, the higher the requirements for minimizing discrimination ought to be.[72] This principle can be applied in AM settings as well. The Council also suggests countering pervasive surveillance of privacy by design principles,[73] which is also of considerable relevance in the AM context.

5.2.5. Conclusions

In this case study, the implementation of algorithmic management (AM) in German workplaces was examined. It relies primarily on quantitative data and provides relevant contextual information and examples of AM usage in Germany. The aim is to present an overview of the overall situation of the AM usage in Germany, showcase AM implementation examples, and discuss the opportunities and challenges that come with it.

According to the data, only 0.6% of German companies use AI for human resource management or recruitment. The use of AI in AM is still low, but the German start-up interviewed here is using it to streamline and optimize workflows and processes. In it, AI tools are used to analyse visual data and gain granular insights; to keep high-cost manufacturing jobs in the EU; and to make workflows, manufacturing, and logistics processes smoother and more efficient.

The presented data shows that AM is used by a significant number of companies and organisations in Germany. In 2019, 13% of German companies used data analytics to monitor employee performance. This is, however, a strikingly lower rate than in the overall EU, where 27% out of the surveyed 1,976,307 companies use data analytics to this end. Furthermore, in Germany, 76% of companies don't use machines or computers to determine the pace of work; in the EU, this rate is only 53%

Overall, German companies are more reluctant than their European counterparts to use AI and technology in AM contexts, except for wearable devices and other sensors. Only 2% of German companies use robots interacting with workers, and 7% use wearables or other sensors. Larger companies use AM technologies more frequently than smaller ones. This holds true for the majority of the technologies analysed. The only exception to this general rule is individual performance monitoring with the help of data analytics, which is most often employed by companies with 50 to 249 employees. Roughly 20% of employees in Germany are affected by computer systems, compared to 30% in the EU-27. Men and women in Germany and the EU-27 report similar experiences with computer systems influencing their work.

Individual employee monitoring is rather rare in Germany (ESENER-3: 9%). This reinforces the findings that companies and organizations are reluctant to use worker monitoring and surveillance technologies in Germany, possibly due to its history involving totalitarian and authoritarian regimes in the 20th century and the high value accorded to data protection in the public sphere.

In general, during the interview stage, companies were reluctant to share information, and to be quoted with their full name, for fear of backlash and reputational harm. A large German company that used AI to match refugees to open positions in the company has discontinued its use of AI. The company said the AI Act as it is currently proposed would be too cumbersome and its requirements

[72] Deutscher Ethikrat [German Ethics Council], Mensch und Maschine – Herausforderungen durch Künstliche Intelligenz, p. 283.

[73] Ibid, p. 48.

too vague. In general, German companies seem to be reluctant to use AM tools because of the upcoming AI Act.

The GDPR is the main legal framework for AM in Europe. However, there is a rich case law in Germany, both on EU and national regulations, concerning AM. Crowd workers may be classified as employees under German law, according to the General Labour Court. The Regional Administrative Court of Wiesbaden ruled in 2022 that the use of GPS tracking devices in the workplace is not permitted unless it is conducted in real-time only and with proper data protection measures in place, including a data protection impact assessment. The Administrative Court of Hannover declared an order from the State Commissioner for Data Protection of Lower Saxony, which instructed Amazon to cease the “uninterrupted, up-to-date and minute-by-minute collection and use of certain employee data”, to be unlawful in its decision of 8 February 2023. Rather, the court argued, the order was indeterminate, as it was unclear what Amazon was specifically required to do or not to do.

The EU is considering regulating the use of AI in the workplace in the AI Act. But it cannot be based on Article 114 TFEU, which excludes rules concerning worker rights. The AI Act’s provisions on employment are, therefore, legally questionable.

The German Works Council Act was updated to include provisions specifically addressing artificial intelligence. Moreover, based on general principles, the works council must be involved in the introduction and use of technical equipment objectively suitable for monitoring the behaviour or performance of employees.

Most recently, the German Ethics Council has recommended that AI systems be appropriately supervised to guard against discrimination. It argues for a gradual approach: the greater the depth of the AI intervention and the more indispensable the AI systems, the higher the requirements for minimizing discrimination ought to be. This principle may also be applied in the AM space.

5.2.6. Interviewees

Table 16: List of interviewees*

Person		Reason of involvement	Date
1	Deltia GmbH	Start-up offering AM services	March 20
2	Uber BV	Uber BV, is a Dutch company which owns the rights in the Uber app	May 8

(*) Numerous other companies, trade unions, and the BMAS (Federal Ministry of Labour and Social Affairs) did not reply to requests for comments and interview.

Source: Authors’ own elaboration.

5.3. The Netherlands case study

The case explores the application of algorithmic management (AM) in Dutch workplaces. The case is mostly based on **three main data sources:**

1. **Literature review and desk research**

2. **Interviews with stakeholders** (Table 17: List of interviewees at the end of the document presents the list of interviewees).

3. **Quantified data from the EU and international surveys** (e.g., ECS-2019, EWCTS, ESENER-3, and DESI).

It is important to highlight that the case study only presents the most important data in Netherlands, while more data can be found in **Annex 6 – Quantified data for the country case study.xls**.

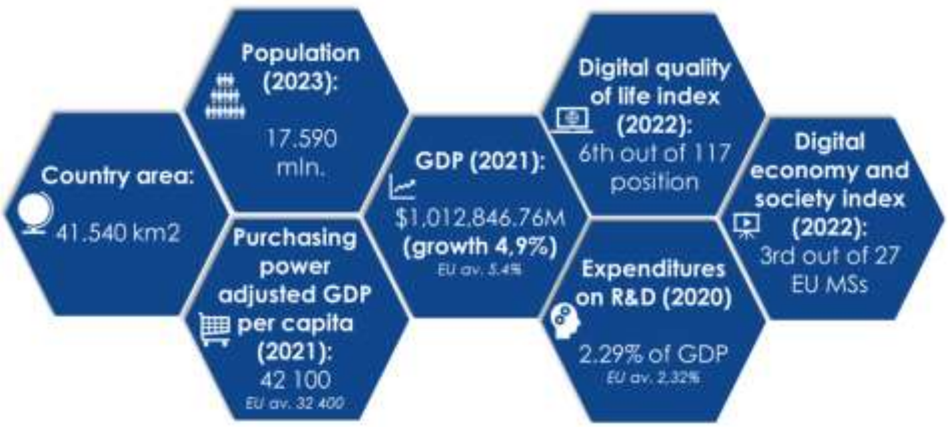
The structure of this case study is as follows. The first section explores the background of the AM application in the Netherlands, presenting the digitalisation context, public discussion, and some specific examples of AM use. The second section presents the quantitative data on AM usage in Dutch workplaces, focusing on the general situation, as well as on AM use in companies of different types, economic sectors, and sizes. The third section discusses the employees' perception of AM use, differentiating the results based on the gender, age, and education of employees. Finally, we will present a comprehensive review of the AM-related regulatory context in the Netherlands.

5.3.1. The context of AM application at the workplace in the Netherlands

The context of the AM application: general digitalisation process, public debates, and the economic background

Based on economic data (see **Figure 39**), the Netherlands shows a high level of country preparedness to adopt AM tools. On a European level, the country ranks high in digitalisation and shows high economic indicators. However, spending on R&D in the Netherlands is a slightly lower than the EU average.

Figure 39: General quantified indicators about the Netherlands



Source: Authors' own elaboration, based on the official data sources.

As for the contextual information on the digitalisation progress in the Netherlands, the DESI indicator shows that 13.1% of Dutch companies use AI-based technologies. Comparatively, on average, 7.9% of companies in the EU do the same. The percentage of Dutch enterprises using AI technologies specifically for human resource management or recruitment is also higher than the EU average: 1.9% (the Netherlands) and 0.7% (EU), respectively. These data show that the progress of digitalisation, at least based on this indicator, is higher than the EU-27 average, which, in turn, may also show the country's preparedness to apply AM-based tools more actively.

Based on desk research and interviews there is a tendency of an increase in the use of AM technology in the Netherlands. Literature suggests that this technology will have far-reaching consequences for the amount and nature of work. As technology becomes more advanced, it is now also possible to automate mental tasks besides physical labour. On the one hand, this may lead to the loss of certain jobs; on the other hand, the automation of tasks can also benefit workers. Some reports already predict that a shortage of people able to work with algorithms in these "new jobs" is expected. It is also expected that employees will collaborate more with smart algorithms, hence the focus lies more on complementarity.[74]

Despite these debates, there are some prominent examples of the AM application in the Netherlands, which are discussed further.

The use of AM in Netherlands

According to an interview with a trade union in the Netherlands, AM technology is increasingly being used in the Dutch call centre and contact centre sector in the past three years. Companies are using AI for several tasks that were previously done by HR or team managers, for example, AI is used to:

- monitor how long employees take to complete a given task,
- monitor sick leave,
- give feedback to employees,
- monitor the quality of work,
- suggest what employees could say at a certain moment during their telephone calls,
- recruit and hire people (this is done semi-automatically),
- send automatic contracts.

Although AM-based monitoring is a relatively new phenomenon in the sector, it already plays a big role within it. For the interviewed trade union, this is an important topic for the upcoming collective bargaining negotiations. Bigger companies in this sector are increasingly making use of 'robo coaches' to give feedback to employees and to automate certain tasks. Collecting data has become more and more finetuned. Robo coaches take over tasks from team managers. Previously team managers would listen along with employees and give them feedback based on what they hear. Now these conversations are recorded, an algorithm scans the results, looks for certain words and gives

[74] Wetenschappelijke Raad voor het Regeringsbeleid, 'Het betere werk. De nieuwe maatschappelijke opdracht' (2020). Available at: https://www.wrr.nl/publicaties/rapporten/2020/01/15/het-betere-werk

feedback to employees. The possibilities are becoming more advanced and therefore the broader application of the technology in the sector is also gradually increasing.

Notably, according to the interviewed trade union, the use of AM tools in the workplace does not lead to job loss on a large scale in this sector yet. On the contrary, Dutch contact centres / call centres are struggling with labour shortages (see **Box 2** below for more details). Therefore, there is a tendency of companies transferring their work to other countries such as Poland and Suriname. It is expected that more and more work will be automated and / or translated to other languages which makes it easier to transfer work to companies outside the Netherlands.

Box 2: The application of AM tools in Dutch call centers and contact centres

The application of robo coaches and other AM tools in Dutch call and contact centres: in the past 3 years, the use of 'robo coaches' and other AM tools has taken a flight among larger enterprises in the Dutch call centre and contact centre sector. This trend was partly set in motion due to labour shortages on the Dutch market.

The users of AI-technology in call and contact centres are mostly employees who are in contact with clients. Whereas team managers used to listen along with employees and provide them with feedback on their conversation techniques, robo coaches are increasingly taking over this role. The AI system scans the use of certain words and certain patterns in the conversation, draws conclusions based on its own analysis and gives feedback to employees.

In general, employees are not directly involved in the design or implementation of such technology. However, it is common for companies in the sector to inform new employees during the hiring procedure about the technology being used. New employees are made aware that their calls are being recorded, and they give explicit consent for this. The employer is obliged to notify the work council when intending to implement such technology and the work council monitors critically whether the technology is only used for the agreed purposes and not misused.

Key drivers for the use of AM tools: for employees in the contact and call centre sector the key drivers for the use of AM tools are, on the one hand, time and cost efficiency, and on the other hand, optimisation of the quality of calls.

Negative and positive effects of the use on workers and employers: the trade union and work council that were interviewed for this study are not against the use of AM tools in the call and contact centre sector, if it is used to support employees in their work, to improve their conversation techniques, and to make and keep the work fun. However, the use of these kinds of systems can also have a negative consequences. Firstly, AI does not always understand certain human interactions. Secondly, in their wish to work as cost and time efficiently as possible, companies might choose to use AI for directing employees, instead of supporting them with these tools. This may lead to higher work pressure and to employees feeling they are losing their autonomy. As employees previously experienced a small break in-between difficult phone conversations by also handling the easier calls, the system now takes over the easy calls and the employees focus most of their time on the difficult conversations only, thus increasing overall efficiency.

Future perspectives / plans on the use of AM tools: based on the interviews, it seems that the use of robo coaches in the call and contact centre sector did not yet lead to big problems between companies and employees. It also did not negatively influence employment yet, as the sector is struggling with labour shortages. At the same time, the usage of AM technology in the sector is new and increasing, and already has made an impact on the work of employees. The interviewed union and work council underline the importance of defining how AI is being used and for what purpose: to help employees or to direct them? Also, the workers' councils have an important role to play in monitoring closely whether AI is being used for the agreed purposes and not being misused. Therefore, the issues of privacy and transparency and the use and misuse of AM at the workplace will be important themes in the upcoming CBA-negotiations for the sector.

Source: Authors' own elaboration, based on the interview with Dutch trade union and the work council of a company making use of robo coaches

Another important AM trend seen in the Netherlands is the increased use of recruitment software to recruit, assess, and select candidates. Such recruitment technology is used in different phases of the recruitment and selection process. For example, CV matching tools that (semi-)automatically select or recommend applicants, assessments, and even video applications with facial recognition software (see **Box 3** below for more details). However, this raises concerns on discrimination, which can occur (unconsciously) using recruitment technology to fill vacancies. Indeed, in some cases algorithms can lead to discrimination. The nature of algorithms further exacerbates this risk, for example, the decision-making process of algorithms is often non-transparent, and algorithms have the potential to systematize bias – and thus discrimination. Algorithms cannot simply unlearn bias and biased algorithms can also be easily used on a large scale, causing discrimination to spread. Finally, algorithms can make many complex connections, which increases the possibilities of differentiating (and therefore also discriminating) people.[75]

Currently, the ethical problems as well as the possibilities of the use of AM in recruitment processes are widely studied in technological companies as well as in the academic world. A recent study on the impact of technological developments (robotisation, digitalisation and automation) on the role of HR professionals and HRM education has been finalised in April this year by the Department of Human Resource Studies at Tilburg University in the Netherlands. This study focuses on the role of HR professionals in three sectors (business services, healthcare, and logistics), and it examines how the HR-position and HRM-education can add strategic value to the collaboration between humans, robots, and digitalisation in work.

A point of concern is that much of the research is happening in the bigger companies, such as Facebook, which focus more on the possibilities of AM and AI in general, and less on fairness and transparency.

Box 3: The application of AM tools in HR and recruitment in Dutch companies

The application of AM tools in HR and recruitment in Dutch companies: based on an interview with a large internationally operating AI recruitment software company, a pioneering step was taken in the development of AI for recruitment in 2016. The company introduced deep learning, which made it possible for algorithms to read CVs (parsing). That is where contemporary AI started to take place, and then more competing developers started to follow.

The tool was developed to support recruiters in their processes. It automates part of the recruitment process: it scans all the received documents and makes a selection. Subsequently, the recruiter can do the interviews and make contact. Nevertheless, this doesn't mean the whole process is automated. The system can be adapted to make the matches relevant.

AM tools for recruitment are used in a broad range of sectors, including temporary employment agencies, recruitment firms, and corporate companies with large HR departments.

[75] College voor de Rechten van de Mens, 'Als computers je CV beoordelen, wie beoordeelt dan de computers?' (2021). Available at: https://publicaties.mensenrechten.nl/file/c082761c-4322-496b-8bca-d0d2a625ae2f.pdf

Another tool beside 'parsing' is 'matching'. Matching is not deep learning-based and therefore more transparent and explanatory.

Key drivers for the use of AM tools: the tool makes recruitment processes more efficient. Recruiters no longer have to read large amounts of documents, as the tool scans all the documents for them. It also helps the larger corporate enterprises to find better candidates. Internal mobility can also be a benefit, as some companies have a large pool of candidates.

Negative and positive effects of the use on workers and employers: a negative effect of AI recruitment software is that (unconscious) discrimination can occur using this technology to fill vacancies. The decision-making process of algorithms is often non-transparent, and algorithms have the potential to systematize bias – and thus discrimination. Algorithms cannot simply unlearn bias and biased algorithms can also easily be used on a large scale, causing discrimination to spread. Finally, algorithms can make many complex connections, which increases the possibilities of differentiation (and, consequently, discrimination) of people. Therefore, one of the biggest challenges of AM technology in recruitment processes is that the user knows how to work with the system, understands how the match was created, can tweak the search with this and filter biases. AI is a powerful tool and thus it is imperative that individuals that use it have a clear understanding of AI's capabilities and limitations.

The positive effect of the use of this technology is that it makes the recruitment processes more efficient for employers. Another positive effect is that, if properly used, AM technology in recruitment processes can also make matching processes more objective for new candidates. Human selection is not always objective either, there can also be biases in these kind of recruitment processes.

Future perspectives / plans on the use of AM tools: based on the interview with an AI recruitment software company, there seems to be more momentum in the AI industry regarding the movement of fairness and transparency. Researchers are aware of and engaged in these issues, as are some responsible tech companies. However, much of the research is happening in big companies such as Facebook, companies that are mostly focusing on the possibilities of AI and less on its dangers.

Source: Authors' own elaboration, based on the interview with an AI recruitment software company

5.3.2. The use of AM by employers

This section explores how extensively AM is being used in Dutch companies. It is important to note that some of the data refers to digital (AI) tools, rather than strictly to AM-based tools. This is because, on the national level, there is almost no data specifically on the application of AM, mainly due to the novelty and complexity of AM. However, the available data on the usage of digital tools, presented in this study, directly includes AM features, such as employee monitoring, determination of the pace of work, use of robots in the working process, and others.

In addition, the majority of data comes from 2019, before the COVID-19 pandemic, which had a strong effect on the usage of some AM technologies, such as those that monitor workers when they telework. Nevertheless, it gives good (preliminary) indications of how prominent AM is in the Netherlands.

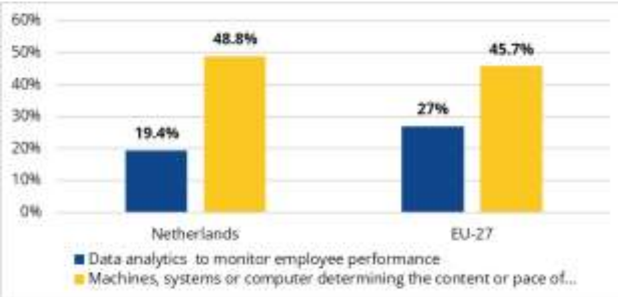
To obtain more relevant estimates of AM usage, survey results from ECS-2019, EWCTS-2021, and ESENER-3 (2019) were extrapolated to determine the number of employers and workers using such tools. This was done by applying relevant weights from each survey. For more information on how the data was weighted, please refer to **Annex 6 – Quantified data for the country case study.xls**.

Overall usage in companies / organisations

Based on ECS-2019, around 19,4 % of companies that have more than 9 employees (i.e., 21,337 companies of such companies) use data analytics to monitor employee performance, which is lower than the EU-27 average (27%). However, the percentage of companies determining the pace of work by machines or computers for at least some workers is a little higher than the EU average according to ECS-2019: around 48.8% of Dutch employers (i.e., 53,219), compared to 45.7% in the EU-27 (see **Figure 40** below).

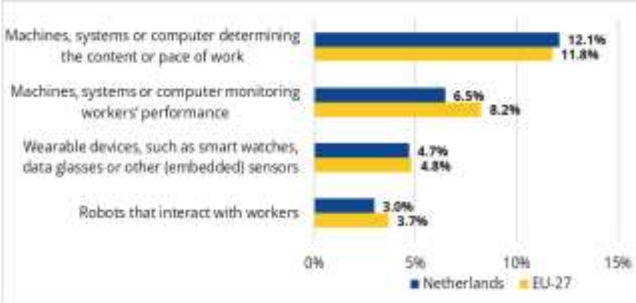
In addition, based on ESENER-3, which provides information on companies that have 5 or more employees (i.e., 170,949 companies of such type), 3% of Dutch employers use robots that interact with workers, 4.7% use wearable devices, 6.5% use technologies that monitor worker performance, and 12,1% use machines, systems, or computers that determine the content and pace of work (see **Figure 41** below). In the EU-27, these percentages are 3.7% (robots), 4.8% (wearables), 8.2% (monitor workers), and 11.8% (pace of work). Hence, overall, the Netherlands is scoring average when comparing the use of technologies associated with AM by companies with more than 5 employees to the EU average. Only the usage of technology to monitor worker performance is (still) a little less widespread among Dutch employers in comparison. The usage of tools determining the pace of work by machines or computers for at least some workers is a little higher.

Figure 40: Percentage of companies (with more than 9 employees) using specific AM tools



Source: Authors' own elaboration based on ECS-2019 data.

Figure 41: Percentage of companies (with 5 or more employees) using specific AM tools



Source: Authors' own elaboration based on ESENER-3 data.

However, based on desk research and interviews, the use of monitoring software is increasing in the Netherlands. The pandemic has accelerated the supply on software to monitor workers. As many worked from home, many employers seemed to opt for monitoring as they had little faith in the work ethic of their employees (Zoomer & Otten, 2021).[76] According to software comparing website Capterra, the demand from Dutch companies for monitoring software for employees has risen sharply since the pandemic. The demand rose by 58 percent compared to the same period (pre-pandemic) the year before (NOS, 2021)[77][78].

[76] ibid.

[77] NOS. 'Gluurapparatuur' in trek door thuiswerken, vakbonden bezorgd' (2021). Available at: https://nos.nl/artikel/2375956-gluurapparatuur-in-trek-door-thuiswerken-vakbonden-bezorgd

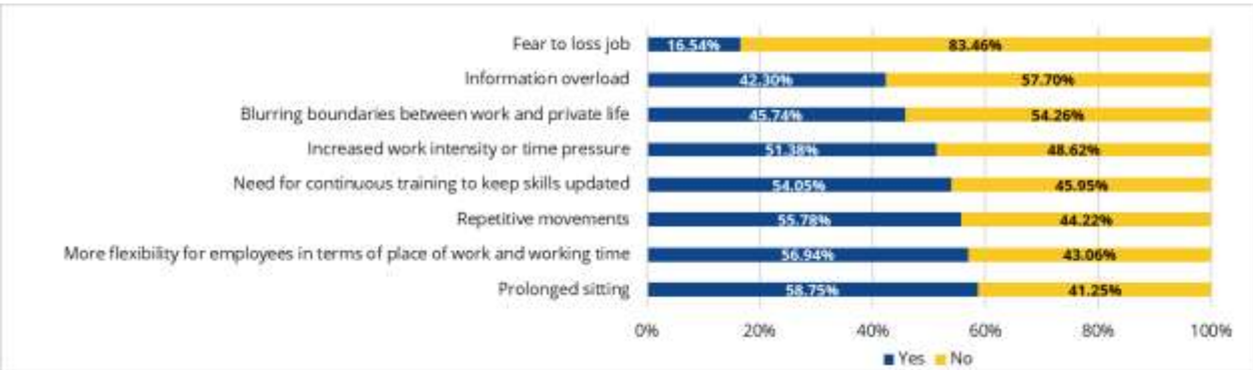
[78] https://www.capterra.nl/directory/31087/employee-monitoring/software

This situation has been a point of concern for trade union CNV, which has led them to conduct a study on the use of AM technology to control employees. CNV set out a survey among 2600 employees. The survey shows that almost 1 out of 5 employees is monitored by their employer to determine whether the employee is working. A total of 16% of the employees who responded to the survey were aware that their employer tracks their location when on the job, while a quarter of the participants stated that the monitoring at work has been increasing over the years. The survey further shows that 4 out of 10 employees state that their employer is more aware of the digital monitoring possibilities than 5 years ago. Finally, in 13% of cases the employer registers which websites their employees visit and 1 out of 3 companies are using cameras at work to monitor their employees (CNV,2023)[79]. Many of the respondents of this study by CNV react negatively to the fact that their employers use digital means to control them. A total of 40% of the respondents find it a problem that their employers have more opportunities to control them, while 71% of the respondents do not want their employer to know everything about them. Some participants also fear that employers will use digitally obtained information against them (CNV, 2023).[80]

Furthermore, ESENER-3 (2019) data shows that (on average) 48% of Dutch companies have been discussing the possible impact of new technologies, the most important topics being ‘prolonged sitting’ (58.75%), ‘more flexibility for employees in terms of place of work’ (56.94%), ‘repetitive movements’ (55.78%), ‘need for continuous training to keep skills updated’ (54.05%), ‘increased work intensity or time pressure’ (51.38%), ‘blurring boundaries between work and private life’ (45.74%) and ‘information overload’ (42.30%). The issue ‘fear to loss job’ (16.54%) was not as frequently discussed as the other issues (see **Figure 42** below).

Notably, when comparing this situation to the EU-27 level average data, at the EU-27 level these AM-related issues are discussed with the employees more frequently (see **Figure 43**). This data indicates the unfavourable situation – although AM-based tools in the Netherlands in most cases are applied more frequently or to the same extent as at the EU level (based on the average indicators), employers in the Netherlands do not pay as much attention to the discussions of the potential AM-related consequences.

Figure 42: Percentage of enterprises in the Netherlands discussing different possible impact of new technologies



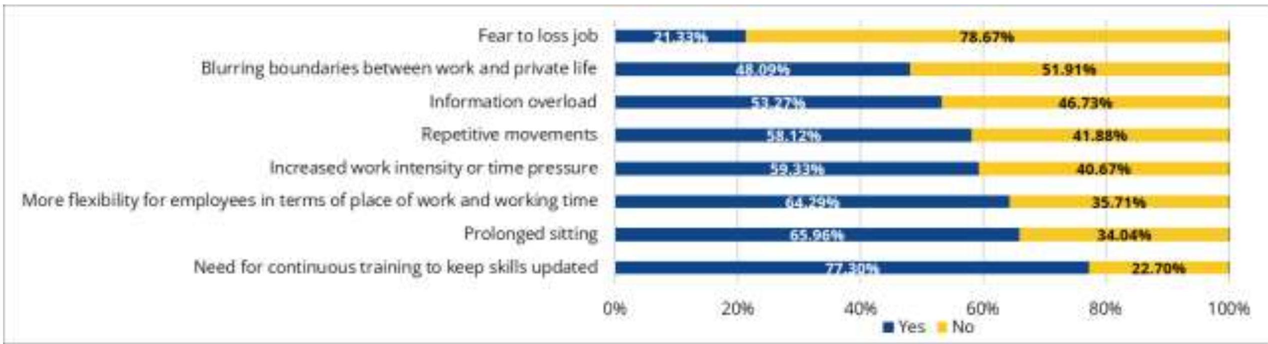
Note: Only companies with over 4 employers are covered

Source: Authors’ own elaboration, based on ESENER-3 (2019) data.

[79] CNV, ‘CNV-onderzoek: steeds meer bazen controleren hun personeel via digitale middelen’ (2023). Available at: Al onze nieuwsberichten in een overzicht - CNV-onderzoek: steeds meer bazen controleren hun personeel via digitale middelen | CNV

[80] ibid

Figure 43: Percentage of enterprises in EU-27 discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by public / private sector

Desk research shows that Dutch public institutions are increasingly using AM technology. The Dutch Court of Audit has recognised that the central government already employs algorithms for the implementation of policy. Algorithms play an increasingly important part in the functioning and actions of the central government and are part of the services provided to citizens and businesses. It is mostly administrative actions which are automatised, such as automatically sending letters. As of 2021, the central government does not make use of algorithms that are fully self-learning, only learning algorithms, meaning there is always an employee involved in algorithmic learning. Among the Dutch ministries, there is a broad agreement on the new opportunities offered using algorithms, with most departments already deploying them.[81]

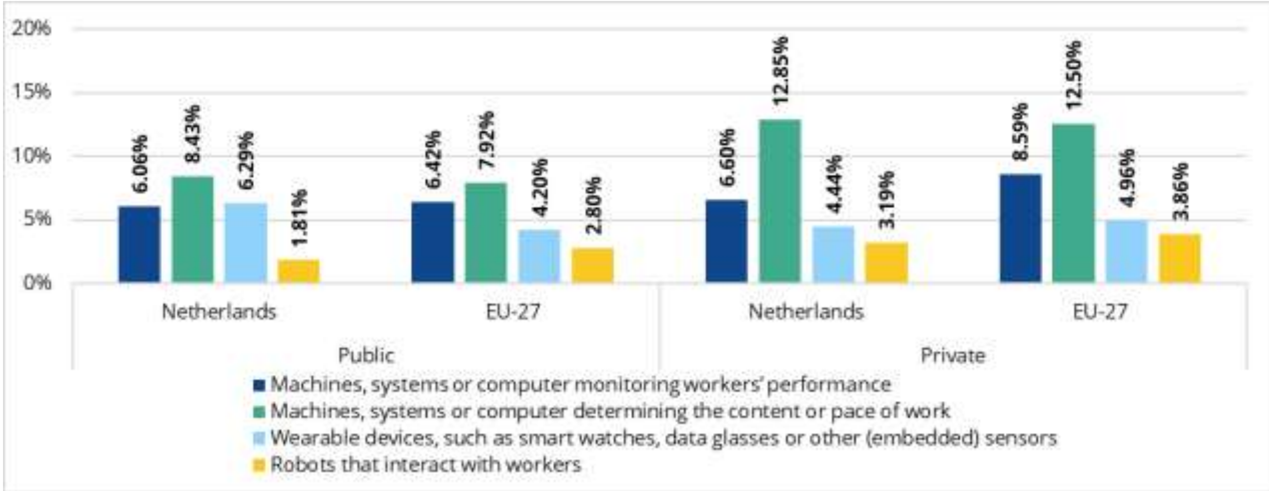
Based on the ESENER-3 (2019), it can be concluded that the use of different technologies associated with AM is more frequently used within private enterprises than in public institutions, in the Netherlands as well as in the EU. Only the use of wearable devices is higher among Dutch public institutions (6,29%) compared to private institutions in the Netherlands (4,44%) and the EU average (4,20% public, 4,96% private) (see **Figure 44** below).

The data further show that the usage of technology to determine the content or pace of work in the Dutch public and private sector is a little higher than the EU average (public: 8,43% in NL vs 7,92% in EU, private: 12,85% in NL vs 12,50% in EU) (see **Figure 44** below).

Furthermore, the use of technology to monitor workers' performance and robots that interact with workers is a little less widespread among Dutch public and private institutions (monitoring performance: 6,06% and 6,60% respectively, robots: 1,81% and 3,19% resp.) than the EU average (monitoring performance: 6,42% and 8,59% resp., robots: 2,80% and 3,86% resp.) (see **Figure 44**).

[81] Algemene Rekenkamer, 'Aandacht voor Algoritmes' (2021). Available at: Aandacht voor algoritmes-2021 (officielebekendmakingen.nl)

Figure 44: Percentage of public and private enterprises using different technologies associated with AM



Note: Only companies with over 4 employers are covered. *Source:* Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by economic sector

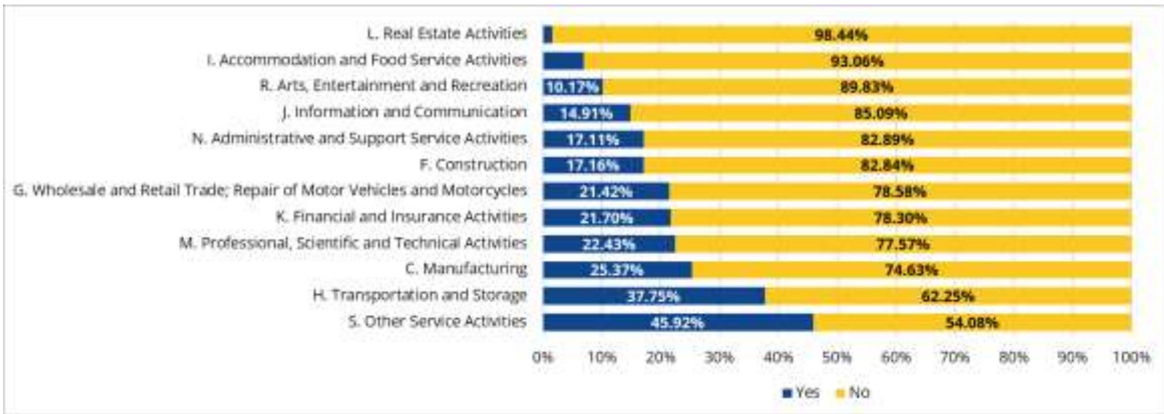
The ESENER-3 (2019) data show that there is variation in AM-related tools' usage across economic sectors. The use of data analytics to monitor employee's performance is most common in the transportation and storage sector (37.75%) and 'other service activities[82] (45.92%). It is used to a lesser extent in the manufacturing sector (25.37%); in professional, scientific, and technical activities (22.43%); in the finance and insurance sector (21.70%); as well as in wholesale and retail trade (21.42%). This type of AM is the least used in the real estate sector (less than 2%), in the accommodation and food service sector (around 7%); as well as in the arts, entertainment and recreation sector (10.17%) (also see **Figure 45** below).

When comparing this data to the EU-27 level, some differences can be observed. At the EU-27 level, such economic sectors as transportation and storage (35.9%); financial and insurance activities (31.7%); and professional, scientific, and technical activities (31.4%) stand as major users of data analytics to monitor employee's performance (see **Figure 46** below). The possible explanation for this is the distribution of workers in different economic sectors in the Netherlands, with the highest share of employees working in such economic sectors as services, agriculture, and industry, which, in turn, can lead to more active uptake of AM-based tools.[83]

[82] Other service activities include occupations and businesses that offer services such as repair and maintenance, personal care services, laundry and dry cleaning, funeral services, religious and membership organizations, equipment rental and leasing, and other miscellaneous services. Some examples of specific occupations within this sector include hairdressers, barbers, nail technicians, pet groomers, fitness trainers, repair technicians, event planners, and many others.

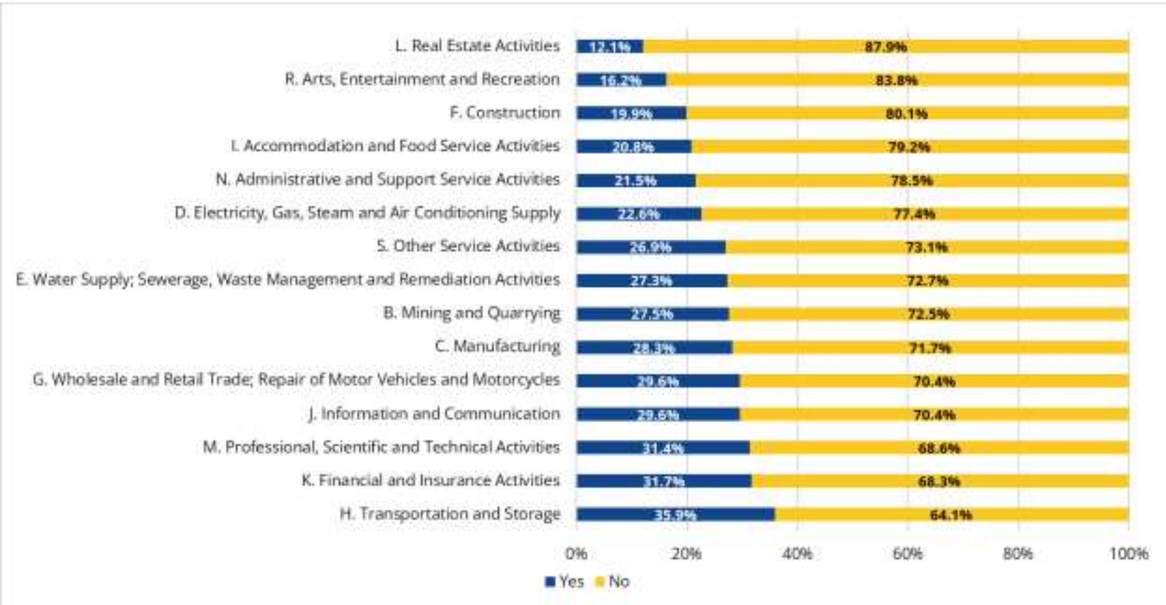
[83] https://www.statista.com/statistics/276716/distribution-of-the-workforce-across-economic-sectors-in-the-netherlands/

Figure 45: Percentage of companies in the Netherlands, by sector, using data analytics to monitor employee's performance



Note: Only companies with over 4 employers are covered. *Source:* Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 46: Percentage of companies in EU-27, by sector, using data analytics to monitor employee's performance

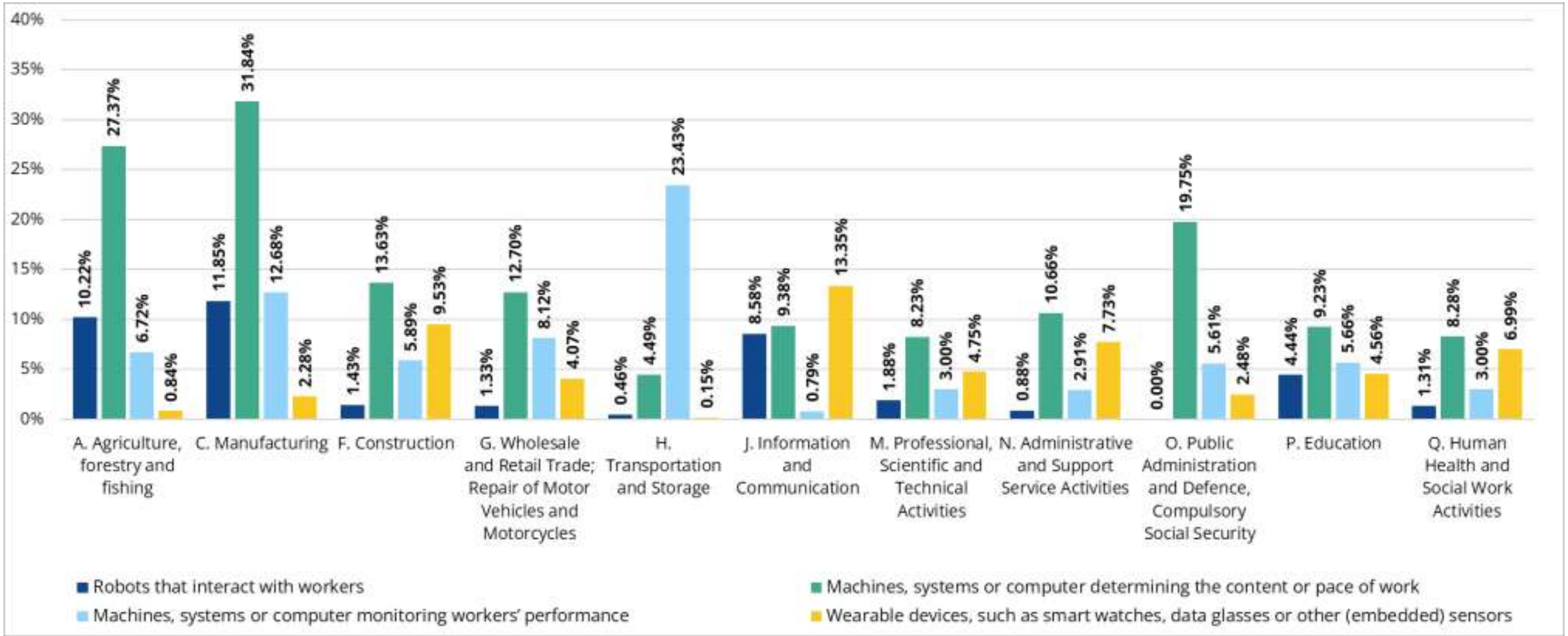


Note: Only companies with over 4 employers are covered. *Source:* Authors' own elaboration, based on ESENER-3 (2019) data.

A large deviation can also be seen across economic sectors regarding the usage of other technologies associated with AM. For example, the usage of technology determining the content or pace of work are by far most frequently used in sectors related to manufacturing (31.84%); agriculture, forestry, and fishing (27.37%); and public administration and defence (19.75%). The usage of tools that monitor workers' performance is by far most frequently used in the transportation and storage sector (23.43%), followed by the manufacturing sector (12.68%). Robots are most used in sectors related to manufacturing (11.85%); agriculture, forestry, and fishing (10.22%); and information and communication (8.58%). They are hardly used in other sectors (see **Figure 47 below**).

When comparing this data to the EU-27 average indicators, a similar situation can be observed. Specifically, AM-based tools such as technologies determining the content or pace of work are most frequently used in manufacturing sector (23%); as well as in the agriculture, forestry, and fishing sector (19.6%). Furthermore, the usage of tools that monitor employee performance are most frequently used in the sectors related to financial and insurance activities (17.5%) and transportation and storage (17.2%). Robots are most used in sectors related to agriculture, forestry, and fishing (8.8%), and manufacturing (9%). Finally, the distribution of users of wearables is quite similar across different economic sectors (see **Figure 48** below).

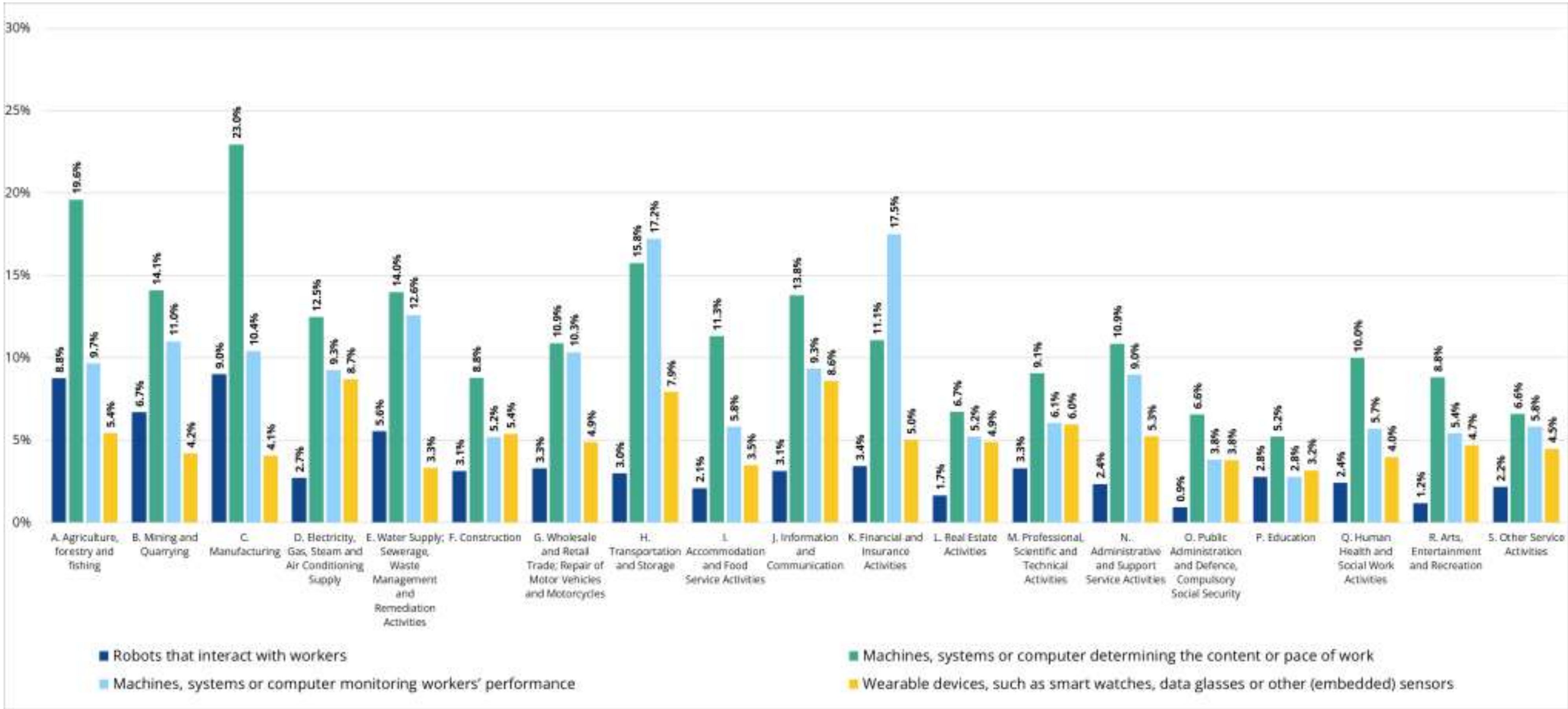
Figure 47: Percentage of companies in the Netherlands that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 48: Percentage of companies in EU-27 that use different technologies associated with AM by economic sector



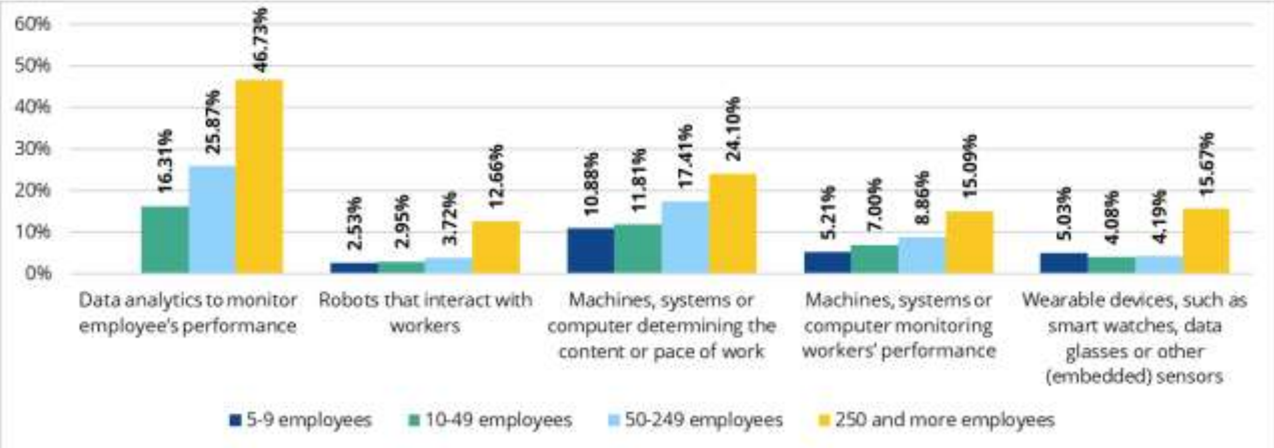
Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by company size

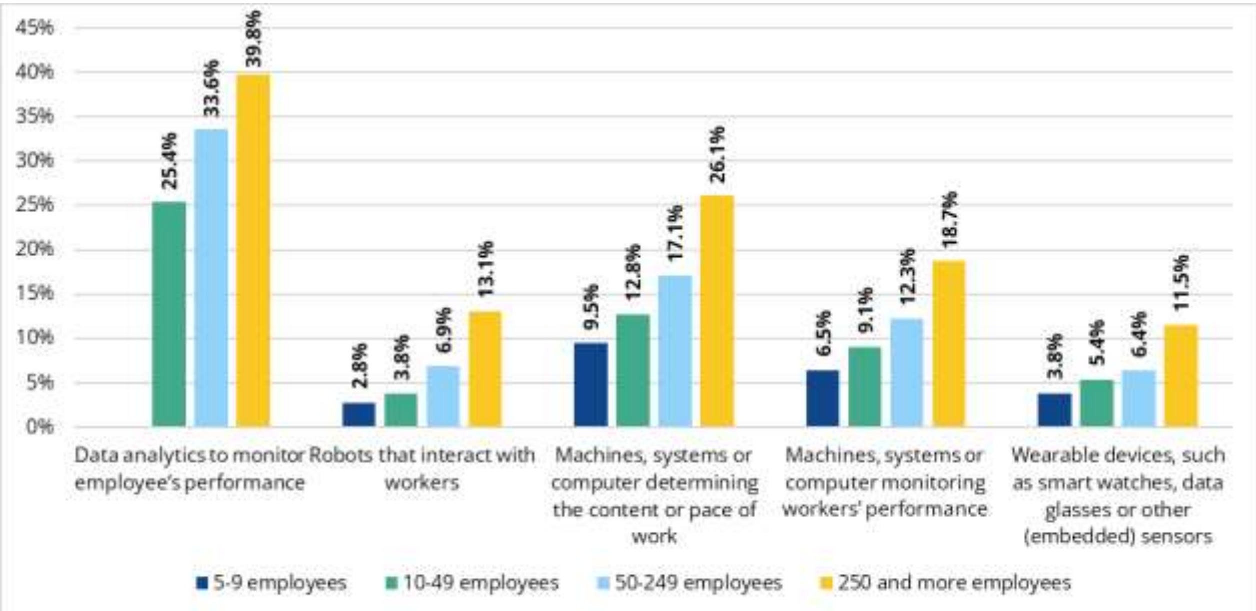
ESENER-3 (2019) data show that the usage of technologies associated with AM are a more frequent practice among larger enterprises than smaller enterprises in the Netherlands (see **Figure 49** below). This counts for all technologies analyzed. A remarkable exception is the usage of wearable devices, such as smart watches, data glasses or other (embedded) sensors: these are most used by the largest enterprises (with 250 and more employees), as well as by the smallest enterprises (with 5-9 employees). Technology to monitor an employee's performance is the most used technology among all enterprises, except for companies with 5-9 employees where this technology is hardly used. A similar situation can be also observed when looking at the EU-27 level average data (see **Figure 50** below)

Figure 49: Percentage of companies in the Netherlands that use different technologies associated with AM by type



Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

Figure 50: Percentage of companies in EU-27 that use different technologies associated with AM by type



Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

5.3.3. Employees' experience with AM

Overall experience by workers

Based on EWCTS-2021 and ESENER-3, Dutch employees are making less use of AM than the EU-27 average. The data of EWCTS-2021, which cover companies of all size, found that for around 36.9% of employees in the Netherlands (around 2.4 million) computer systems influence what they do at work. In EU-27 this percentage is 57.6%. However, this stands as proxy evidence of the AM application, as it may not only refer to the automatic allocation of working hours or the planning of tasks and resources (which is an AM-based functionality) but also simple digitalisation solutions which automate working processes.

In addition, it is important to note that these percentages do not include individuals who did not answer this question (around 4.6 million individuals in the Netherlands), which makes it difficult to draw a strong conclusion. The reasons for not including these non-answers in the calculation of the percentage are discussed in the footnotes.[84]

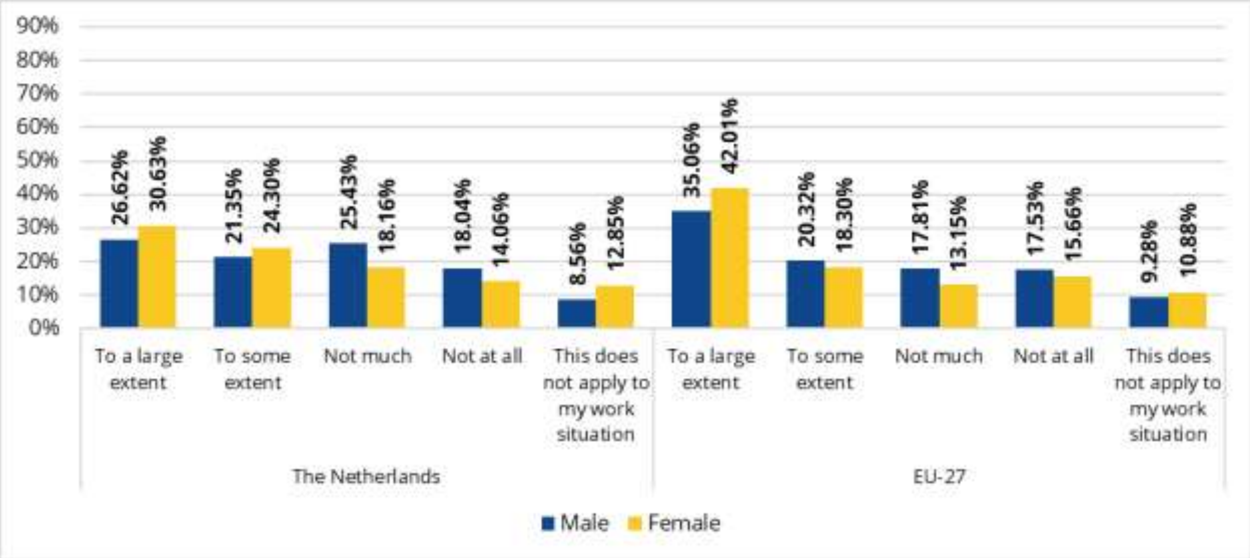
Based on ESENER-3 that focuses on companies with more than 5 employees, only 4.1% of such workers (around 379.459) interact with robots at work, 11,1% (1.02 million) are subject to machines, systems, or computers determining their pace of work, 5.9% (551 134) employees are subject to machines, systems, or computers monitoring their performance, and around 4.8% (445633) work with wearable devices. In contrast these percentages for EU-27 are higher: 7.3% (interaction with robots), 17.3% (pace of work), 12.2% (monitoring workers), 7.2% (wearables).

Usage by gender and age group

There is relatively limited quantitative data available regarding the usage of AM by gender and age group: only EWCS-2021 provides such information. Nevertheless, some insights can be derived from it. First, both male and female employees have a similar experience with computer systems influencing what they do at work, both in the Netherlands and in the EU-27 (see **Figure 51** below). A noteworthy difference is that for females such technologies influence what they do more frequently 'to a large extent' and 'to some extent' in the Netherlands, in comparison to male employees. On an EU-27 level for females such technologies influence what they do at work more frequently 'to a large extent' as well, while for men it is more frequently 'to some extent'. It would be an interesting study to assess why the work of female employees is more often influenced by computers than men. An explanation could be that male employees are more frequently employed in the industry related sectors, while female employees are more frequently employed in services related occupations.

[84] The reason for not including these non-answers in the calculation of the percentage is related to the fact that a high number of such responses as "Don't know" and refusals distorts the broad picture and does not allow us to assess for how many people computer systems influence what they do at work. In addition, it also would not allow us to compare the Netherlands' data with the EU-27 average as the higher response rate at the EU-27 level also implies a higher number of "Don't know" responses or refusals. Considering these arguments, the inclusion of this type of answer does not have an added value here.

Figure 51: Percentage of workers by gender for whom computer systems influence what they do at work

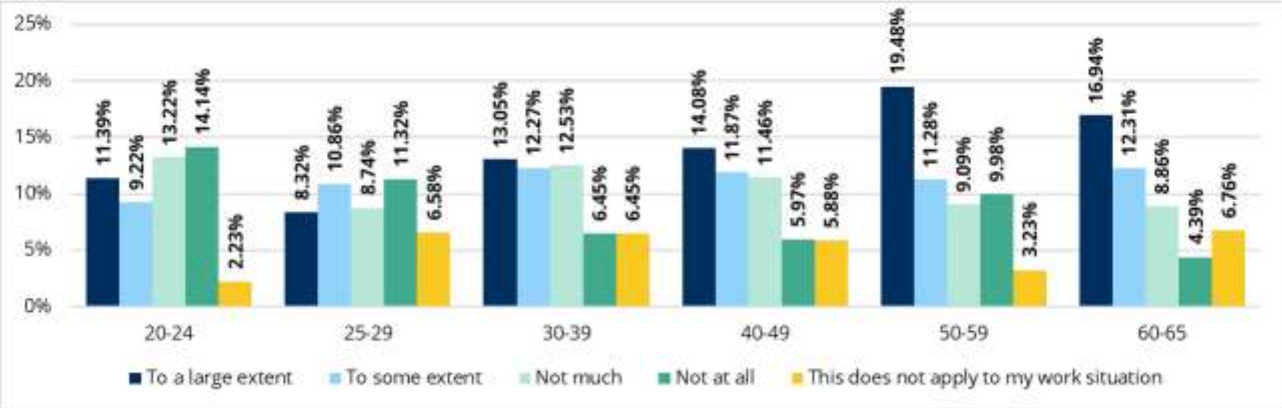


Source: Authors' own elaboration, based on EWCTS (2021) data..

When looking at the distribution of workers being influenced by computers by age, it can be observed that for approximately 14% of all employees computers strongly influence ('to a large extent') what they do at work. This percentage is higher in the older age categories than in the other age categories (19,48% age 50-59 and 16,94% age 60-65). In the lower age categories (age 20-24 and age 25-29) the percentage of workers for whom computer systems influence what they do at work is classified as 'not at all' or 'not much' is higher than the older age categories (see **Figure 52** below). An explanation for this could be that new technologies to control workers are less often used in entry level jobs or jobs requiring lower experience in which more younger employees are employed.

When comparing these figures to the EU-27 level average data, this situation looks different. Here, middle-aged people (i.e., 30-49 years old) experience a higher influence of computer systems on what they do at work. Meanwhile, younger (20-29) and older generations (50-65) tend to experience this influence less frequently (see **Figure 53** below). However, the relatively high impact of the AM-based systems on the older generation may be explained by the fact that this group consists of skilled people (who decided to continue their professional activities after reaching retirement age), who tend to use digital technologies at work.

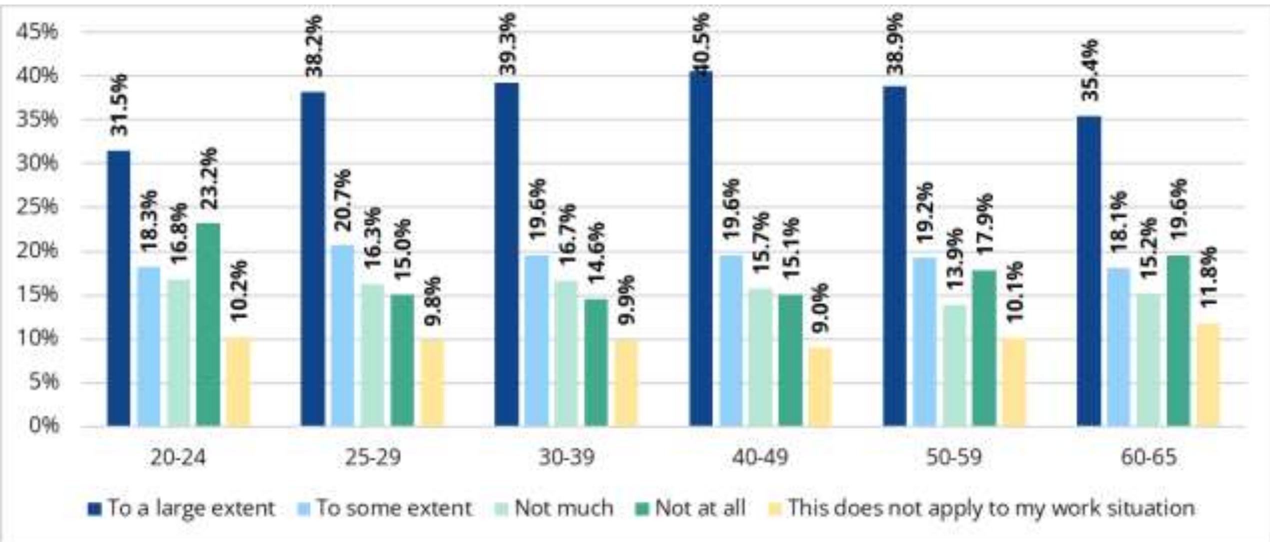
Figure 52: Percentage of Dutch workers by age for whom computer systems influence what they do at work



Note: 15-19 and above 65 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data

Figure 53: Percentage of workers in EU-27 by age for whom computer systems influence what they do at work



Note: 15-19 and above 65 age individuals were removed from the visual due to small sample size.

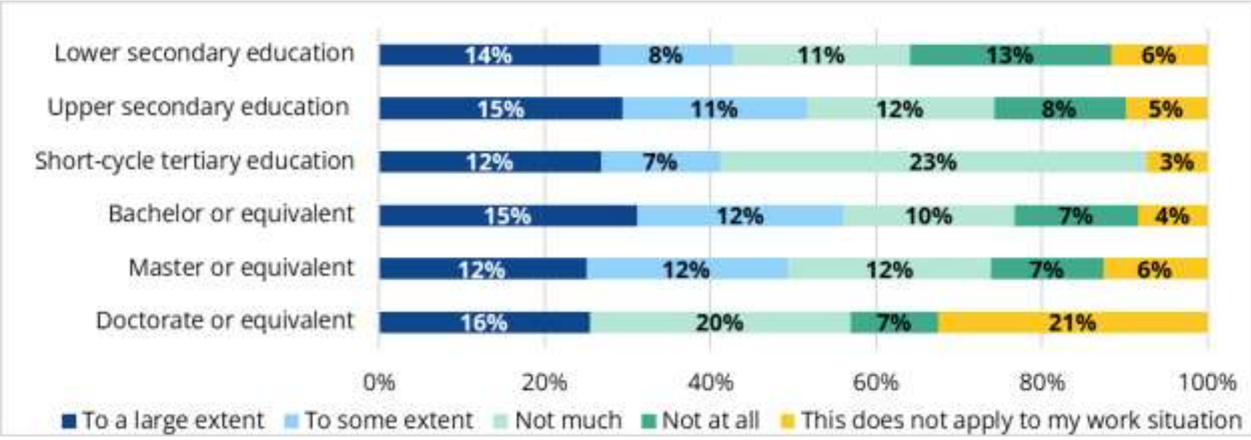
Source: Author's own elaboration, based on EWCTS (2021) data.

Usage by level of education

When considering the level of education in the Netherlands, it is evident that approximately 14% of workers across all levels of education are significantly influenced by computer systems in their work. For workers with a doctorate or equivalent and short-cycle tertiary education, the extent to which computer systems influence what they do at work is more often reported as 'not much' than other levels of education (20% and 23% respectively, while for other education levels it is around 11%). In addition, for a larger percentage of workers with a doctorate or equivalent computer systems do not influence what they do at work at all (i.e., 'This does not apply to my work situation': 21%) (see **Figure 54** below).

This is in contrast with the situation that can be observed on EU-level: in EU-27, as education level goes up, workers are more likely to be susceptible to the influence of computer systems on what they do at work (see **Figure 55** below). However, when an individual reaches short-cycle tertiary or bachelor's education level, the percentage to which his/her work is influenced by computers does not change and remains stable at around 50% for "to a large extent" and around 20% for "to some extent".

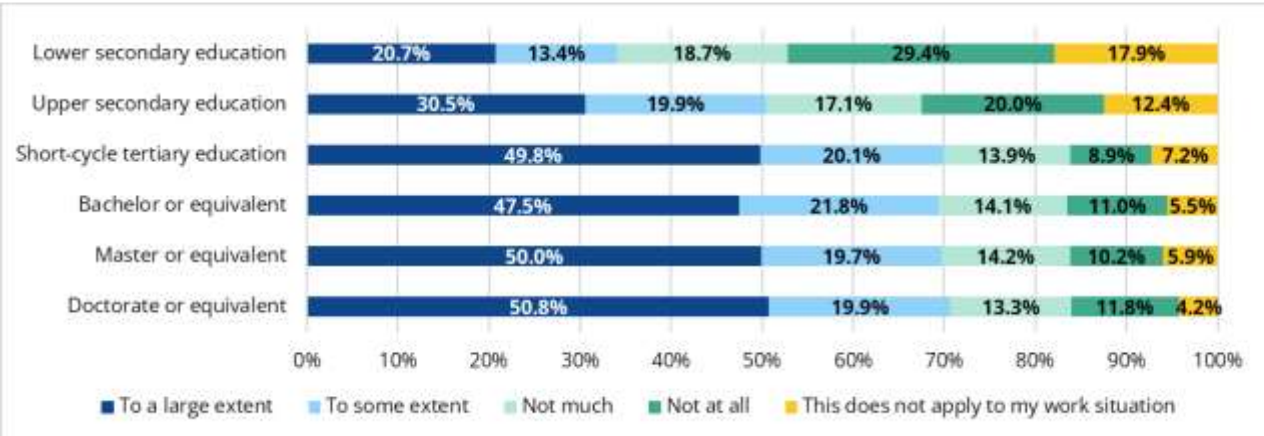
Figure 54: Percentage of Dutch workers by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.

Source: Author's own elaboration, based on EWCTS (2021) data.

Figure 55: Percentage of EU-26 workers by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.

Source: Author's own elaboration, based on EWCTS (2021) data.

5.3.4. Review of AM-related regulatory context in the Netherlands

Despite the increasing use of algorithmic management in the Netherlands, current laws do not provide enough protections for the damaging aspects of algorithmic management.[85] The Dutch Data Protection Authority cannot do much in the realm of enforcement and the overseeing of the usage of algorithmic management in the Netherlands. Literature suggests that the Dutch Data Protection

[85] Zoomer. T and Otten. B, 'Het algoritme de baas' (2021). Available at: https://www.wbs.nl/sites/default/files/2021-10/03.%20T%20Zoomer%20%26%20B%20Otten_Het%20algoritme%20de%20baas_SD_2021_5.pdf.

Authority should help in drafting explicit guidelines on the use of algorithmic management as currently their guidelines regarding the processing of personal data do not explicitly mention AM.[86]

Currently, in the Netherlands, there is no direct legislation which is related to algorithmic management. However, there are several pieces of legislation which indirectly regulate the use of algorithms. These legislations are as follows:

- **The Archives Act** regulates data storage and transparency. This act requires every government organization to ensure that their documents and information are made publicly available and ultimately destroyed when the retention period has expired. The government should be able to provide insight into the way in which decision-making has come about, even if it is supported by algorithms. Therefore, information about algorithms used must be included in the archive and managed in accordance with the requirements of the Archives Act.[87]

- **The Working Conditions Act** regulates the health, safety, and well-being of employees by employers. In this regard, Article 3 requires the employer to ensure the safety and health of the employees with regard to all aspects related to work and to implement a policy aimed at the best possible working conditions, which includes policy aimed at preventing or, if that is not possible, limiting psychosocial workload. Subsequently, employers may not schedule work or regulate work in a manner that will lead to risks to health and safety. This means that if the introduction of algorithmic management in the workplace causes too much stress for the employees, it would be contrary to the requirements of the article.[88]

- **The Works Councils Act** regulates employee participation in companies in the Netherlands. This legislation is indirectly related to AM, specifically Article 27(1)(I). When a company has 50 or more employees, the company must have a work council. It consists of its employees and management, in this way employees are involved in certain decision-making. Thus, if a company wants to introduce systems (such as AM) that have as a purpose to control employees on behaviour, presence or performance, the work council must also vote to take this decision.[89]

- **The Act General Data Protection Regulation** implements the EU General Data Protection Regulation. This legislation has several implications for the use of algorithms by employers. Considering that algorithms often process personal (sensitive) data, which means that the algorithms need to comply with the requirements for processing such data as set out in the legislation. Additionally, when using algorithmic systems, a Data Protection Impact Assessment (DPIA) is often mandatory. A DPIA is an instrument used to identify the privacy risks of data processing in advance.[90]

- **The General Equal Treatment Act** affords protection against discrimination on the grounds of religion, belief, political opinion, race, gender, heterosexual or homosexual orientation and marital status. The main purpose is thus to prevent unauthorised discrimination. When this legislation was first introduced, it afforded specific protection to groups that were being discriminated in the recruitment of and applying for jobs. It originally applied to non-online

[86] Ibid.

[87] The Archives Act. Available at: wetten.nl - Regeling - Archiefwet 1995 - BWBR0007376 (overheid.nl)

[88] Working Conditions Act. Available at: https://wetten.overheid.nl/BWBR0010346/2022-05-20

[89] Work Councils Act. Available at: https://wetten.overheid.nl/BWBR0002747/2022-01-01

[90] Act General Data Protection Regulation. Available at: wetten.nl - Regeling - Uitvoeringswet Algemene verordening gegevensbescherming - BWBR0040940 (overheid.nl)

forms, but now also applies when digital recruitment technologies, such as algorithms, are used to apply for a job.[91]

- **Strategic Action Plan for Artificial intelligence.** while this proposal for regulation is not binding, it sets out numerous plans from the government to protect citizens and employees in the introduction of AI across the Netherlands. The government deems AI to be a useful tool that can promote the economy; however, it does recognize the danger that algorithmic management may bring. Besides the standard GDPR and other legislation mentioned above, the government has proposed that it might introduce more legislation where it deems that not enough protection is granted. The Government has stated that where companies do not carry their own responsibility, further regulation can be introduced to protect from the misuse of AI.[92]

The **FNV v Uber B.V.** stands out as a relevant law case in this context. Specifically, this law case refers to delivery drivers that work for Uber, who, despite being able to choose their own working hours, are being increasingly controlled by an algorithm that shows a comparative role to an employer. Therefore, the FNV brought the case to the Amsterdam district court to determine whether the relationship between Uber and the drivers should be qualified as an employment contract. The algorithm on Uber decides the wage a driver receives, what route they must take based on the priorities set by the algorithm. Once the driver has logged in, it becomes subject to the operation of the algorithm. This makes the determination of a classic employer-employee relationship evermore hard to determine. But in this case, the court determined the relationship between Uber and its drivers classified as an employment contract. Drivers therefore fall under a generally binding collective agreement and are therefore also subject to more protections under labour law. These types of cases have been appearing more often in the Netherlands and serve as precedent for further legislation and regulation.[93]

Based on the interviews and desk research, there is a need for European regulation when it comes to the use of AM tools in the Netherlands. One of the interviewees pleaded for an EU quality label for wearables, as it is currently possible for companies to use wearables of meagre quality, causing false security and putting employees in danger. This further highlights the necessity for regulation regarding privacy and fairness in relation to the use of AM in the workplace.

5.3.5. Conclusions

The application of AM is still a relatively new phenomenon in the Netherlands. However, the usage of such technology is higher among Dutch companies than the EU average and it is increasing. When using the DESI indicator on the percentage of companies using at least some AI technologies as a rough proxy for AM use, 13,1% of Dutch companies use such technologies. Comparatively, on average in the EU 7.9% of companies do the same. Although monitoring tools are a little less frequently used in the Netherlands in comparison to the EU average, it has been increasing in the last 3 years, especially in the call and contact centre sector. Another important AM situation seen in the Netherlands across a broad range of sectors is the increased use of recruitment software to recruit, assess, and select candidates.

[91] General Equal Treatment Act. Available at: https://wetten.overheid.nl/BWBR0006502/2015-07-01

[92] Ministry of Economic Affairs and Climate, 'Strategisch Actieplan voor Artificiële Intelligentie'(2019). Available at: https://www.rijksoverheid.nl/documenten/beleidsnotas/2019/10/08/strategisch-actieplan-voor-artificiele-intelligentie

[93] FNV v Uber B.V. (ECLI:NL:RBAMS:2021:5029). Available at: https://www.wijnenstael.nl/publicaties/7784 https://uitspraken.rechtspraak.nl/inziendocument?id=ECLI:NL:RBAMS:2021:5029&showbutton=true&keyword=uber

Overall, it can be concluded that the use of different technologies associated with AM is more frequent within private and larger enterprises than in public institutions and smaller companies. This conclusion can be drawn for both the Netherlands as well as the EU average. Furthermore, there is variation in AM usage across economic sectors. For example, the use of data analytics to monitor employee's performance is most common in the transportation and storage sector, and other service activities. It is used to a lesser extent in the manufacturing sector; in professional, scientific, and technical activities; in the finance and insurance sector; as well as in wholesale and retail trade. This type of AM us is found the least in the real estate sector; the accommodation and food service sector; and the arts, entertainment, and recreation sector.

An increasing number of Dutch companies is seeing the benefits of AM tools. Key drivers for the usage of AM tools at the workplace are time and budget efficiency, as well as improving the quality of work and finding the best possible candidates. These tools tend to have both positive as negative impacts, depending on how they are understood and used by its users. The greatest concerns among employees are related to fairness, privacy, and transparency.

Based on the interviews and desk research, current laws do not provide enough protection for the damaging aspects of algorithmic management. On the one hand, it is suggested that on a national level the Dutch Data Protection Authority should help in drafting explicit guidelines on the use of algorithmic management as currently their guidelines regarding the processing of personal data do not explicitly mention algorithmic management. On the other hand, there seems to be an explicit need for European regulation when it comes to the use of AM tools at the workplace. Currently, there is no direct national legislation related on the use of algorithmic management at the workplace, only several pieces of legislation which indirectly regulate the use of algorithms, and which do not provide enough protection. For example, one of the respondents pleaded for the possibility to create an EU quality label for wearables, as it is currently possible for companies to use wearables of meagre quality, causing a feeling of false security and bringing employees in danger. Furthermore, the desk research and interviews reveal that there is a need for regulation regarding privacy and fairness in relation to the use of AM at the workplace.

5.3.6. Interviewees

Table 17: List of interviewees

Person		Reason of involvement	Date
1.	Roderik Mol, Trade union executive/ advocate Flexwork at trade union CNV	Roderik Mol works as a trade union executive for trade Union CNV. In this role he represents the workers of call centres or contact centres. Digital monitoring plays a big role in this sector. It is also a topic for the upcoming collective bargaining negotiations.	March 15
2.	Vincent Slot, team lead R&D, software developer Texternel	Vincent Slot works as Team Lead R&D at software developer Textkernel. This company develops recruitment AI.	March 21
3.	• Leon de Jong, Policy advisor at trade union CNV	Leon de Jong is Policy Advisor at trade union CNV. He is an expert on sustainable deployment, fair, healthy, and safe working conditions, co-determination, privacy and monitoring of employees. He is in contact with the socio-economic council, is in contact with several Dutch ministries and has a broad view on labour policy in the Netherlands.	March 23

Person		Reason of involvement	Date
4.	Bernard Romkes, Chair of Workers' Council at Yource, Executive at CNV and he is the chairman of the OR platform of call centres	Chair of Workers' Council at Yource: a company specialised in customer contact services: Outsourcing, Insourcing, and staffing. This company makes use of 'robo coach' technology. He is also Executive at CNV, and he is the Chairman of the OR platform for call centres.	March 24

Source: own elaboration

5.4. Poland case study

The case explores the application of algorithmic management (AM) in Polish workplaces. The case is based on **three main data sources:**

1. **Literature review and desk research**
2. **Interviews with stakeholders** (Table 19: List of interviewees at the end of the document presents the list of interviewees).
3. **Quantified data from the EU and international surveys** (e.g., ECS-2019, EWCTS, ESENER-3, and DESI).

It is important to highlight that the case study only presents the most important data in Poland, while more data can be found in **Annex 6 – Quantified data for the country case study.xls**.

The structure of this case study is as follows. The first section explores the background of the AM application in Poland, presenting the digitalisation context, public discussion, and some specific examples of AM use. The second section presents the quantitative data on AM usage in Polish workplaces, focusing on the general situation, as well as on AM use in companies of different types, economic sectors, and sizes. The third section discusses the employees' perception of AM use, differentiating the results based on the gender, age, and education of employees. Finally, we will present a comprehensive review of the AM-related regulatory context in Poland.

5.4.1. The context of AM application at the workplace in Poland

The context of the AM application: general digitalisation process, public debates, and the economic background

The readiness to adopt AM solutions in every country is related to the general readiness to adopt new technologies based on ICT, IoT or Big Data. Although Poland is a country with social and economic potential (economic situation being relatively stable even during the COVID-19 pandemic) in this regard, it is lagging behind the EU technology leaders in many technology-related areas. The Network Readiness Index (NRI) - a synthetic measure assessing how countries are prepared to take advantage of network society, placed Poland on 34th rank among 131 countries, with the NRI value of 61.16, more than 20 points below the United States (NRI leader). Even relatively high GDP growth in the recent years has not translated into convergence processes regarding GDP per capita and the R&D intensity in Poland. At the EU level, according to DESI index, Poland overtakes only Greece, Bulgaria, and Romania, scoring below EU average in all DESI dimensions. Poland suffers from relatively low citizens' digital literacy, insufficient internet connectivity coverage for the households, and relatively low intake of more advanced IT solutions (e.g., cloud computing, Big Data, AI) in companies, having relatively well developed digital public services (see **Figure 56** below).

Figure 56: General quantified indicators about Poland

Source: Authors' own elaboration, based on the official data sources.

There are examples of the use of AI tools in the public domain. In 2014 the Ministry of Labour and Social Policy (currently the Ministry of Family and Social Policy) introduced profiling of the unemployed who registered in the local employment offices. Unemployed individuals were assigned to one of three profiles based on a set of his or her traits, in an automated way, with the scope of support provided depending on the profile. As there were many doubts regarding the transparency in the decision-making process and the risk of discrimination, the unemployed profiling was withdrawn in 2019 (more details are presented in the section on the AM regulatory framework). In 2018, the Ministry of Justice introduced the so-called Random Case Assignment System in the courts, which uses algorithms to assign cases and tasks to the judges. The monitoring of this system revealed that tasks were allocated unevenly – some of the judges had been overburdened with work, while others had not received a single case for a long time. Moreover, the Ministry of Justice did not provide information about how the algorithm works (the source code has not been made publicly available), but admitted that it may have led to uneven distribution of cases and that there is a need to introduce changes into the algorithm. In 2017, based on amendments to the tax ordinance Act, IT Clearing House System was implemented. The system enables the exchange of information between banks and the National Revenue Administration and uses algorithms to determine the risk of exploitation of the banking sector by tax frauds, especially in the field of VAT tax. By law, the details of how the algorithm works are kept secret for security reasons. Algorithms are also used in the education sector in the recruitment processes to nurseries, kindergartens, schools, and universities, as well as in more advanced tools – e.g., Education Management Platforms developed by Assecco Data Systems, which support management processes for students' information, students' attendance, and calculating scholarships, among others. One of the better-known cases which revealed the failure of the algorithm was the recruitment of children to the nurseries in Wrocław (capital of Dolnośląskie region) in 2018. The failure concerned inaccurate classification of children being "at the edge" of age groups – as a result 600 children were affected[94].

The digital (r)evolution is clearly visible in Polish companies in the private sector. However, the distance to the positions of the EU leaders is still apparent. In 2021 "only" 86% enterprises in Poland had access to Internet via broadband fixed line (24th ranked in the EU, while the EU average amounted to 94%).

[94] Cybulko, A. (2022). Dyskryminacja algorytmiczna w Polsce i możliwości przeciwdziałania jej na podstawie obowiązujących regulacji prawnych, [in] Krajewska, A., Rawłuszko, M. (eds.). Równouprawnienie, Wydawnictwo Uniwersytetu Warszawskiego, Warszawa, pp. 285-316; Mileszyk, N., Paszcza, B., Tarkowski, A. (2019). AlgoPolska. Zautomatyzowane podejmowanie decyzji. Fundacja Centrum Cyfrowe Klub Jagielloński, Warszawa.

Table 18: Enterprises using industrial and service robots in Poland in 2022 (in %)

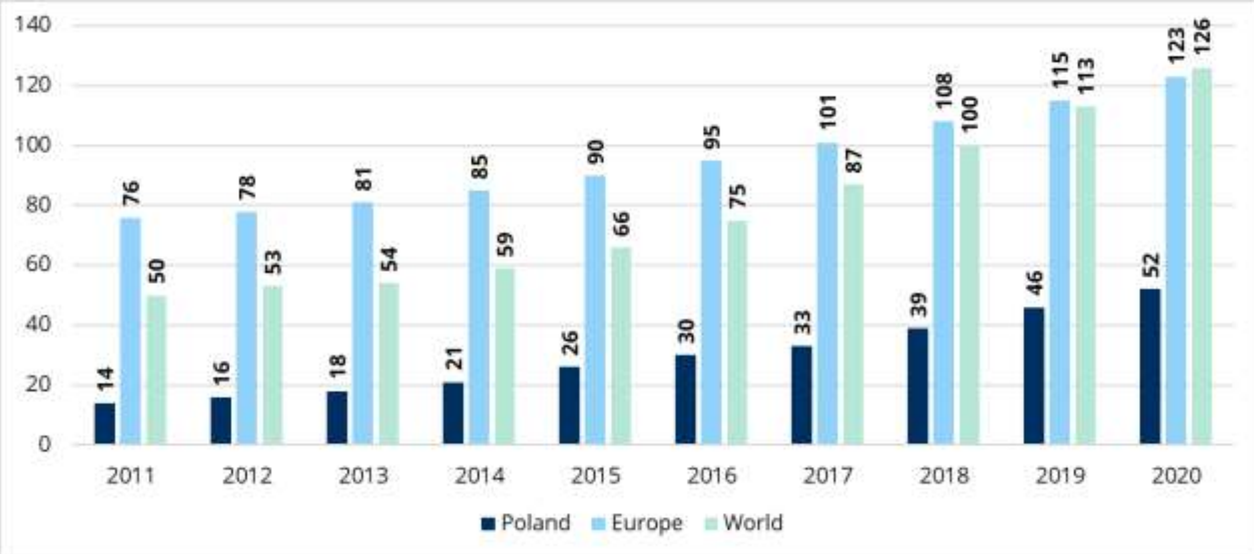
	Industrial robots	Service robots	Total
Total	3.7	1.2	4.3
By company size			
Small	1.9	0.8	2.5
Medium	7.7	1.4	8.5
Large	27.1	9	29.5
By activity type			
Manufacturing	10.8	1.6	11.1
Electricity, gas, steam and air conditioning supply	0.6	0.6	1
Water supply, sewerage, waste management and remediation activities	0.8	1.4	1.6
Construction	1.6	1	2.2
Trade; repair of motor vehicles	1	0.9	1.7
Transportation and storage	0.7	1.6	1.9
Accommodation and catering	0.5	0.7	0.9
Information and communication	0.9	0.7	1.6
Real estate activities	-	0.3	0.3
Professional, scientific and technical activities	0.4	1	1.3
Administrative and support service activities	0.4	1.5	1.6
Repair of computer and communication equipment	-	2.7	2.7

Source: Information Society in Poland, CSO, Warsaw 2022, pp. 98-99

The use of robots – one of measures of robotisation – is at relatively low level (4.3% of all companies using robots), and biased towards large enterprises, operating mainly in the manufacturing industry (see **Table 18** above)[95]. Another commonly used measure of automation – robot density (the number of robots per 10,000 workers in manufacturing) – reveals that Poland has been catching up, but still the performance is much below the average for Europe and the World (Figure 57: Robot density in manufacturing in 2020**Figure 57**). So, it is not surprising that the utilisation of more advanced digital tools in Polish enterprises is also at a relatively low level.

[95] Similar results on the use of robots in companies operating in Poland provides ECS-2019 study – robots were used in 5,359 (4.45%) out of 120,327 of companies which answered the survey question on this matter.

Figure 57: Robot density in manufacturing in 2020



Source: based on Müller, C. (2021). World Robotics 2021 – Industrial Robots, IFR Statistical Department, VDMA Services GmbH, Frankfurt am Main, Germany, p. 75

As the DESI indicator shows, in 2021 2.9% of companies in Poland used some kinds of AI technologies (compared to 7.9% in the European Union)[96], while only 0.2% implemented AI tools for personnel management and recruitment processes. Unsurprisingly, AI and AM to support HRM are most common in large enterprises operating in the Information and Communication sector. This indicates that algorithmic management is currently at an early stage of development and implementation in Poland. Experts emphasise that AM tools in the recruitment and performance analysis are usually implemented and utilised in companies which are subsidiaries of the multinational corporations, especially those operating in manufacturing and new technologies sectors[97].

The data presented above implies that there might be some prominent cases of the AM usage in Poland, which are discussed in the following sub-section.

The use of AM in Poland

There are publicly well-known cases referring to improper use of algorithms by Amazon and Glovo in Poland. Glovo couriers took to the streets in Białystok and Gdańsk in May 2021 to protest against a change in the algorithm for determining couriers' remuneration. The change consisted of the algorithm failing to take into account the travel to the restaurants from which couriers pick up orders for the remuneration, only factoring in the distance from the restaurant to the customer, which significantly reduced couriers' earnings. Importantly, Glovo did not consult these changes with couriers. The couriers who took to the streets and went on strike were blocked from accessing the application. The other case is related to Amazon, which uses algorithms to set, measure, and control workers' performance. If a worker fails to meet the expected minimum performance, s/he receives a warning and after a third one may be fired. According to the workers' representatives and

[96] The use of Big Data retrieved from smart devices and sensors is almost non-existent (only 2.0% of enterprises in Poland in 2020 reported using such technologies).

[97] https://szukampracy.pl/blog/sztuczna-inteligencja-zwalnia-pracownikow-2/ (accessed on 08.03.2023)

independent experts, the main issues with AM in this case are that the strict performance standards set by Amazon and the rules by which the algorithm is run are not transparent. Moreover, these rules are changed on a monthly basis without any consultation with workers. These observations were confirmed by an individual who worked for Amazon in Poland. Interestingly, when workers complained about the pace of work, supervisors blamed the algorithm that "makes" these decisions, arguing they have no influence over them. However, the workers were not provided any information on how the algorithm works or which factors are considered when assigning tasks. Moreover, it was apparent that the algorithm had been consistently raising productivity benchmarks based on historical data.[98]

These potential drawbacks of AM are discussed more and more extensively in the Polish academic / research literature. One stream of this discussion is related to the legal framework and the threat of the so-called algorithmic discrimination, analysed from the perspective of European as well as Polish legal regulations.[99] There are also works that try to analyse the impact of AM on HRM practices in companies from the theoretical and empirical perspectives[100], and the use of algorithms in migration policy.[101]

5.4.2. The use of AM by employers

This section explores how extensively AM is being used in Polish companies. It is important to note that some of the data refers to digital (AI) tools, rather than strictly to AM-based tools. This is because, on the national level, there is almost no data specifically about the application of AM, mainly due to the novelty and complexity of AM. However, the available data on the usage of digital tools presented in this study directly includes AM features, such as employee monitoring, determination of the pace of work, use of robots in the working process, and others.

In addition, the majority of data comes from 2019, before the COVID-19 pandemic, which had a strong effect on the usage of some AM technologies, such as those that monitor workers when they telework. Nevertheless, it provides good (preliminary) indications of how prominent AM is in Poland.

To obtain more relevant estimates of AM usage, survey results from ECS-2019, EWCTS-2021, and ESENER-3 (2019) were extrapolated to determine the number of employers and workers using such tools. This was done by applying relevant weights from each survey. For more information on how the data was weighted, please refer to **Annex 6 – Quantified data for the country case study.xls**.

Overall usage in companies / organisations

[98] This information was retrieved in the form of semi-structured interview. The interviewee asked for full anonymity.

[99] Baba, M. (2020). Algorytmy – nowy wymiar nadzoru i kontroli nad świadczącym pracę. Praca i Zabezpieczenie Społeczne, 3, 11-21; Nowik, P. (2020). Specyfika pracy na globalnych platformach internetowych w świetle zarządzania algorytmicznego. Studia Prawnicze KUL, 1(81), 269-292; Otto, M. (2022). Dyskryminacja algorytmiczna w zatrudnieniu. Zarys problemu. Studia z Zakresu Prawa Pracy i Polityki Społecznej, 29(2), 145-160.

[100] Jagielska M. (2017) Sztuczna inteligencja w zarządzaniu - stan aktualny a perspektywy [in:] Sułkowski Ł., Migdał A.M. (red.) Zarządzanie humanistyczne i publiczne. Przedsiębiorczość i Zarządzanie, XVIII 2, II, pp. 95- 104; Kinowska, H., Sienkiewicz, L. (2022). Influence of algorithmic management practices on workplace well-being – evidence from European organisations. Information Technology & People, DOI 10.1108/ITP-02-2022-0079; Sienkiewicz, L. (2021). Algorithmic Human Resources Management – Perspectives and Challenges. *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia, 55(2), 95-105.*

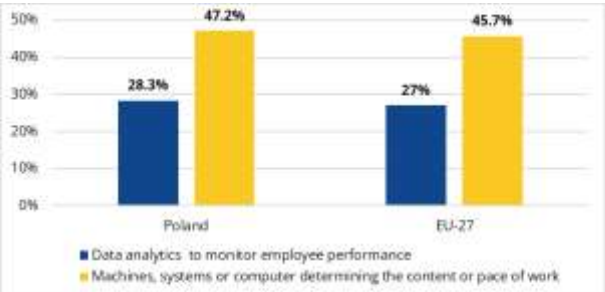
[101] Florczak, I. (2022). Sztuczna inteligencja jako narzędzie do kierowania polityką zatrudnienia cudzoziemców? Studia z Zakresu Prawa Pracy i Polityki Społecznej, 29(2), 161-172.

One of the indicators for measuring the use of AM in companies is taking advantage of data analytics. ECS-2019 study[102] results show increasing trend in data analytics utilisation between 2016 and 2019 (59% of companies which took advantage of these tools in 2016 reported an increase of use in 2019, while a decrease was recorded only in 4% of the surveyed establishments). The distribution of this phenomenon was uneven across economic sectors – the highest increase in the use of data analytics was reported in Professional, Scientific and Technical Activities (increase in 73% of companies), Accommodation and Food Service Activities (70%), and Manufacturing (66%) – as well as company size, with higher increases in large enterprises (67%) compared to small (59%) and medium-sized (55%) firms.

In addition, according to ECS-2019, 28% of companies operating in Poland (39,072 out of almost 138.5 thousand surveyed enterprises) used such tools. The result may not seem too high, but still it is 1 percentage point above the EU average (27%). In 47.2% of surveyed companies (slightly more than EU-27 average: 45.7%), the pace of work is determined by machines or computers to varying degrees – in more than half of these companies computers / machines determine the pace of work of up to 40% of employees, but there are also cases (4,610 enterprises, 7.4% of the group using machines to determine the pace of work) in which all employees are "controlled" by computers (see **Figure 58** below).

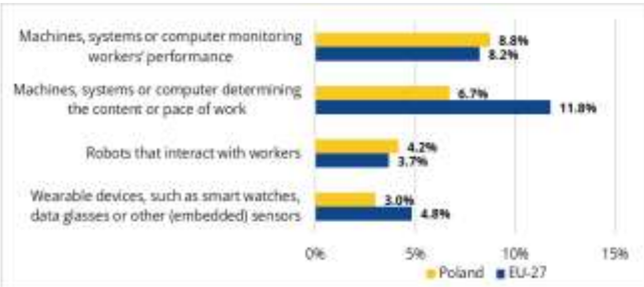
Another piece of evidence for the AM application in enterprises is provided in the ESENER-3 study, which covers companies employing 5 or more individuals[103]. The results reveal that 8.8% of enterprises in Poland use machines, systems, or computers to monitor their workers' performance (compared to 8.2% EU-27 average). Additionally, 6.7% of Polish companies utilize machines, systems, or computers to determine the content or pace of work (EU: 11.8%), while use of robots was reported by 4.2% of Polish entities (EU: 3.7%). Wearables (e.g., smart watches, data glasses or other embedded sensors) were used by 3% of companies in Poland compared with 4.8% in the EU. Thus, from the broader perspective it seems that application of AM tools in Poland follows a similar pattern as the EU-27 average, however there are "in minus" deviations in some dimensions (e.g., determining the pace of work by machines and wearable devices) (see **Figure 59** below).

Figure 58: Percentage of companies (with more than 9 employees) using specific AM tools



Source: Authors' own elaboration, based on ECS-2019 data.

Figure 59: Percentage of companies (with 5 or more employees) using specific AM tools



Source: Authors' own elaboration based on ESENER-3 data.

There is no doubt that new technologies are changing the work environment at the macro and micro level. From the macro perspective, ICT, and recently AI technologies, are leading to shifts in the employment and wage structure, which can be explained within the framework of the Routinisation-

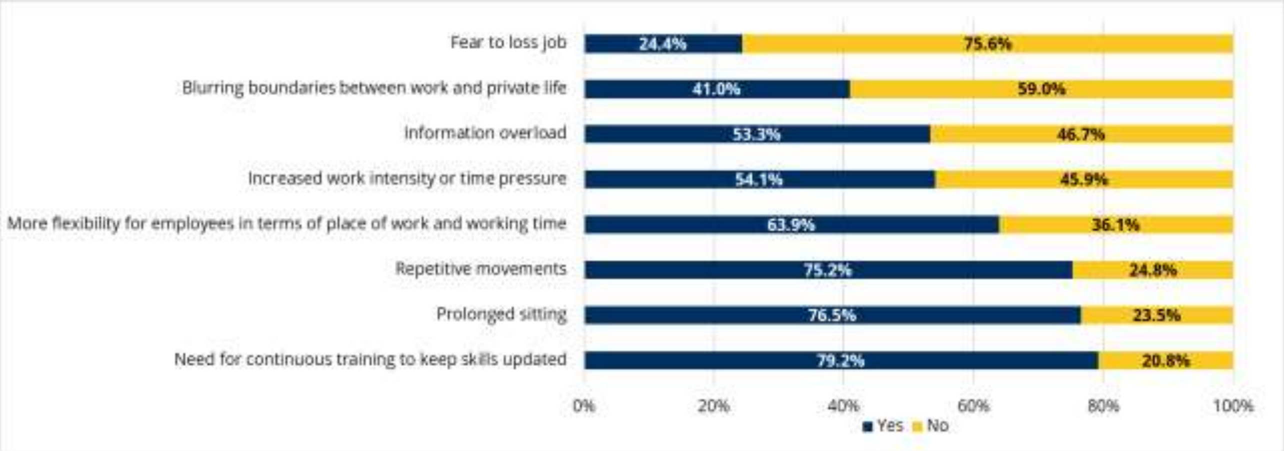
[102] The sample in ECS-2019 did not cover micro enterprises.

[103] As the scope of companies' sample and operationalisation of technologies used in the enterprises differ, the results between ECS-2019 and ESENER-3 are hardly comparable.

Biased Technical Change hypothesis, commonly known as polarisation hypothesis. The Polish labour market has followed the pattern of polarisation in recent years. However, the pattern has been different from the standard one, with relatively high demand for routine cognitive jobs and a relatively large wage premium in routine manual jobs[104].

From the micro perspective, technical change, including introduction of AM tools, leads to multidimensional changes in the workplace. The fear of losing jobs is one of the main concerns expressed by individuals/workers in highly developed countries[105]. However, discussing the possible impact of AM does not seem to be top priority for Polish companies (see **Figure 60** below). From the enterprises' point of view, the key concern is the development of workers' skills in line with dynamically changing needs. Topics related to physical nuisances (e.g., repetitive movements, prolonged sitting) are also important. At the same time, consideration of issues like blurring boundaries between private life and work, information overload, and increased work intensity / time pressure, which may be fueled by broader implementation of AM-based solutions, are much less common. When comparing these data to the EU-27 average, a similar situation can be observed (see **Figure 61** below).

Figure 60: Percentage of enterprises in Poland discussing different possible impact of new technologies



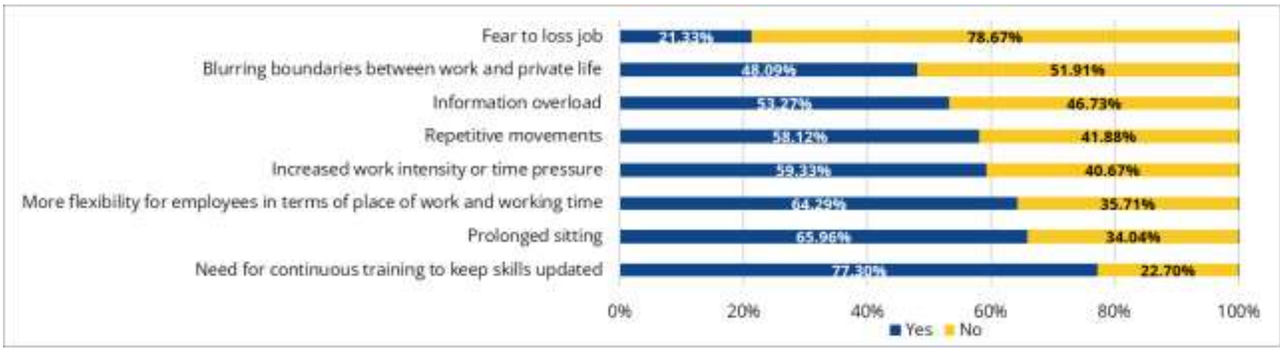
Note: Only companies with over 4 employers are covered; the results should be treated with caution, as only about 24% of the surveyed companies in Poland provided answers to these questions

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

[104] Arendt, L., Grabowski W. (2019). Technical change and wage premium shifts among task-content groups in Poland. Economic Research-Ekonomska Istraživanja, 32(1), 3392-3410.

[105] These fears are usually growing with information about the scale of potential jobs losses as a result of technology advancements, given to the public – of the best examples is Frey and Osborne estimates for the US, showing that 47% of the US labour force may face a high risk of being replaced by technology (see Frey, C.B., Osborne, M.A. (2017), *The future of employment: How susceptible are jobs to computerisation?*, Technological Forecasting and Social Change, 114 (C), 254-280.)

Figure 61: Percentage of enterprises in EU-27 discussing different possible impact of new technologies



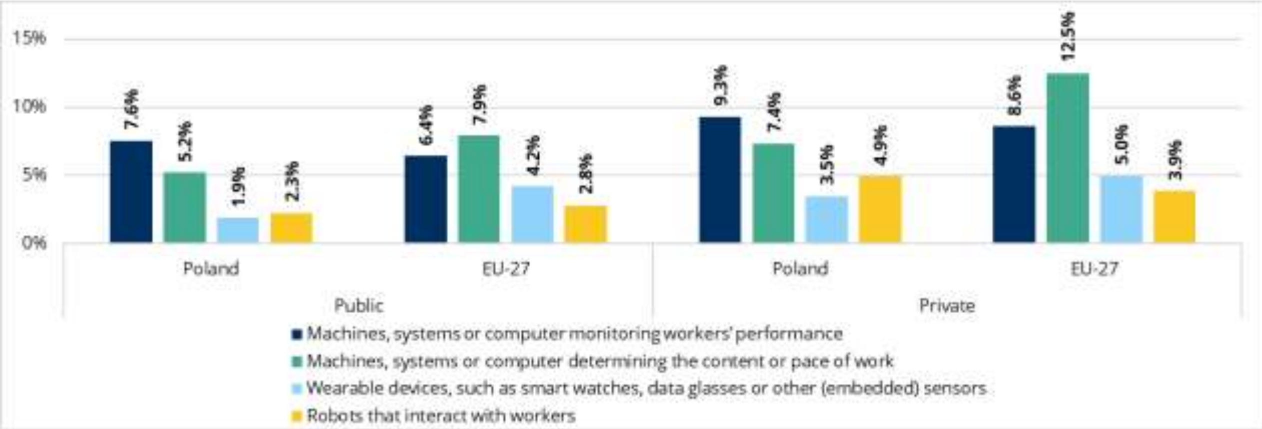
Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by public / private sector

Use of different types of technologies related to AM is more common in the private than public sector (in the European Union generally, including Poland), however differences are noticeable when focusing on particular kinds of technologies / tools (**Error! Reference source not found. Figure 7** below). Although all listed technologies are more common in the private sector in Poland, the biggest difference is recorded in the use of robots interacting with workers (2.67 p.p. higher in private vs public sector), followed by determining the content or pace of work by machines/computers (2.15 p.p. difference). These may be easily explained by differences in tasks performed by individuals, as well as by intensity of manufacturing activities in both sectors. Interestingly, the biggest difference at the EU-27 level was reported for systems determining the pace and content of work (4.57 p.p. in favour of the private sector).

Systems to monitor worker's performance are the only AM tool which is used more often by Polish companies, compared to EU-27 average, both in the private (9.3% vs 8.6%) and public (7.6% vs 6.4%) sector. Polish public and private entities take advantage of machines / systems determining the pace of work and of wearable devices less frequently than in the EU-27. This lower usage is noticeable especially in case of wearables in the Polish public sector (1.9% vs 4.2% in EU-27). In case of human-robot collaboration, Polish private sector uses this solution more often than in the EU-27, while the public sector is lagging behind the EU-27 average (2.3% compared to 2.8%) (see **Figure 62** below). Hence, there is no clear pattern in explaining differences in the use of these selected technologies / AM tools between Poland and the average European level.

Figure 62: Percentage of public and private enterprises using different technologies associated with AM (Poland vs EU-27)



Note: Only companies with over 4 employers are covered

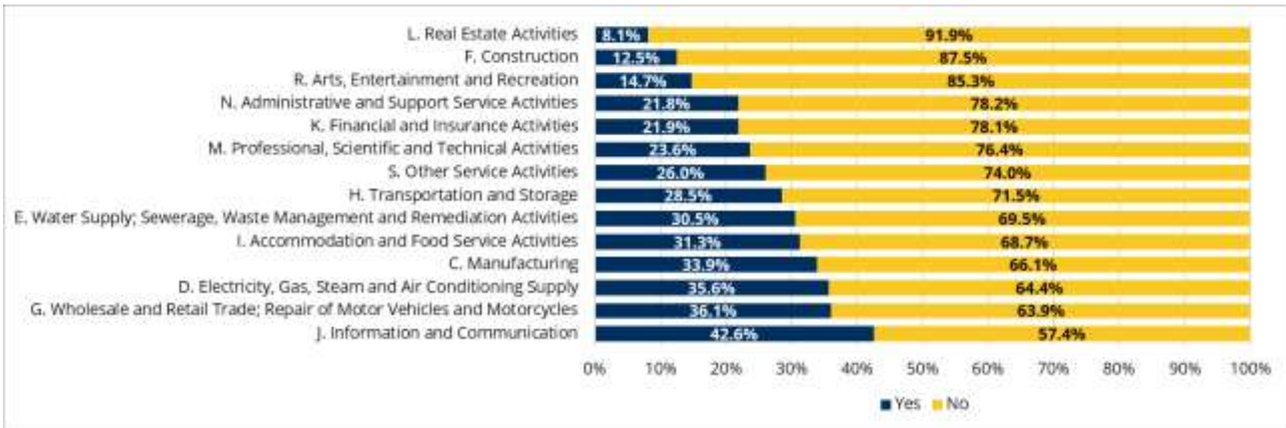
Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by economic sector

Use of data analytics for monitoring workers' performance, a popular tool in AM, varies significantly across economic sectors, according to ECS-2019 study. The range between companies operating in the Information and Communication section (highest intensity of utilisation: 42.6%) and these in Real Estate Activities (lowest intensity: 8.1%) amounts to 34.48 percentage points (much bigger than in the case of EU-27, which is 23.81 p.p.[106]). Having in mind the distribution presented on **Figure 63**, we may conclude, that data analytics for monitoring workers' performance is more often used in Polish companies providing different services, than enterprises whose core business is related to the production of goods (e.g., manufacturing, construction). Meanwhile, at the EU-27 level, the data analytics for monitoring workers' performance is more often used in companies operating in sectors such as transportation and storage; financial and insurance activities; and professional, scientific, and technical activities (see **Figure 64** below).

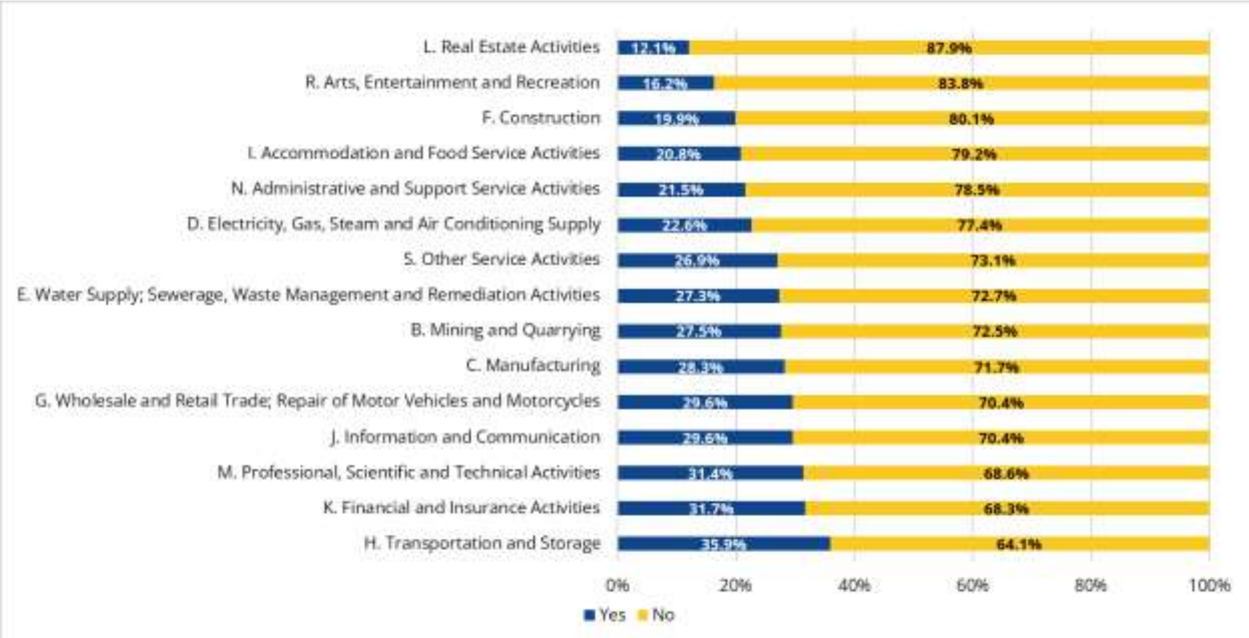
[106] In the EU-27 (average) the highest intensity was recorded in companies dealing with Transportation and Storage, while the lowest in enterprises operating the Real Estate section.

Figure 63: Percentage of companies in Poland, by sector, using data analytics to monitor employee's performance



Note: Only companies with over 9 employers are covered. *Source:* Authors' own elaboration, based on ECS 2019 data.

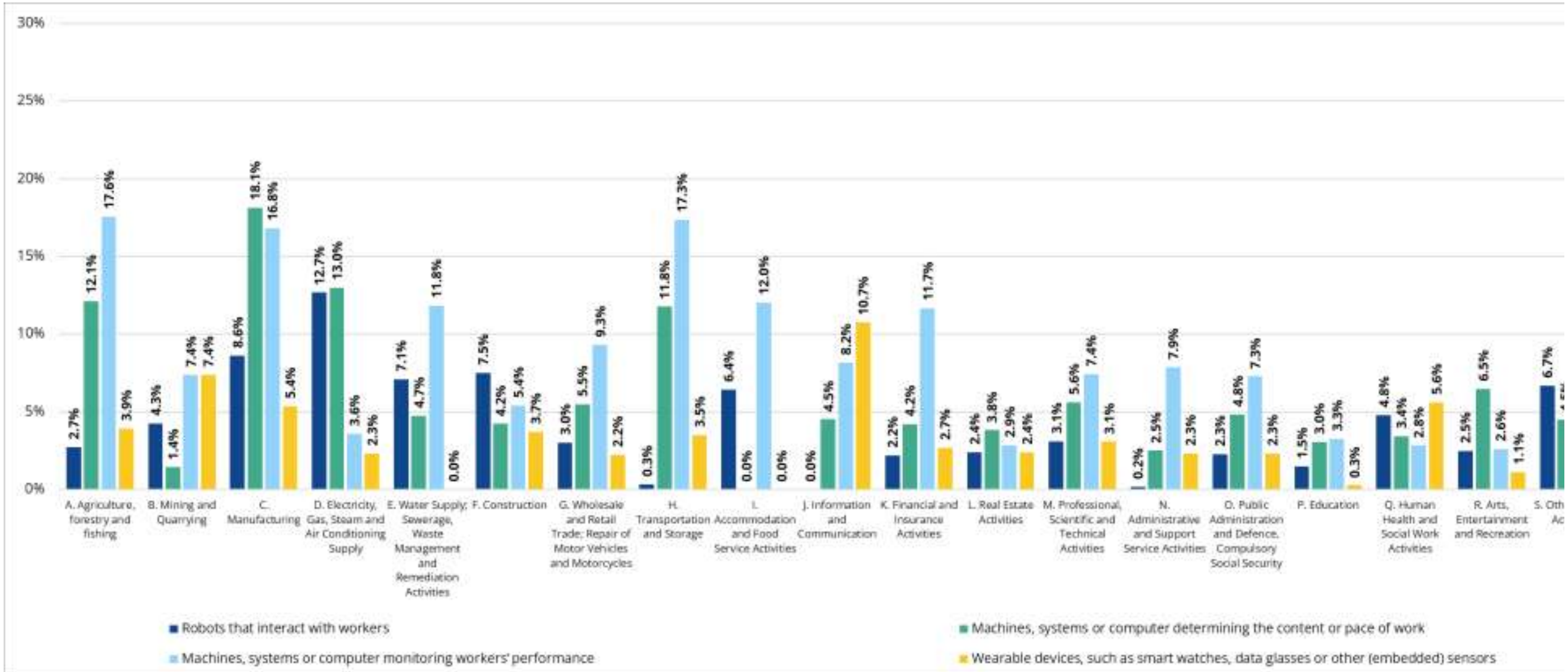
Figure 64: Percentage of companies in Poland, by sector, using data analytics to monitor employee's performance



Note: Only companies with over 9 employers are covered. *Source:* Authors' own elaboration, based on ECS 2019 data.

Data from ESENER-3 study also points to perceptible discrepancies in the use of different technologies across economic sectors (**Figure 65**). Systems for monitoring workers' performance are used frequently in Agriculture (17.6%), companies operating in the Transport and Storage sector (17.3%) and manufacturing enterprises (16.8%). On the other side of this distribution, we can find entities dealing with arts and entertainment activities (2.6%), health and social work (2.8%), and real estate activities (2.9%). Robots interacting with humans are utilised most often in companies providing electricity, gas, and other such supplies (12.7%) and in manufacturing (8.6%) but are non-existent in the Information and Communication sector (0%). Machines / systems which determine content or pace of work are most popular in manufacturing (18,1%), electricity and gas supplying companies (13%), and enterprises operating in the agricultural sector (12.1%), with no interest in Accommodation and Food Service activities (0%). Information and Communication companies are leaders when it comes to use of wearable devices (10.7%), followed by enterprises in mining and quarrying (7.4% - probably for health and safety reasons). At the same time, wearables are not used at all in companies dealing with water supply, as well as in the accommodation and food services sector. These observations prove that the propensity to utilise particular AM tools in different economic sectors is heavily dependent on the intrinsic features of these tools and their potential applications in each sector. Even if there is no regularity in the intensity of these AM-related tools across sectors, as presented in **Figure 65** below, it can be noted that most of these tools are used relatively often in the Polish manufacturing industry, while enterprises providing accommodation and food services use them rarely. When comparing this data to the EU-27 average, a similar situation can be observed (see **Figure 66** below).

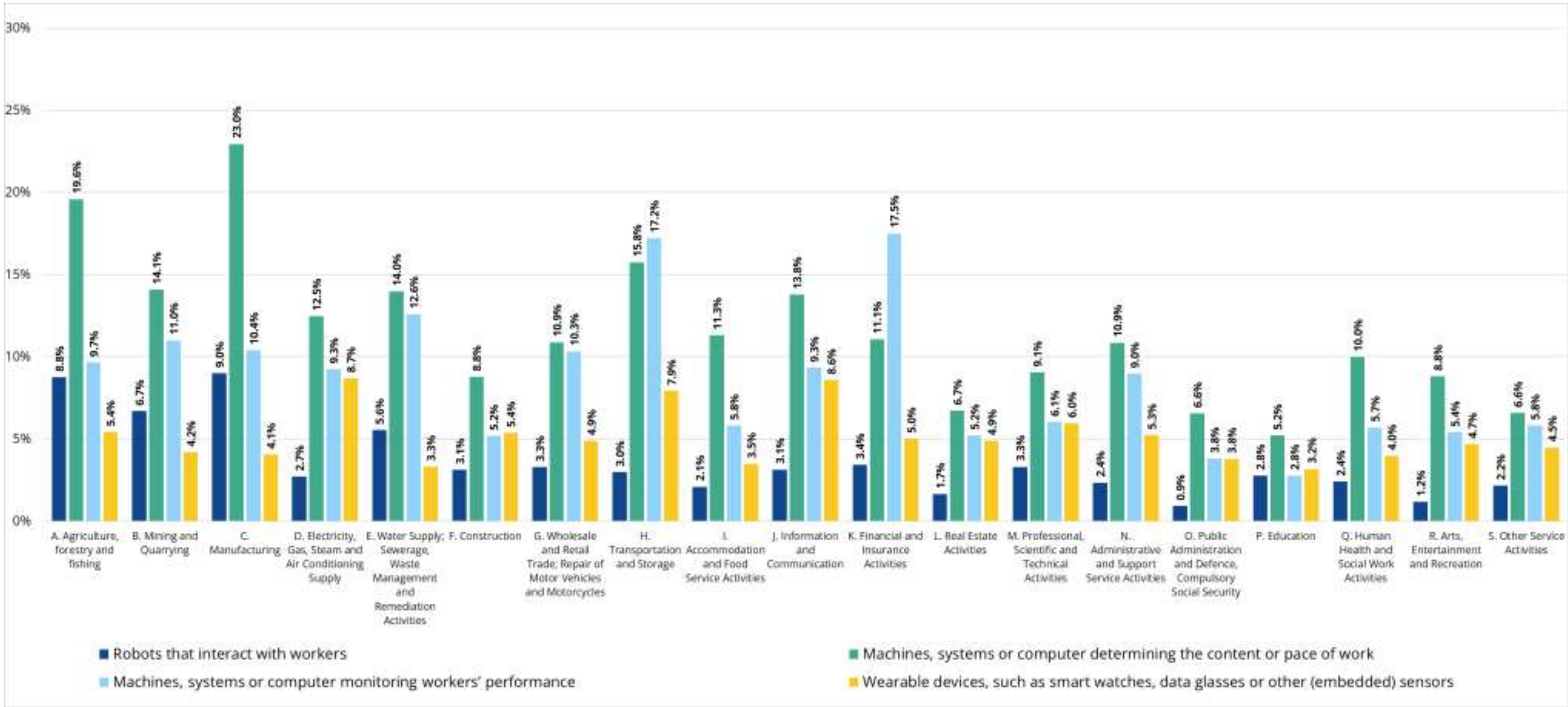
Figure 65: Percentage of companies in Poland that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 66: Percentage of companies in EU-27 that use different technologies associated with AM by economic sector



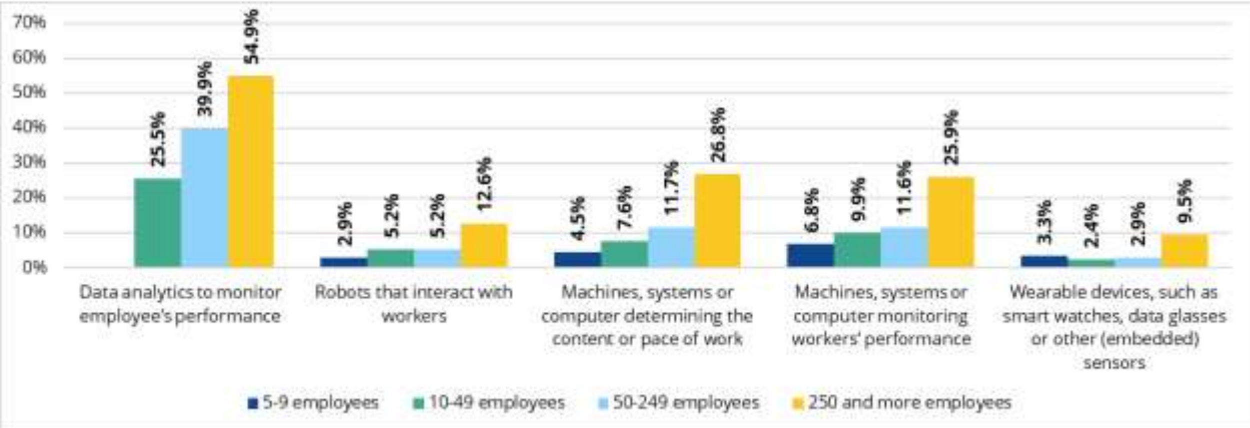
Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by company size

The relationship between use of different AM-related technologies and the size of companies in Poland reveals a clear pattern, in which the percentage of enterprises taking advantage of particular technologies is growing as the company's size increases. One exception can be found in this pattern – in case of wearables the frequency of use in small and medium-sized enterprises is lower than in micro companies (**Figure 67**). Important to emphasize is the noticeable discrepancy in the scale of utilization of these technologies between large companies and other size-groups – e.g., in Poland, large enterprises are more than twice as likely to use robots and systems to determine work pace or monitor workers' performance compared to medium-sized companies, whereas the use of wearables is more than three times higher among large enterprises. This means that large companies are most advanced as far as AM-related technologies are concerned[107]. Moreover, with regard to monitoring employees' performance, it is evident that many companies take advantage of data analytics but are much less likely to make use of more advanced AM tools in this area. This may mean that many enterprises still conduct performance assessments "manually". When comparing these data to the EU-27 average, a very similar situation can be observed at the EU-27 level (see **Figure** 68 below).

Figure 67: Percentage of companies in Poland that use different technologies associated with AM by type

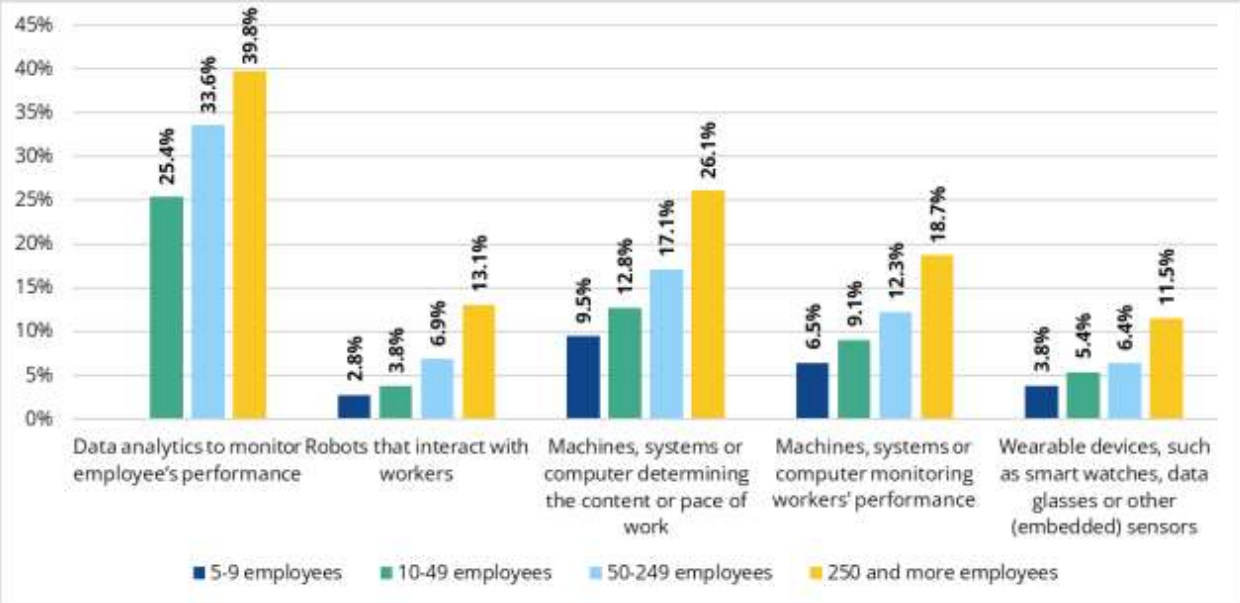


Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".

Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

[107] Such a conclusion also stems from interviews with stakeholders.

Figure 68: Percentage of companies in EU-27 that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for “data analytics to monitor employee’s performance”.

Source: Authors’ own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

5.4.3. Employees’ experience with AM

Overall experience by workers

As the EWCS-2021 study shows, the execution of work tasks of 65.9% of employees in Poland[108] are somehow influenced by computer systems, which is 8.3 p.p. more than average for EU-27. However, this stands as proxy evidence of the AM application, as it may not only refer to the automatic allocation of working hours or the planning of tasks and resources (which is an AM-based functionality) but also simple digitalisation solutions which automate working processes.

In addition, it is important to note that these percentages do not include individuals who did not answer the question (around 8.6 million individuals in Poland), which makes it difficult to draw a strong conclusion. The reasons for not including these non-answers in the calculation of the percentage are discussed in the footnotes.[109]

Furthermore, if we refer to ESENER-3 study to analyse the utilisation of AM-related technologies in Polish companies from the employees’ perspective, it appears that these technologies are not very popular in companies. 7.1% of employees are working in enterprises which use robots interacting with workers (compared to 7.3% in the EU-27). In case of 14.0% individuals, the content or pace of their work may be determined by machines, systems, or computers (17.3% EU-27). A slightly higher

[108] This share was calculated on the basis of answers provided by 8,057,154 respondents. 8,598,946 individuals did not provided their answer.

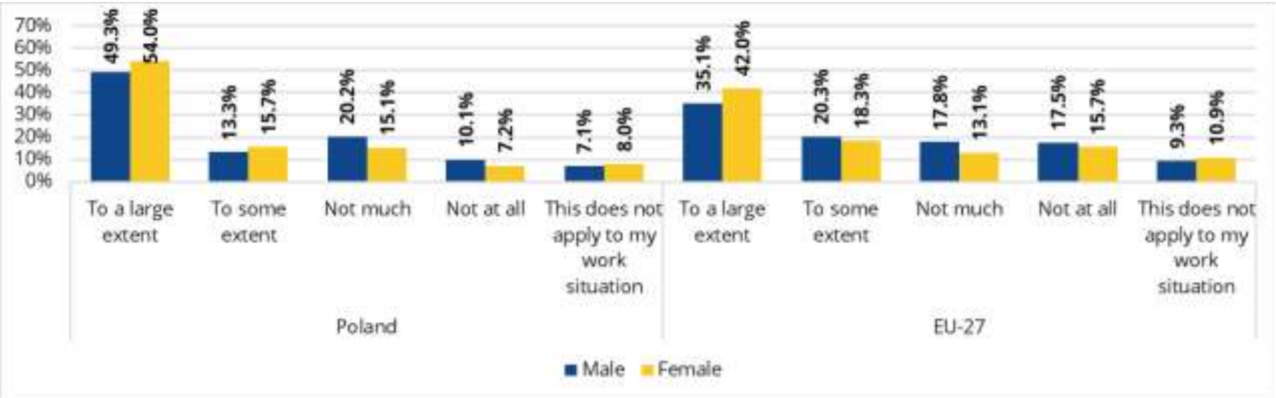
[109] The reason for not including these non-answers in the calculation of the percentage is related to the fact that a high number of such responses as “Don’t know” and refusals distorts the broad picture and does not allow us to assess for how many people computer systems influence what they do at work. In addition, it also would not allow us to compare Poland’s data with the EU-27 average as the higher response rate at the EU-27 level also implies a higher number of “Don’t know” responses or refusals. Considering these arguments, the inclusion of this type of answer does not have an added value here.

percentage of employees (14.6% vs 12.2% in EU-27) may have been monitored by systems / computers regarding their performance, while only 4.7% work in companies that use wearable devices (7.2% EU-27). Results show a larger scale of utilisation of the technologies in companies, compared to the employers' perspective. Importantly, since individuals reported on the use of technologies in their companies rather than the effects felt by these technologies, it is impossible to estimate the number of workers influenced by AM tools.

Usage by gender and age group

More detailed analysis how AM-related technologies may influence individuals' work is limited to data from the EWCS-2021 study, since additional variables (for dimensions like gender, age, and education level) are available only in this database. When it comes to gender, it seems that technologies are not gender-biased, meaning that both women and men perceive their impact in a similar way (in Poland, as well as in EU-27). The largest difference is reported in cases when IT systems influence work to a large extent (**Figure 69**) – it is noticeable more at EU-27 level (almost 7 p.p. difference), than in Poland (less than 5 p.p.). It is also worth emphasising that both women and men in Poland consider the impact of technologies on their workplaces to be large more frequently than men and women in EU-27.

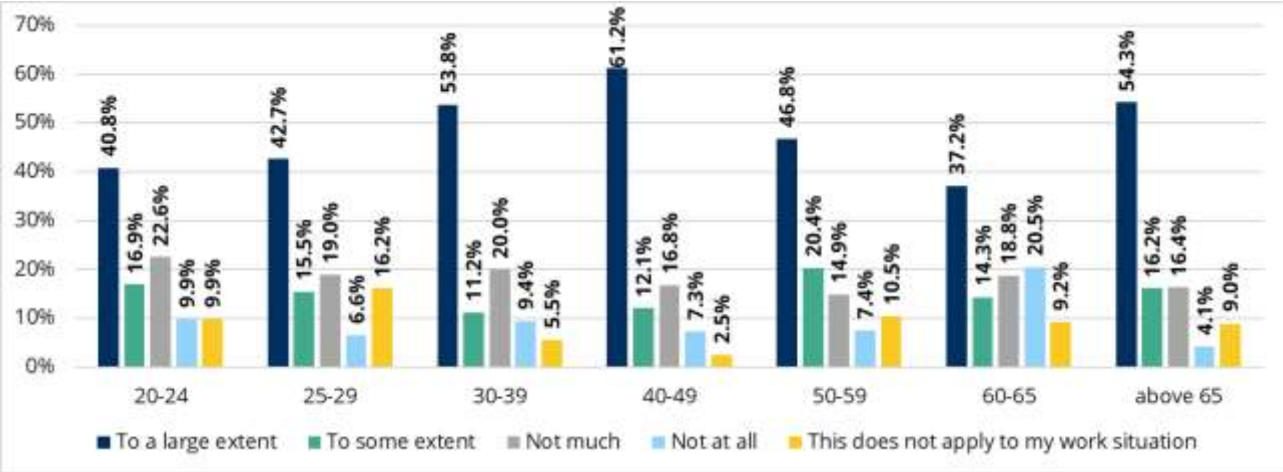
Figure 69: Percentage of workers by gender for whom computer systems influence what they do at work



Source: Authors' own elaboration, based on EWCTS (2021) data.

The extent to which technologies influence work tasks varies across age groups, however there is no clear pattern in this distribution (**Figure 70**). On the one hand, strong influence is reported most frequently by individuals in 40-49 age group (61.2%) and drops when moving to younger and older age groups. This regularity does not stand, however, in the case of the oldest group aged 65+, as the share of workers for whom technology largely influences their work is one the highest (54.3%) across all age groups. On the other hand, the share of individuals who do not interact with computer systems reaches its maximum in the (pre)retirement age group 60-65 (in Poland statutory retirement age is 60 years for women and 65 years for men) but decreases significantly for people aged 65 years and more. Hence, it seems that the common belief that older people are more prone to digital exclusion cannot be supported on the basis of the presented results. This relatively high impact of computer technologies on work performed by individuals 65+ may be explained by the fact that this group tends to consist of skilled people (who decided to continue their professional activities after reaching retirement age) who usually use digital technologies at work. When comparing this data to the EU-27 average, the situation at the EU-27 level is quite similar, even though the share of employees exposed to the influence of AM-based computer systems is lower.

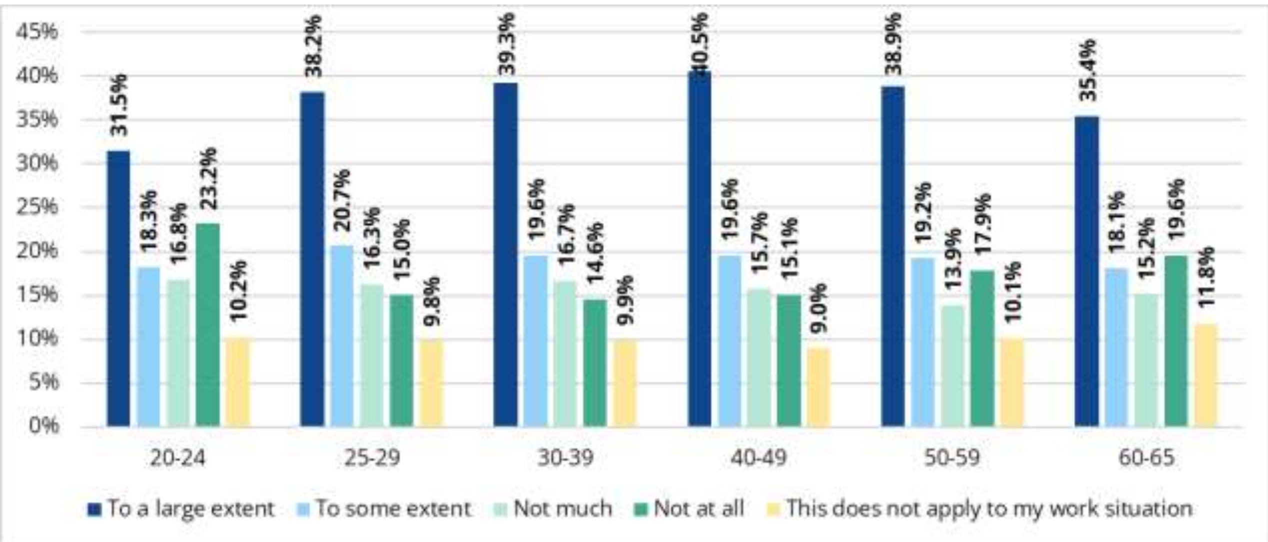
Figure 70: Percentage of Polish workers by age for whom computer systems influence what they do at work



Note: 15-19 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data

Figure 71: Percentage of workers in EU-27 by age for whom computer systems influence what they do at work



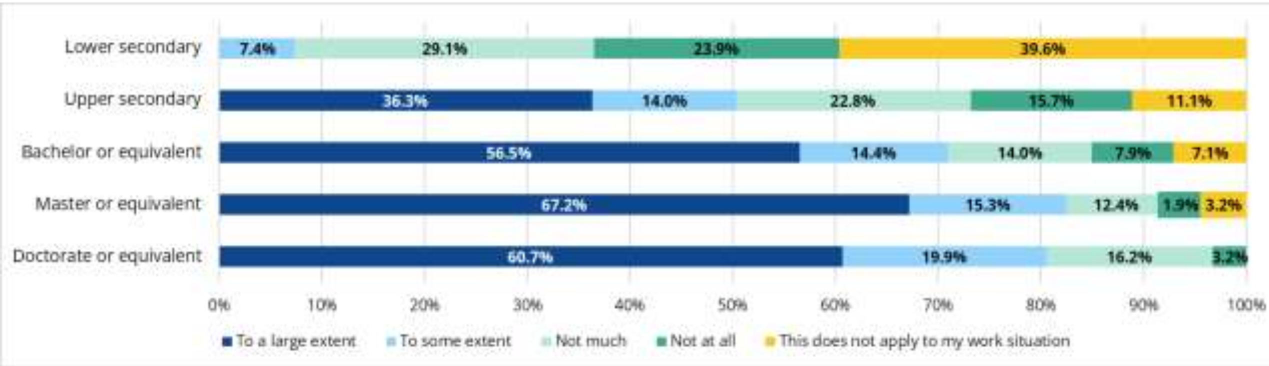
Note: 15-19 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data.

Usage by level of education

Impact of computer systems on individuals' workplace is also associated with educational attainment. In general, the higher the completed level of education, the larger the share of individuals who report strong influence of technology on the content of their jobs – none of the individuals with lower secondary education performed working tasks which would be strongly impacted by technology, while in the case of holders of master's degrees this situation applied to ca. 2/3 of this group (**Figure 72**). Interestingly, highly educated people with a PhD degree in Poland seem to be less exposed to computer (AM-based) systems driving their job content, compared to those holding a master's degree. At the same time, the share of individuals for whom AM-based technologies do not have an influence on their work tasks is evidently decreasing in better educated groups (reaching 1.9% for people with master's degree, and 3.2% for PhD holders).

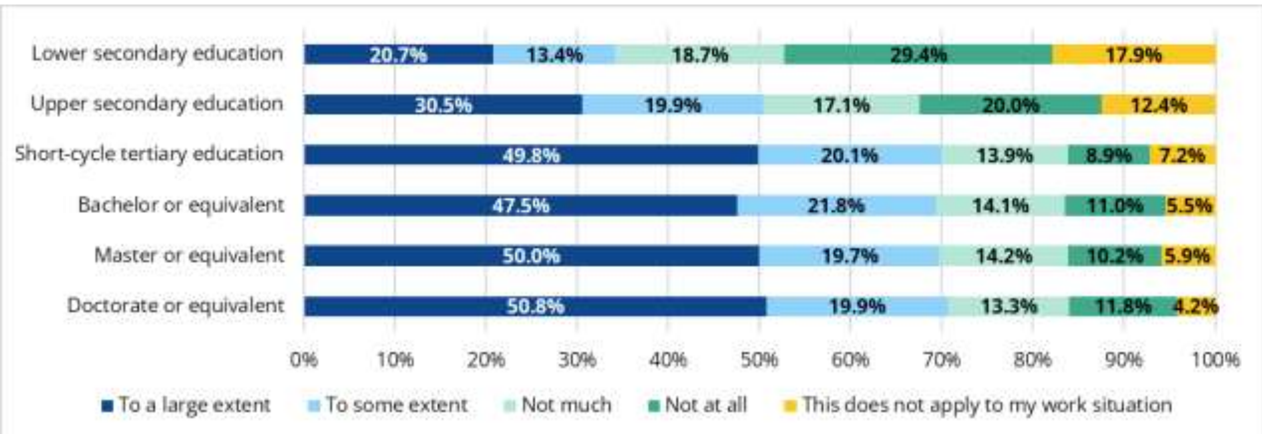
Figure 72: Percentage of Polish workers by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.

Source: Author's own elaboration, based on EWCTS (2021) data.

Figure 73: Percentage of workers in EU-27 by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.

Source: Author's own elaboration, based on EWCTS (2021) data.

When comparing the above-discussed data to the EU-27 level average, at the EU-27 level a similar pattern is observed. Specifically, the higher the education level, the higher the reported influence of AM-based computer systems. However, this is not the case for people holding bachelor's degrees, where the influence of AM-based computer systems is experienced by only 47.5% of employees (which is lower than among employees with short-cycle tertiary education level) (see **Figure 73**).

5.4.4. Review of AM-related regulatory context in Poland

The need to introduce a regulatory framework with regard to AM is now a matter of academic debate rather than legislative work. It seems that the discourses on the future of work in light of developments in artificial intelligence are held predominantly in the context of job losses and technological unemployment. However, scholars also notice that many areas that were previously the sole responsibility of managers are increasingly affected by algorithmic management, these being: employment relations, hiring, performance management, and remuneration[110]. This process carries significant repercussions for human rights protection, including discrimination in employment.[111] AM is based on the electronic collection and processing of data, therefore regulations in these fields may also apply.

Experts and employers' organizations representatives unanimously state that the topic of AM utilisation in companies is not on the top of the agenda in discussions related to labour issues. This topic is a relatively new one in the public domain - the discussion has been triggered largely as a result of EU-level initiatives regarding Artificial Intelligence and AM, and to some extent Polish legislative initiative (described below). Recent inflow of news with regard to GPT capabilities has also fuelled the discussion on algorithms in Poland. However, the level of expertise is relatively low since no research studies in this area have been conducted in Poland as of yet. The greatest challenges of AM utilization refer to the lack of transparency on how the algorithm works; lack of specific technical know-how on algorithms among stakeholders (employees, employers, policy-makers); lack of legal framework and legal definitions of AI/AM in Polish and EU law; and insufficient levels of social dialogue dealing with the impact of algorithmic management on workplace and workers' wellbeing (because of this, social dialogue on EU level seems to be particularly important). At the same time there is no doubt that the scale of AM use in different HR processes will be growing as a result of dynamic technological development. As such, there is a need for regulating AM use. However, there are discrepancies as for the scope of regulation between various stakeholders (employers are in favour of guidelines based on best practices, while experts opt for more detailed regulation – e.g., in the form of Artificial Intelligence Act). Since there is not much progress in this area in Poland, EU legislative initiatives seem to be necessary interventions. Providing transparency of use of algorithms is perceived as a critical task within the regulatory framework. Interestingly, both experts and employers' representatives are of the opinion that algorithms should support decision-making processes, but the final decisions must be made by humans[112].

Based on literature analysis and interviews with stakeholders, the following should be considered as the existing AM-related regulatory context in Poland.

- **Labour code**[113], including especially regulations on non-discrimination and video surveillance.

[110] Branowska, A. (2021). Proces doboru pracowników w przedsiębiorstwach – przegląd nowoczesnych i tradycyjnych metod selekcji. Zeszyty Naukowe Politechniki Poznańskiej. Organizacja i Zarządzanie, 83, 9-25; Sienkiewicz, L. (2021). Algorithmic Human Resources Management – Perspectives and Challenges. *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia, 55(2), 95-105;*

[111] Otto, M. (2022). Dyskryminacja algorytmiczna w zatrudnieniu. Zarys problemu. Studia z Zakresu Prawa Pracy i Polityki Społecznej, 29(2), 145-160.

[112] This paragraph is based on interviews conducted with stakeholders.

[113] Ustawa z dnia 26 czerwca 1974 r. Kodeks pracy – Labour Code of 26 June 1974 (Journal of Laws 2022, item 1510, as amended), available at: https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU19740240141/U/D19740141Lj.pdf

- Employment relationship is a subordinated one, i.e., an employee performs work under the direction of the employer. As a result, the employer has the right to assess the employee based on information at the employer's disposal. The employer may freely determine the rules and criteria for evaluating the employee's work, provided, however, that they are objective, fair, and non-discriminatory, which refers both to hiring and performance assessment. A way of gathering information on employees' behaviour is video surveillance. The Labour code provisions determine the conditions for admissibility of the video surveillance, e.g., the necessity to ensure the safety of employees or to protect property and business secrets, as well the procedures for its introduction in a workplace. In addition to that, the employer must be particularly careful when collecting information about the employees' whereabouts so as not to violate their general right to privacy.

- **General Data Protection Regulation**: Being the part of Polish legal order in the context of labour, it will be applied in conjunction with Labour code's regulation both on non-discrimination and workplace video-surveillance. In both contexts, data collection, protection, and processing, including when in cyberspace, will be subject to the provisions of the GDPR. **The Polish Act on personal data protection** will also apply as a procedural act aiming at the execution of GDPR provisions.[114]

As for the **legislative initiative** regarding AM specifically, a draft amendment of The Act on Trade Unions was proposed by the Commission for Digitization, Innovation and Modern Technologies of the Sejm (Polish parliament). It provides for the implementation of a provision obligating the employer to submit to the company's trade union organisation information on the parameters, rules and instructions on which AI systems are based if such systems affect decision-making about working conditions or pay, access to jobs and job retention, including profiling. Such provisions shall counteract employees' exploitation and also be an implementation of their fundamental right to information. The proposal of this amendment was developed on the basis of similar solutions enforced in Spain – trade union representatives and some members of the Commission for Digitization, Innovation and Modern Technologies consulted their initial ideas with experts from Spain. Finally, the proposal was prepared and deliberated. The amendment was proposed on 15th September 2022, and then forwarded to work in the Sejm's commissions on 28th September 2022[115]. Since that moment there was no further parliamentary work on it, however, there is a chance that within a couple of weeks the amendment will be further processed.

As for **AI-related legislation no longer in force**, unemployment profiling by labour offices has to be mentioned. Based on the Regulation by the Minister for Labour[116], algorithms were used by employment offices for the profiling of the unemployed unil 14th June 2019. The issue raised numerous questions, for one, because the way the algorithm used for profiling of the unemployed in employment offices was originally not publicly accessible. Also, it was revealed that in some offices the system would automatically qualify the unemployed, while in others, officials try to interfere with this automatism. The lack of transparency was reported by both labour offices themselves and human rights organisations.[117] After the Regulation lost its force as the result of the Constitutional Tribunal's Judgement, the legal bases for the profiling of the unemployed as such was removed from

[114] Ustawa z dnia 10 maja 2018 r. o ochronie danych osobowych – Act of 10 May 2018 on personal data protection (Journal of Laws 2019, item 1781,as amended), available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20180001000

[115] https://www.sejm.gov.pl/Sejm9.nsf/PrzebiegProc.xsp?id=F1D9C32EE2AB85BDC12588CB0031A801#xd_co_f=OTA2OGRiYWEtYmI0NC00NGIwLTg3MTItMzA1ZTkxZWE0YmY3

[116] Rozporządzenie Ministra Pracy i Polityki Społecznej z dnia 14 maja 2014 r. w sprawie profilowania pomocy dla bezrobotnego - Regulation of the Minister of Labour and Social Policy of 14 May 2014 on profilling the suport to the unemployed (Journal of Laws 2014, item 631), available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20140000631

[117] https://panoptykon.org/wiadomosc/co-zawiera-algorytm-sluzacy-do-profilowania-w-urzedach-pracy (accessed 10.03.2023)

the *Act on Employment promotion and labour market institutions*[118], on the initiative of the Minister for Labour.

Governmental policy acts refer to the AI development in general rather than to the specific AM issues. *The Policy for the Development of Artificial Intelligence in Poland from 2020*[119], although emphasising AI's potential for economic development, at the same time does not underestimate the threats resulting from the progress of work automation, including technical unemployment, and simultaneously insists on the need to undertake proper measures to counteract such an undesirable aftermath. In turn, the *Statement of purpose for the AI strategy in Poland. Action plan of the Ministry of Digital Affairs*[120] notes the ability of AI systems to make discriminatory decisions, which may result from erroneously formed sets of training data. This document identifies the need to develop anti-discriminatory legal regulations, however, it gives no specific legislative proposals.

The **judicial practice** so far neither identifies AM-related legal problems nor provides guidance as for prospective future legislation. Two cases[121] have been identified where there is an indirect link between the application of the electronic attendance registration system and the employer's decision to terminate the employment contract. Namely, employees were preliminarily selected for dismissal based on the percentage of sick-leave time in the employees' overall working hours calculated by the system and its indications on employees' absence from work for other reasons[122]. However, it is unclear from the written statements whether the employer used an automated decision-making process to terminate the contract. The courts judged the terminations in both cases were unlawful, yet it was purely for legal reasons unrelated to the application of the attendance registration system. However, information collected within interviews with stakeholders indicate situations when workers (also trade union representatives), who tried to provide information to the public about AM practices in some companies, lost their jobs (officially dismissals were not driven by their AM-related activities).

5.4.5. Conclusions

The overall level of technological advancement in Poland is below the EU-27 average, thus it is not surprising that the use of AM-based digital technologies in the HR domain is not widely spread across companies / organisations operating in Poland. It is virtually impossible to properly estimate the scale of different AM tools on the basis of publicly available data. There is also a lack of more in-depth studies in this area, as this topic has emerged in public discussions in Poland relatively recently. The main conclusions / messages stemming from the analysis of statistical data are the following:

[118] Ustawa z dnia 20 kwietnia 2004 r. o promocji zatrudnienia i instytucjach rynku pracy – Act of 20 April 2004 on employment promotion and labour market institutions (Journal of Laws 2022, item 690, as amended), available at: https://isap.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20040991001

[119] Appendix to the Resolution No. 196 of the Council of Ministers of 28 December 2020 (item 23), available at: https://monitorpolski.gov.pl/MP/rok/2021/pozycja/23

[120] The Statement of purpose for the AI strategy in Poland. Action plan of the Ministry of Digital Affairs Recommendations prepared pro bono, at the invitation and under the direction of the Ministry of Digital Affairs by stakeholders interested in the development of AI in Poland., available at: https://www.gov.pl/documents/31305/436699/Za%C5%82o%C5%BCenia_do_strategii_AI_w_Polsce_-_raport.pdf/a03eb166-0ce5-e53c-52a4-3bfb903edf0a

[121] Sąd Rejonowy Poznań Grunwald i Jeżyce w Poznaniu, case ref. No, V P 695/16, (I instance), Sąd Okręgowy w Poznaniu 7 grudnia 2018 r. , case ref. No. VIII Pa 160/18 (second instance); Sąd Okręgowy w Poznaniu w wyroku z 29 października 2018 r. (case ref. No. VII Pa 57/18), Sąd Rejonowy Poznań - Grunwald i Jeżyce w Poznaniu, case ref. No. VI P 655/16.

[122] Please note, that in the "Mapping of the relevant case law" I have made a following comment: "Based on percentage of sick leave in working time, algorithms used by Amazon selected employees for dismissal." I also indicated the judgement of Sąd Okręgowy we Wrocławiu (case ref. No VIII Pa 43/18) as a third possible case where such selection supposedly took place. Those information was based on the public sources accessible to me at the moment of making of the *Mapping*. However, the detailed analysis of the judgements' statement of reasons, which were only available to me later on, did not confirm the above.

- AM tools are more frequently used in larger companies (many of which are subsidiaries of multinational corporations) operating in private sector.

- There are perceptible differences in the utilization of particular AM solutions across the economic sectors, which stems from the intrinsic features of these solutions, and their potential applications in the sector. Although no clear pattern was revealed, the manufacturing industry seems to be the “largest” user.

- The issues discussed most in companies, related to implementation of (AM) technologies, include development of required skills and physical nuisance, while blurring boundaries between private life and work, and fear of job loss are among the least discussed.

- More than 2/3 of workers in Poland are somewhat influenced by computer systems. However, this does not indicate that all of them are exposed to AM tools. Interestingly, even if digital technologies are more common in private companies, individuals working in the public sector in Poland are more impacted by these technologies than their colleagues from private sector.

- Technology is, in general, gender-neutral but biased towards better educated individuals, who are in the middle of the age distribution.

The conclusions based on the qualitative research approach may be summarised in the following way:

- The presence of AI and AM topics in the public domain in Poland is still relatively low, including discussions within the social dialogue framework. Trade union representatives seem to be most active in the Social Dialogue Council with regard to implementing the European social partners' agreement on digitization from 2020, which strongly emphasises the role of AI in the workplace.

- Although policy makers notice the multifaceted issues related to AI and AM utilisation, it seems they are not proactive in developing new regulatory proposals – they are rather waiting for EU institutions’ decisions regarding AI and AM regulations, to transfer these rules into the national legal framework. At the same time, the need to define and implement the legal framework on AM at the EU level is strongly awaited (since lack of legal definitions of algorithms and algorithmic management is perceived as one of main challenges in the broader utilization of AM tools).

- Transparency seems to be a critical feature of any AM-related legislative proposal.

- Algorithms shall support humans in the decision–making process with regard to personnel management, while sole decisions made by algorithms, without humans’ involvement is not a recommended solution – that is the joint message of different stakeholders.

5.4.6. Interviewees

Table 19: List of interviewees

Person		Reason of involvement	Date
1	Robert Lisicki, PhD	Head of Labour Department in the Confederation Lewiatan – most influential Polish employers’ organisation	March 20

	Person	Reason of involvement	Date
2	Izabela Florczak, PhD	Expert in labour law, consulted the amendment of The Act on Trade Unions with regard to obligations of the employer to inform on use of AI systems in company	March 21
3	Liwiusz Laska, PhD	Advisor to All-Poland Alliance of Trade Unions (OPZZ) involved in works of the Commission for Digitization, Innovation and Modern Technologies in the Parliament	March 28
4	Barbara Surdykowska	Senior Adviser, National Commission of NSZZ Solidarność	April 4

Source: Authors' own elaboration.

5.5. Spain case study

The case explores the application of algorithmic management (AM) in Spanish workplaces. The case is based on **three main data sources:**

1. **Literature review and desk research**
2. **Interviews with stakeholders** (Table 20: List of interviewees at the end of the document presents the list of interviewees).
3. **Quantified data from the EU and international surveys** (e.g., ECS-2019, EWCTS, ESENER-3, and DESI).

It is important to highlight that the case study only presents the most important data in Spain, while more data can be found in **Annex 6 – Quantified data for the country case study.xls**.

The structure of this case study is as follows. The first section explores the background of the AM application in Spain, presenting the digitalisation context and AM use. The second section presents the quantitative data on AM usage in Spanish workplaces, focusing on the general situation, as well as on AM use in companies of different types, economic sectors, and sizes. The third section discusses the employees' perception of AM use, differentiating the results based on the gender, age, and education of employees. Finally, we will present a comprehensive review of the AM-related regulatory context in Spain.

5.5.1. The context of AM application at the workplace in Spain

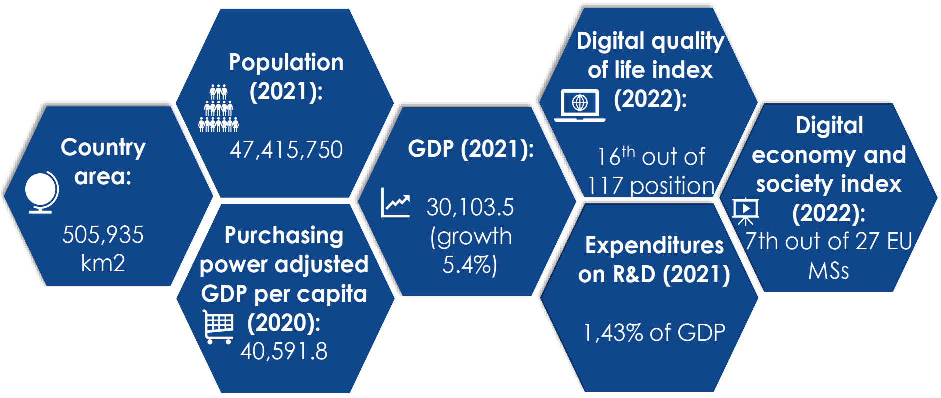
The context of the AM application: general digitalisation process, public debates, and the economic background

Spain has a relatively high digital economy and society index (DESI) score (60.8), ranking 7th among the EU Member States (see **Figure 74**). It is particularly strong in terms of connectivity (3rd position in the EU) and is making notable progress regarding the integration of digital technology, digital public services, and human capital. Still, enterprises in Spain are reportedly behind on cloud or big data and other advanced digital technologies,[123] even if Spain's performance on AI is aligned with the EU average (8%).[124]

[123] Digital Economy and Society Index (DESI) 2022, Spain, p. 4.

[124] Digital Economy and Society Index (DESI) 2022, Spain, p. 12.

Figure 74: General quantified indicators about Spain



Source: Authors' own elaboration, based on the official data sources.

According to Eurostat (DESI) from 2021, AI technology (as a proxy evidence of the AM application) is used mostly by companies with 250 and more employees (32.3%). The use of AI is less prevalent among companies employing 50-249 workers (13.4%), and even less widespread among those employing 10-49 employees (6.1%). There are great sectoral differences in AI use. Companies providing information and communication services adopt AI most often (26.7%), followed by those providing professional, scientific, and technical activities (13.7%) and those operating in the transportation and storage sector (9%). Only 0.5% of companies employing 10 or more employees use AI for HR management or recruitment purposes.[125] Analysis of big data from smart devices and sensors is more common than AI-driven HR management and recruitment, with 2.3 % of companies employing more than 10 workers resorting to this method.

The use of AM in Spain

According to one interviewee, only 8% of companies use AM-based tools and fewer than 1% of workplaces are managed by AM. As a result, the trade union movement is not particularly concerned with the risk of substitution posed by new technologies and algorithms. Algorithms seem to be mainly used in two phases of the employment lifecycle: personnel selection and worker monitoring. Large enterprises use filters to screen large numbers of applications. Small and medium-sized enterprises (with fewer than 50 workers) rent software and applications from third-party providers. The application of dashboards and technologies for company-level functions such as payslips and administrative requirements is also increasing.

5.5.2. The use of AM by employers

This section explores how extensively AM is being used in Spanish companies. It is important to note that some of the data refers to digital (AI) tools, rather than strictly to AM-based tools. This is because, on the national level, there is almost no data specifically about the application of AM, mainly due to the novelty and complexity of AM. However, the available data on the usage of digital tools presented in this study directly includes AM features, such as employee monitoring, determination of the pace of work, use of robots in the working process, and others.

[125] This is the case for 4.1 % of companies employing over 250 employees, and to a much lesser extent for small and medium enterprises (0.5% and 0.6% respectively).

In addition, the majority of data comes from 2019, before the COVID-19 pandemic, which had a strong effect on the usage of some AM technologies, such as those that monitor workers when they telework. Nevertheless, it gives good (preliminary) indications of how prominent AM is in Spain.

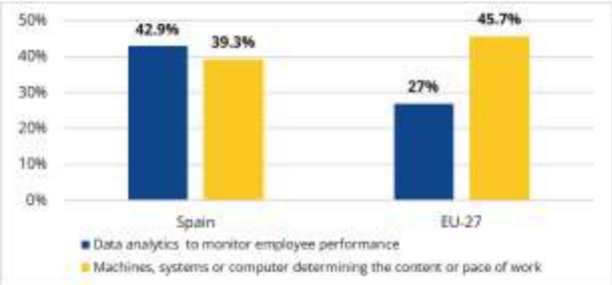
To obtain more relevant estimates of AM usage, survey results from ECS-2019, EWCTS-2021, and ESENER-3 (2019) were extrapolated to determine the number of employers and workers using such tools. This was done by applying relevant weights from each survey. For more information on how the data was weighted, please refer to **Annex 6 – Quantified data for the country case study.xls**.

Overall usage of AM in companies

According to the ECS-2019 study, around 42.9% of companies with more than 9 employees use data analytics to monitor employee performance (see **Figure 75**).[126] This is considerably higher than the EU-27 average, which is around 27%. Furthermore, 39.3% of Spanish enterprises[127] determine the pace of work by means of machines or computers for at least some workers. The greatest share of companies (15.73%) does so for fewer than 20% of their employees, and only 2.36% of them report to determine the pace of work for all employees.

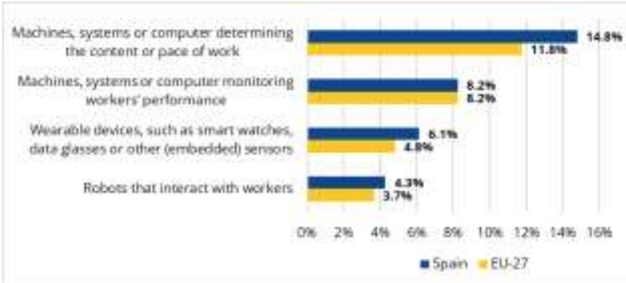
Drawing on the ESENER-3 2019 survey,[128] 14.8% of enterprises in Spain use machines, systems, or computers to determine the content or pace of work and 8.2% of them do so to monitor workers' performance. The use of wearables and robots interacting with workers is less widespread (6.1% and 4.3% of companies respectively) (see **Figure 76**).

Figure 75: Percentage of companies (with more than 9 employees) using specific AM tools



Source: Authors' own elaboration, based on ECS-2019 data.

Figure 76: Percentage of companies (with 5 or more employees) using specific AM tools



Source: Authors' own elaboration based on ESENER-3 data.

The potential impact of AM technologies is discussed by 33.21% of enterprises (on average). Private companies discuss it slightly more frequently than public ones.[129] As shown below in **Figure 77**, the main topic of these debates relates to the risks of musculoskeletal disorders, caused by situations such as prolonged sitting[130] and repetitive movements. The need of providing workers with continuous training and more flexibility in terms of place and time of work is also commonly discussed (in nearly 75% and 66% of enterprises respectively). Information overload and increased intensity of work or time pressure is debated in roughly half of the Spanish enterprises using AM systems.[131] Blurring boundaries between work and private life, as well as fear of losing a job are less discussed,

[126] I.e., 83354 out of 194862 of such companies.

[127] I.e., 73439.

[128] The survey does not cover companies with fewer than 5 employees.

[129] 30% of public companies and 33,51% of private companies discuss it. This number does not include companies for which no data was provided (8336 out of 394358 private companies included in the ESENER-3 2019 survey, 2,11%), and 527 out of 60930 public companies (0,9%).

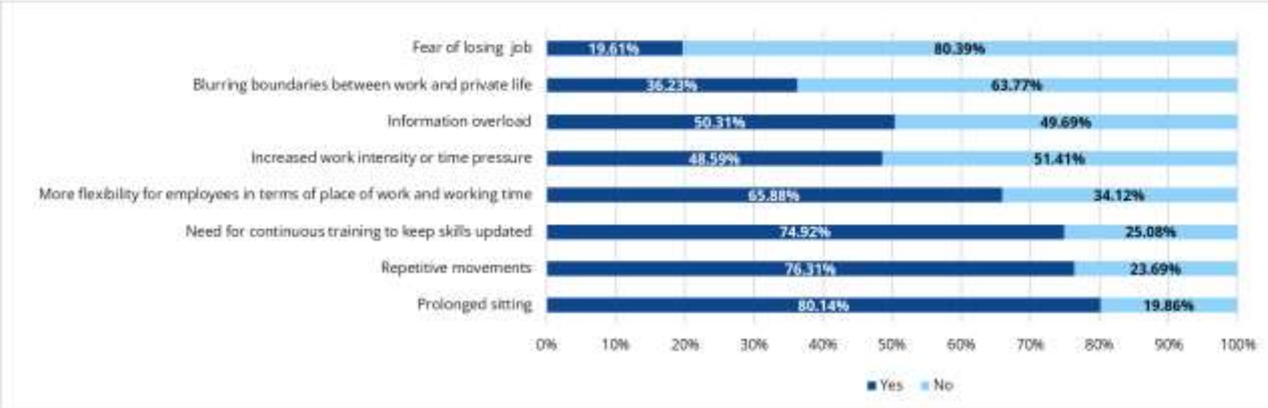
[130] Discussed in 109832 enterprises. No data was available on this aspect in 320708 enterprises.

[131] No data was available on this aspect in 327689 enterprises.

although they are present in a non-negligible share of Spanish enterprises (36% and almost 20% of enterprises, respectively).[132;133]

The situation in Spain, based on the above-discussed data, slightly differs from the situation at the EU-27 level. Mainly, at the EU-27 level, the majority of enterprises tend to discuss a need for continuous training (77.3%), while such AM-related issues as prolonged sitting (65.96%) and repetitive movements (58.12%) are being discussed less frequently (see **Figure 78** below).

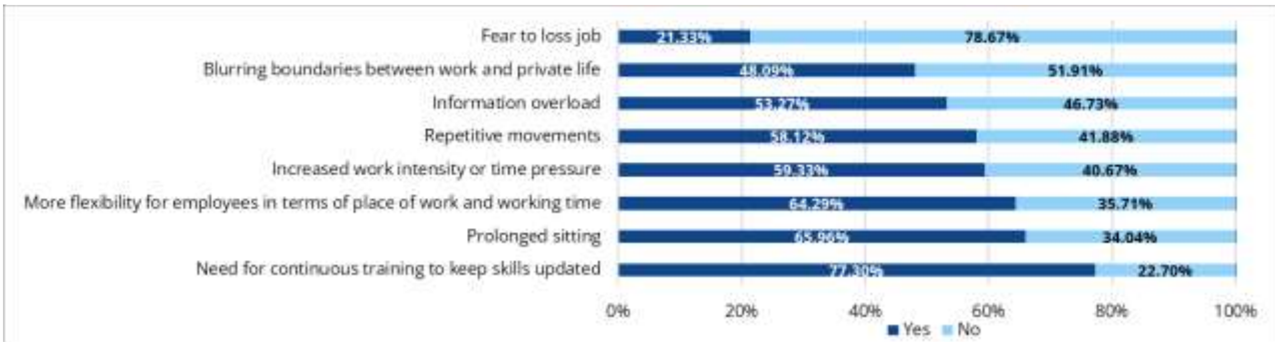
Figure 77: Percentage of enterprises in Spain discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 78: Percentage of enterprises in EU-27 discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage of AM in the public and private sector

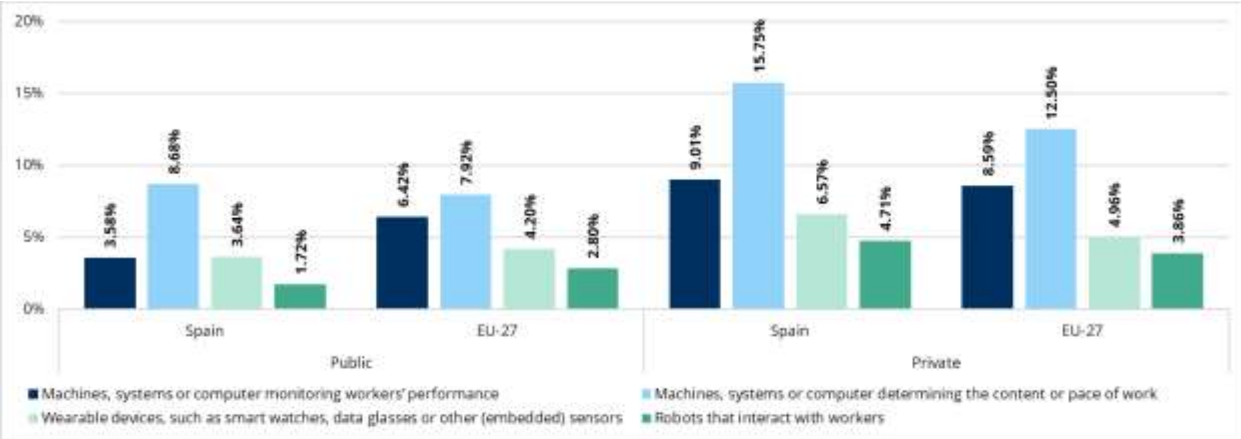
In Spain, much as in the EU-27, each technology associated with AM is used to a lesser extent in the public than in the private sector. As shown in **Figure 79** below, machines, systems or computers determining the content and/or pace of work are used in a relatively large share of Spanish private companies (15.75%). Likewise, this type of system is the most widespread AM-related technology in the public sector (8.68% of Spanish enterprises). The second most common technology for both

[132] No data was available on this aspect in 327689 enterprises.

[133] An important limitation of this data is, however, that data is not available on a high number of enterprises (i.e., around 322000 of them, amounting to about 70% of all companies covered in the ESENER-3 2019 study). This number varies depending on the specific factor. E.g., no answer was given with regard to fear to lose job in 322691 companies and in 324228 with regard to the blurring boundaries between work and private life.

sectors, both in Spain and in the EU-27, are systems monitoring workers' performance. Such systems are used in 9.01% of private enterprises and 3.58% of public enterprises in Spain. Wearables are less common in this country, applied in 6.57% of private and 3.64% of public enterprises. Robots interacting with workers represent the least widespread category of AM-related technologies, used in 4.71% of private and only in 1.72% of public enterprises. Interestingly, the use of AM in Spanish public companies falls below the EU-27 average, while for private companies it is above that average. The only exceptions are systems determining the content or pace of work, which are more widespread in both public and private enterprises in Spain than on average in the EU-27.

Figure 79: Percentage of public and private enterprises in Spain using different technologies associated with AM



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data..

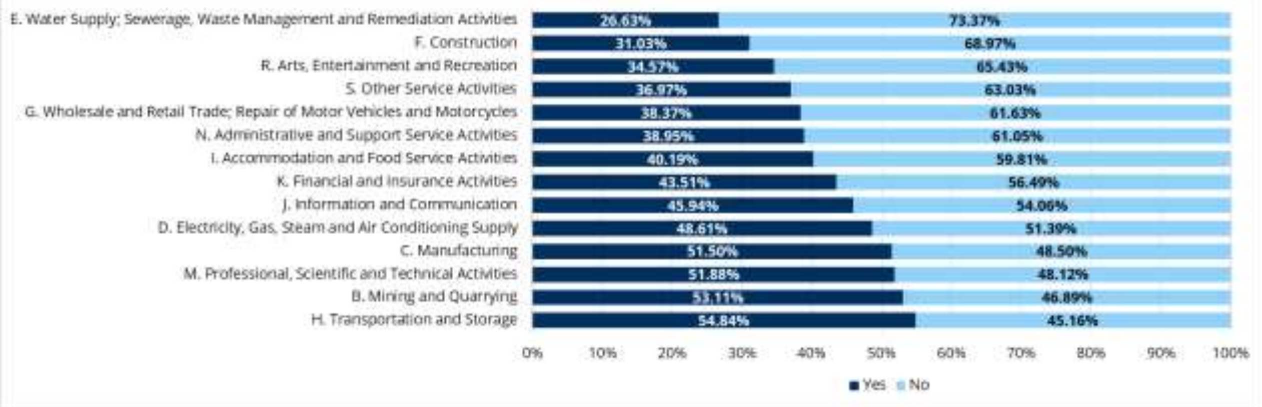
Usage of data analytics by economic sector

The use of data analytics varies greatly across economic sectors. **Figure 80** below illustrates that it ranges from nearly 55% in transport and storage to 26.6% in the water supply, sewerage, waste management and remediation activities industry. Meanwhile, at the EU-27 level these percentages are lower (12.1% to 35.9%) (see **Figure 81**). Only in four sectors in Spain is it used in more than 50% of companies: transport and storage; mining and quarrying; professional, scientific, and technical activities; as well as manufacturing. It is, thus, more prevalent in blue-collar than in white-collar sectors. Roughly 46% of companies in the information and communication sector, and 43.5% of companies providing financial and insurance activities use data analytics. These results need to be considered with two important caveats. Firstly, there was no available data on some companies in sectors covered by this study.[134] Secondly, five sectors have not been covered in the ECS-2019 (managers) survey on which this analysis is based, due to a lack of data.[135]

[134] Manufacturing (66 out of 27545 companies); water supply (20 out of 3309 companies), construction (120 out of 19633 companies), information and communication (248 out of 17879 companies), administrative and support service activities (73 out of 8088 companies); other service activities (131 out of 38015 companies).

[135] No data was available in four sectors, namely: public administration and defence, compulsory social security; education; human health and social work activities; agriculture, forestry and fishing. Moreover, there was not enough data (i.e., fewer than 10 observations) on the real estate activities industry.

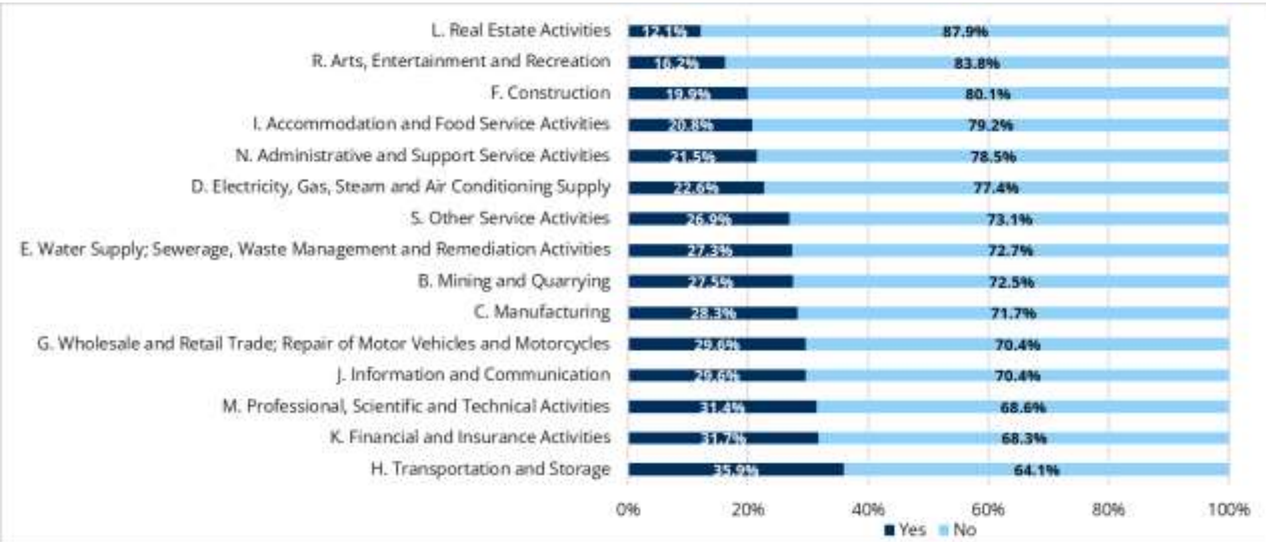
Figure 80: Percentage of companies in Spain, by sector, using data analytics to monitor employee's performance



Note: Only companies with over 9 employers are covered.

Source: Authors' own elaboration, based on ECS 2019 data.

Figure 81: Percentage of companies in EU-27, by sector, using data analytics to monitor employee's performance



Note: Only companies with over 9 employers are covered.

Source: Authors' own elaboration, based on ECS 2019 data.

Usage of technologies associated with AM by economic sector

Systems determining the content and pace of work are the most common type of AM-related technologies across all economic sectors. As illustrated in **Figure 82** below, they are most widespread in manufacturing (23.9% of companies)[136] and real estate services industries (21.5%), and least common in the arts, entertainment, and recreation sector (4.7%). Meanwhile, at the EU-27 level this situation is quite similar. Here, this type of AM-related technologies is being most actively used in manufacturing (23%) and agriculture, forestry, and fishing sectors (19.6%), and least actively

[136] No data was available on 42 companies in this sector regarding this question.

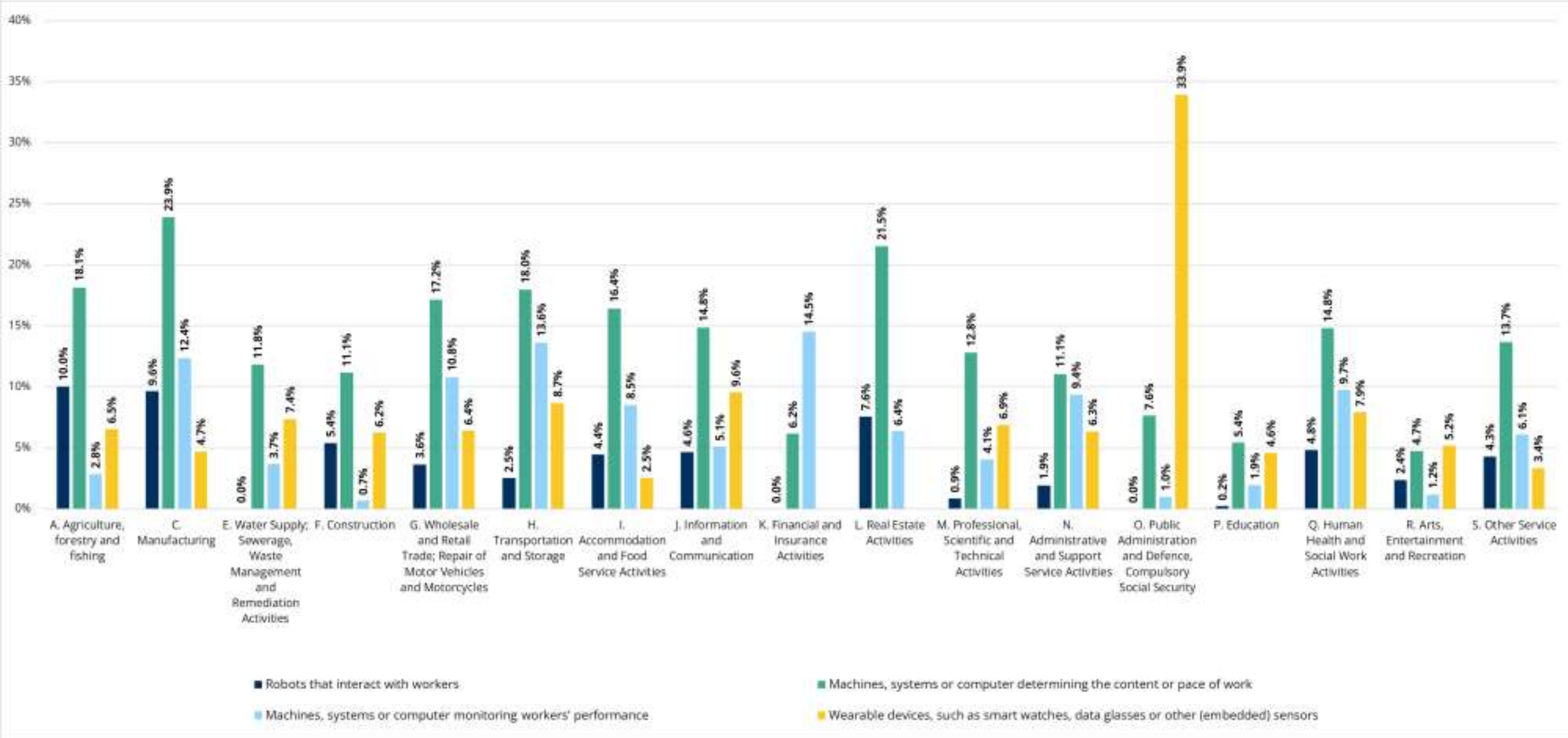
in education (5.2%) and public administration, defence, and compulsory social security (6.6%) sectors (see **Figure 83**).

Furthermore, in Spain, machines monitoring workers' performance were introduced mostly in companies operating in the financial and insurance services sector (14.5%) and transportation and storage (13.6%). In four sectors, i.e., construction; public administration and defence, compulsory social security; arts, entertainment, and recreation; and education, such systems were used in fewer than 2% of companies on which data was provided. Meanwhile, at the EU-27 level, such economic sectors as the financial and insurance services sector (17.5%) and transportation and storage sector (17.2%) also stand out as the most active users of AM-based technologies for employee monitoring purposes.

In addition, robots that interact with workers were used in the agriculture, forestry and fishing sector (10%) and manufacturing (9.6%) – similar to the EU-27 where 8.8% and 6.7% (respectively) of companies in those sectors use it. There were three industries in which they were not used in a single company: water supply; sewerage, waste management and remediation activities; financial and insurance activities; and public administration and defence, compulsory social security.

Finally, wearables are most widespread in two industries: real estate services (34.3%) and public administration and defence, compulsory social security (33.9%). Remarkably, this is the highest percentage of AM use across all types and industries. Meanwhile, when comparing this data to the EU-27 level average indicators, this type of AM technology is not being used that frequently.

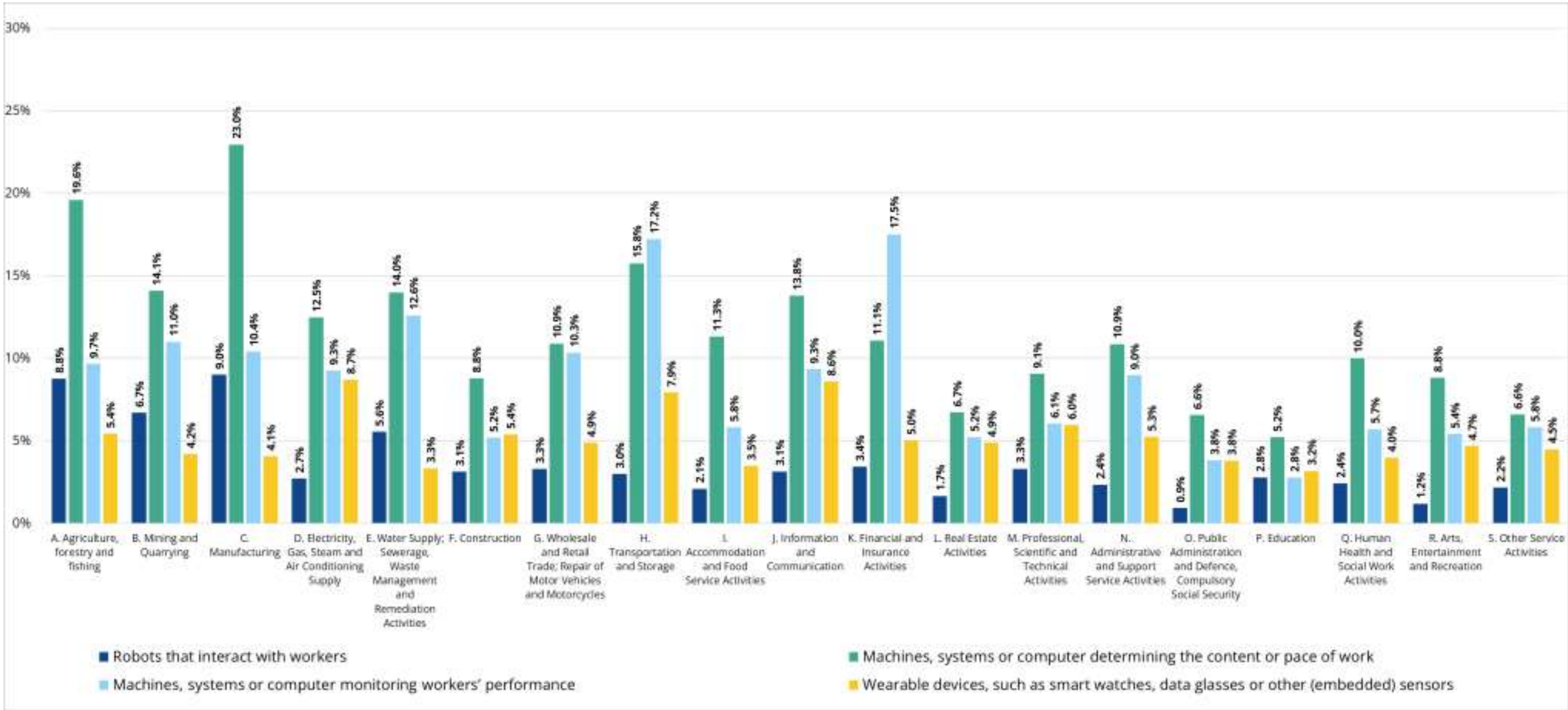
Figure 82: Percentage of companies in Spain that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 83: Percentage of companies in EU-27 that use different technologies associated with AM by economic sector



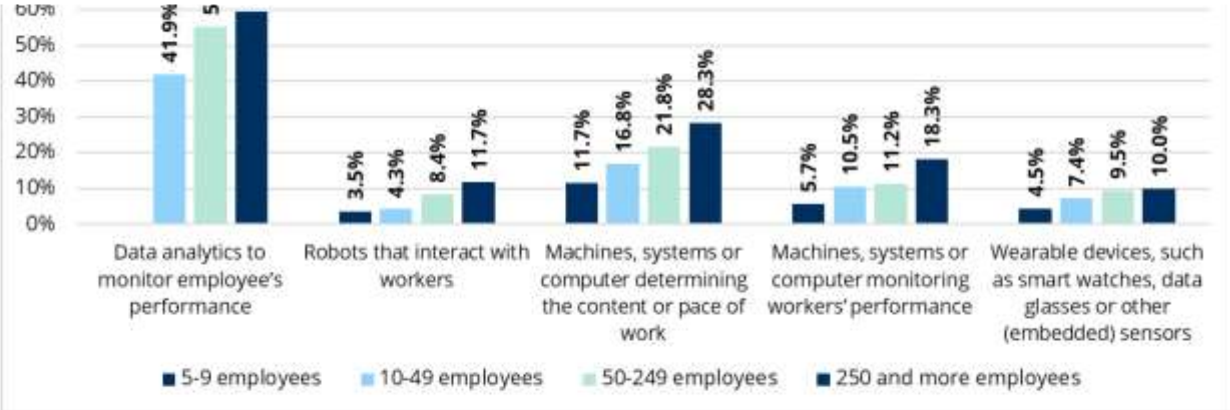
Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by company size

There is a strong correlation between the size of companies and the usage of AM techniques by them, as presented below in **Figure 84**. This correlation is weaker in the case of the use of wearables, with barely any difference between companies employing 50-249 workers and those employing 250 and more workers, and with a relatively small difference in uptake between companies with 5-9 employees and those employing 250 employees or more (only around 5 percentage points). The difference between small and large companies is most visible in the case of data analytics used to monitor people's performance, and systems determining the pace of work. When comparing this data with the EU-27 level, a quite similar situation can be observed (see **Figure 85** below).

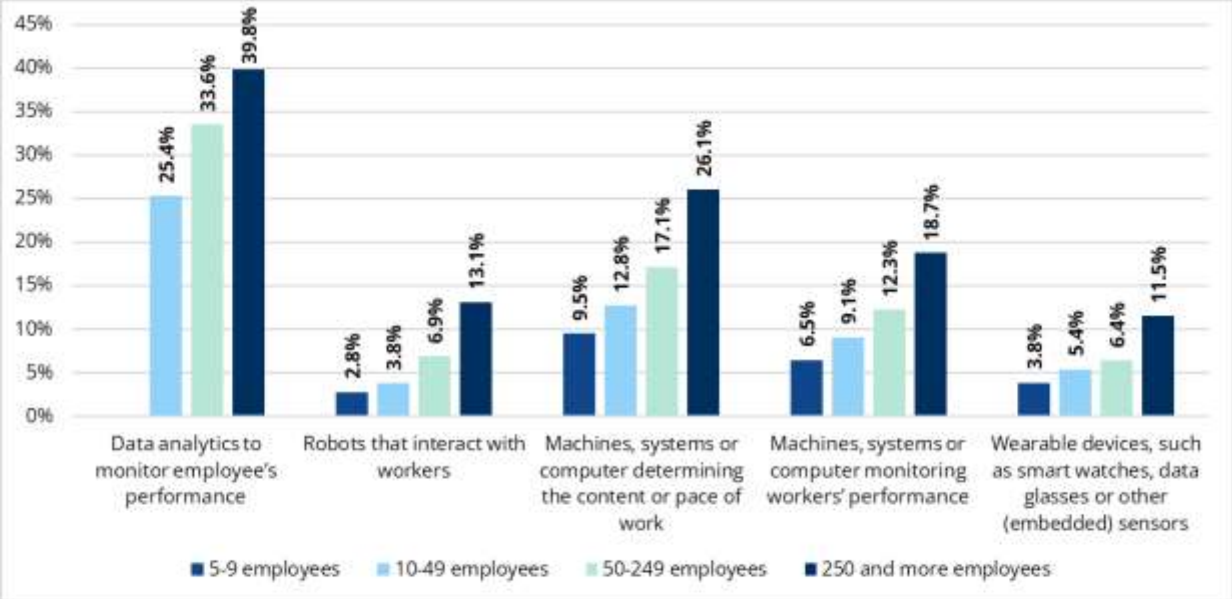
Figure 84: Percentage of companies in Spain that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".

Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

Figure 85: Percentage of companies in EU-27 that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".

Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

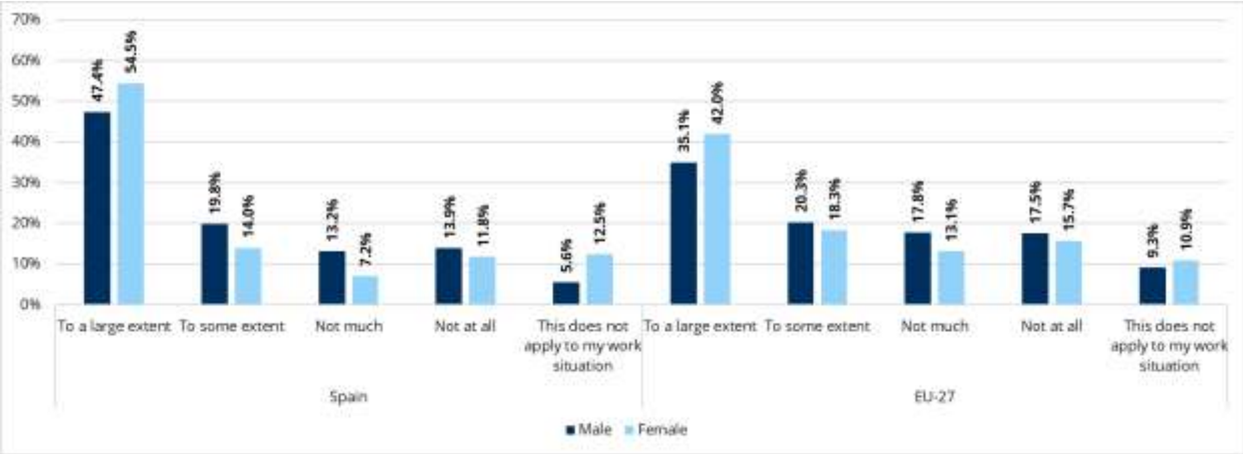
5.5.3. Employees' experience with AM

Usage by gender and age group

According to the EWCS-2021 data, there are slight differences in the way in which female and male workers are influenced by computer systems at work. Nearly 55% of women admit being influenced by such systems to a large extent, as compared to roughly 48% of men who report the same. Notably, this percentage is considerably higher for both genders than in the EU-27 (see **Figure 86** below).

Male workers observe more often than female workers that computer systems have some or not much influence on their work. The percentage of male and female workers who do not see any impact of technologies is very similar, i.e., nearly 14 and 12% respectively. The difference in the number of female and male workers reporting that the use of computer systems does not apply to their work situation is more substantive (12.45% of female workers and only 5.61% of male workers), and greater than at the EU level.

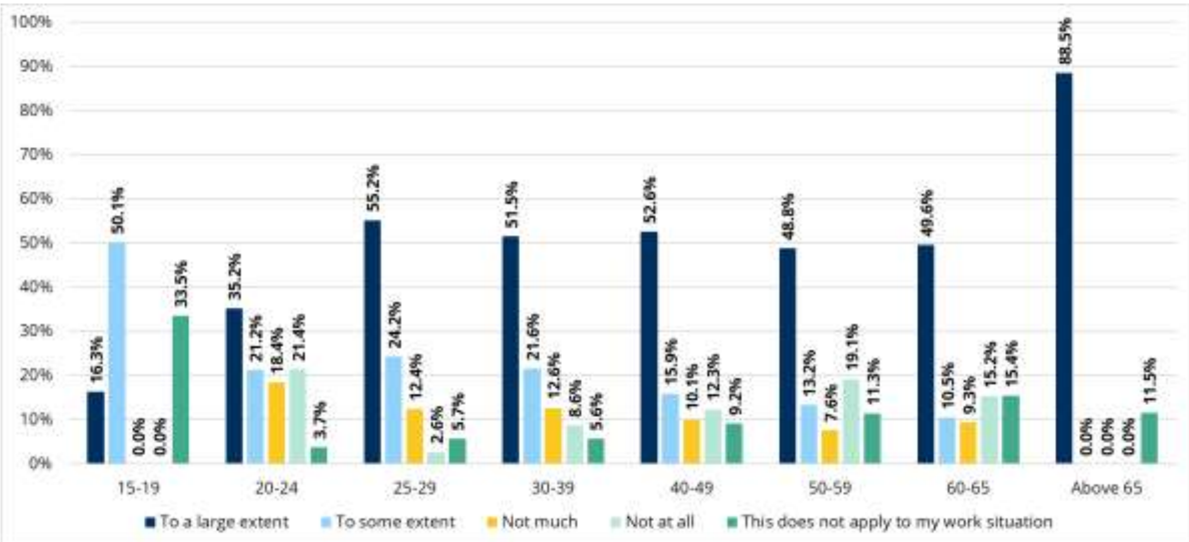
Figure 86: Percentage of workers by gender for whom computer systems influence what they do at work



Source: Author's own elaboration, based on EWCTS (2021) data.

As illustrated in **Figure 87**, there are stark differences in the way computer systems impact various age groups. These differences are much more visible in Spain than in the EU-27 (see **Figure 88** below). A large share of the youngest workers (15-19 years old) reports being influenced to some extent (50%) or not at all (33.52%). These numbers are much lower for other age groups. On the other hand, the oldest workers (above 65 years old) are those who are most often influenced to a large extent by computer systems (88.51%). Interestingly, they did not observe some or a small extent of impact, but their responses were polarised: either influence on a large extent or non-applicability of computer systems to their work situation. This polarisation is not visible at the EU level.

Figure 87: Percentage of workers by age for whom computer systems influence what they do at work in Spain



Source: Author's own elaboration, based on EWCTS (2021) data.

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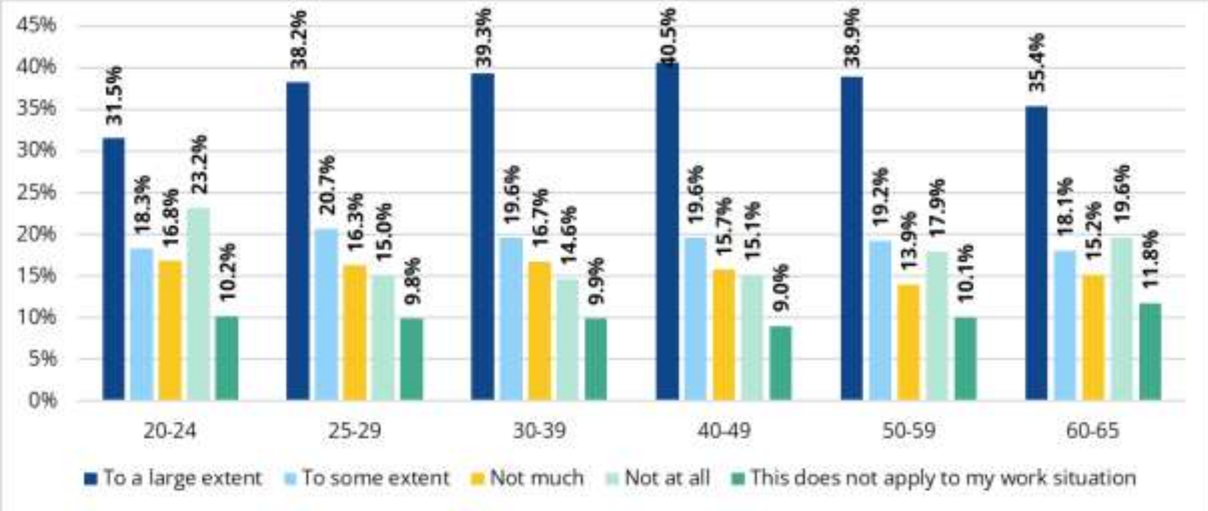
Figure 88: Percentage of workers by age for whom computer systems influence what they do at work in EU-27



Source: Author's own elaboration, based on EWCTS (2021) data.

5.5.4. Review of AM-related regulatory context in Spain

The origins of the debate: platform work

The academic and policy debate on the advent of AM-related technologies and practices has been intense in Spain. It originated in the context of **platform work**, a phenomenon that has received much public attention and regulatory scrutiny in the country.[137]

The impact of AM has been first examined in the context of the notion of subordination.[138] Administrative bodies (e.g., labour inspectorates) and national courts at all levels have been confronted with the question whether powers exercised through digital tools amount to top-down authority. Numerous judicial and administrative decisions on Glovo, Deliveroo and Uber have given a positive answer to this question and reclassified people performing platform work as platforms' employees.[139] To quote an important **ruling handed down by the Spanish Supreme Court (*Tribunal Supremo*) in the Glovo case,**[140] "[the food-delivery platform] uses a *computer program* that assigns the services based on the assessment of each courier, which decisively impacts the nominal freedom to choose schedules and reject orders. In addition, [the platform] exercises the power to sanction its couriers for a plurality of different conducts, which is a manifestation of the employer's managerial power. [It] carries out a real-time control of the provision of the service, without the couriers being able to carry out their task disconnected from the said platform".[141] Moreover, it held that "the company establishes instructions that allow it to control the production process. [It] has introduced means of control on the activity and not only on the result through the

[137] Segarra, A. E. (2022). Desafíos de las relaciones colectivas de trabajo en las empresas de plataforma. LABOS Revista de Derecho del Trabajo y Protección Social, 3(3), 52-76.

[138] Adrian Todolí-Signes, *Notes on the Spanish Supreme Court Ruling That Considers Riders to Be Employees*, Dispatch, *Comparative Labor Law & Policy Journal* (2020), available at https://bit.ly/3tAsgMA.

[139] First decision on this matter dates back already to 2015. Decision of the Spanish Labour Inspection of 9 March 2015, unpublished, classifying Uber drivers as employees. See also e.g., Valencia Social Court, 244/2018, 1/6/2018, reclassifying Deliveroo riders as employees; Madrid Social Court, 53/2019, 11/2/2019, reclassifying Glovo riders as employees.

[140] Tribunal Supremo, Sala de lo Social, Sentencia núm. 805/2020, 25/09/2020.

[141] Mercader Uguina, J. R. (2022). Algoritmos e inteligencia artificial en el derecho digital del trabajo. Tirant, at 81.

algorithmic management of the performance execution, the couriers' evaluation, and their constant geolocation" (emphasis added).

In light of this, whether, and to what extent, managerial prerogatives can be exercised through a combination of technological tools, sophisticated practices, and design solutions, has so far been assessed mostly in the context of the gig economy. More recently, however, academics started to examine AM beyond the gig economy, in line with the development of international literature. [142]

Pioneering AM-specific regulation

Spain was the first EU MS to adopt an **AM-specific regulation**. The centerpiece of the recent Spanish initiatives is Law 12/2021, which reformed the Workers' Statute Law (*Estatuto de los Trabajadores*), aimed at promoting the rights of people working in the delivery sector through digital labour platforms (so-called "Riders' Law"). Apart from introducing a presumption of employment for food-delivery couriers working through digital labour platforms (which is beyond the scope of this report),[143] **it also targeted AM practices at work**. A new letter, d), in article 64.4 of the Workers' Statute Law was introduced, with the following wording: "[works council have the right] [t]o be informed by the company about the parameters, rules and instructions on which the algorithms or artificial intelligence systems are based, which are used for decision-making practices, including profiling, that may affect working conditions, access and maintenance of employment". Importantly, the scope of this regulation covers all workers, also in 'traditional' workplaces.

This text could be considered an expansive transposition of Articles 13 and 14 on information to be provided, Article 15 on the right of access and Article 22 GDPR on automated individual decision-making, including profiling.[144] The GDPR already regulated the company's obligation to inform the worker when systems of automated processing and profiling were in place, as commented by Todolí Signes.[145] However, the individualised dimension of such right resulted in the workers' inability to effectively exercise the right, a problem further exacerbated by the level of technical intricacy and by the workers' fear of retaliation. The lack of a **collective dimension of transparency** and **information rights** has been partially addressed through the "Riders' Law." The law mandates information rights as regards both the very existence of AM and their "parameters, rules and operating instructions".

The law has been hailed as "pioneering" [146] and "ambitious at first sight".[147] Besides providing workers with the possibility to learn more about the parameters, rules and instructions of algorithms

[142] Mercader Uguina, J. R. (2021). Discriminación algorítmica y derecho granular: nuevos retos para la igualdad en la era del Big Data. LABOS Revista de Derecho del Trabajo y Protección Social, 2(2), 4-10.

[143] Ley 12/2021, de 28 de septiembre, por la que se modifica el texto refundido de la Ley del Estatuto de los Trabajadores, aprobado por el Real Decreto Legislativo 2/2015, de 23 de octubre, para garantizar los derechos laborales de las personas dedicadas al reparto en el ámbito de plataformas digitales, https://www.boe.es/eli/es/l/2021/09/28/12.

[144] It must be noted that according to the Spanish Data Protection Authority, the reference to "significant information on the logic applied" in Articles 13.2.f, 14.2.g and 15.1.h of the GDPR, in relation to Article 22, means this logic must be identified with sufficient information, i.e. that which provides an understanding "of the ways in which the data are processed, thus providing certainty and confidence about the results obtained". See "Ensuring that procedures incorporating artificial intelligence comply with the GDPR. An introduction", 2020.

[145] Todolí Signes, A. (2021). Cambios normativos en la digitalización del trabajo: comentario a la 'Ley Rider' y los derechos de información sobre los algoritmos. IUSLabor, 2, 28-65.

[146] Ginès, I., Fabrellas, A. (2021). El derecho a conocer el algoritmo: una oportunidad perdida de la "Ley Rider". IUSLabor, 2(3), 3 ("The information right afforded to workers' representatives at the plant level in the 'Ley Rider' is a pioneering regulation in Europe, which allows workers to know and control the legality of the employment-related decisions adopted by the company. Access to information on the metrics or variables used by the algorithm allows the legal representation to evaluate its suitability for adopting automated decisions regarding labour conditions, access or maintenance of employment").

[147] Villarroel Luque, C. (2021). Workers vs Algorithms: What Can the New Spanish Provision on Artificial Intelligence and Employment Achieve? VerfBlog. Retrieved from https://verfassungsblog.de/workers-vs-ai/.

or AI systems, it does not introduce additional rights on the co-determination of such metrics.[148] Systems of objection and redress are lagging. By operating in conjunction with the GDPR, however, this regulation could pave the way to a modern understanding of algorithmic accountability, by combining national efforts and traditions on workplace monitoring with the general EU framework on data protection.[149]

According to interviewees and commentators, the right to information is aimed at enabling negotiation by social partners in the framework of collective bargaining. Collective bargaining agreements shall be suitable to impose and regulate the criteria, rules and instructions of AM practices that affect the organization of work.[150] In short, the addition of such a statutory right is instrumental to inaugurate and facilitate a new phase of bargaining on the application and calibration of technologies at work. Trade unionists interviewed for this study lamented that the **enforcement of this right is lagging behind the curve**, due to the urgency of other more pressing questions such as salary and pension schemes. Nevertheless, the long-established unions are engaged in a training process to increase awareness of this opportunity in all ranks and at all levels.

In addition, Royal Decree-Law 2/2021 of 26th January on the reinforcement and consolidation of social measures in defence of employment[151] amends art. 53.1 of the Law on Infringements and Penalties in the Social Order, allowing the **Labour and Social Security Inspectorate** (ITSS), a Spanish autonomous agency in charge of the control of compliance with labour and social security legislation, to issue infringement reports based on automated processing. The goal is to streamline and facilitate the workload of the ITSS, making it less onerous and more efficient.

Collective rights and bargaining agreements

The application of AM tools in Spanish workplaces (in both private and public sectors) must comply with the general employment-related and data protection frameworks, including the **Spanish Workers' Statute**. According to Article 64.4 of the Spanish Workers' Statute, "The works council will have the right to issue a report, prior to the execution by the employer of the decisions adopted by him, on the following issues: […] f) The implementation and review of work organization and control systems, management of working time, the establishment of bonus and incentive systems and job evaluation."[152] While this provision does not impose to reach an agreement with worker representatives,[153] information and consultation represent a precondition that must be carried out before implementing technological tools in workplaces. It is understood as a "complementary

148 Aloisi, A. (2022). Platform work in Europe: Lessons learned, legal developments and challenges ahead. European Labour Law Journal, 13(1), 4-29.

149 Aranguiz, A. (2021). Spain's Platform Workers Win Algorithm Transparency. Social Europe. Retrieved from https://socialeurope.eu/spains-platform-workers-win-algorithm-transparency.

150 Muntaner, S. (2021). A vueltas con el algoritmo: derechos de información y negociación colectiva. Retrieved from https://baylos.blogspot.com/2021/05/a-vueltas-con-el-algoritmo-derechos-de.html.

151 Real Decreto-Ley –RDL– 2/2021, de 26 de enero, de refuerzo y consolidación de medidas socia-les en defensa del empleo, https://www.boe.es/eli/es/rdl/2021/01/26/2/con

152 Real Decreto Legislativo 2/2015, de 23 de octubre, por el que se aprueba el texto refundido de la Ley del Estatuto de los Trabajadores, 24/10/2015, https://www.boe.es/eli/es/rdlg/2015/10/23/2/con

153 Cardo, I. A. R. (2022). Gestión laboral algorítmica y poder de dirección: ¿hacia una participación de los trabajadores más intensa? Revista Jurídica de Asturias, 45. De Torres Bóveda, N. (2023). Artificial intelligence and personal data protection in the company: the role of workers' representatives. In E. Menegatti (Ed.), Law, Technology and Labour. Department of Sociology and Business Law.

information obligation".[154] Works councils and worker representation bodies are tasked with facilitating the knowledge-sharing process.[155]

In 2022, **66 collective bargaining agreements (CBA) included a reference to the application of technologies** (corresponding to 6.45% of the total number of CBA). The number of workers covered by such agreements was around 100,000, which amounts to 3.59% of the Spanish working population.[156]

The XXIV **collective agreement in the banking sector** 2019/2023 deals with AM.[157] The latest revision of the collective bargaining agreement regulates "new tools based on algorithms [that] can make management more efficient, facilitating the improvement of management practices". In light of this, "employees have the right not to be subject to decisions based solely and exclusively on automated [systems, with no human intervention], except in those cases provided for by law, as well as the right to non-discrimination in relation to decisions and processing, when both are based solely on algorithms". In such cases, workers can request the assistance and intervention of the persons designated for this purpose by the company if and when they notice a discrepancy between the final decision and what they expected based on their knowledge. Companies shall inform the worker representatives about the use of data analytics or artificial intelligence systems when human resources and labour relations decision-making processes are based exclusively on digital models without human intervention. Such information shall, at a minimum, cover the data feeding the algorithms, the operational logic and the evaluation of the results. The agreement also lays down workers' rights to privacy and disconnection.

The **national collective bargaining agreement for the sector of travel agencies** (2019-2022)[158] defines the areas within the mandate of a "mixed joint committee", "made up of a maximum of twelve members; six of them representing the business organization and the remaining six representing the trade union organizations signatories of this collective agreement, all of them designated by means of the proportional representation system" (article 68). Among the duties of the mixed joint committee are the "establishment of the productivity measurement system appropriate to the sectoral circumstances and the level of the normal productivity index or base period for comparisons" and the "establishment of guarantees regarding the distribution of the improvements in profitability obtained by gains in productivity". A specific section is devoted to "technological innovation". The committee is tasked with "studying issues related to technological innovation based on the following principles, all without prejudice to the organizational capacity of the employer: (i) preventing the unjustified loss of jobs and unnecessary involuntary geographical mobility; (ii) adequate working conditions in terms of repetitive tasks, health and hygiene; (iii) retraining of those workers affected by technological innovations". In addition, the agreement lays down a call to negotiate the "application of changes and technologies after a detailed knowledge of the different options that

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[154] Mercader Uguina, J. R. (2022). Algoritmos e inteligencia artificial en el derecho digital del trabajo (p. 89). Tirant.

[155] De Torres Bóveda, N. (2023). Artificial intelligence and personal data protection in the company: the role of workers' representatives. In E. Menegatti (Ed.), Law, Technology and Labour. Department of Sociology and Business Law.

[156] Data from UGT. Unión General de Trabajadores, *Digitalización de la empresa española: desidia, retraso y sus consecuencias*, in *Servicio de estudios de la confederación*, 2nd edition, 2020, 32. See also Signes, A. T. (2018). La gobernanza colectiva de la protección de datos en las relaciones laborales: 'big data', creación de perfiles, decisiones empresariales automatizadas y los derechos colectivos. Revista de derecho social, 84, 69-88. Sáez, L. C. (2022). Gestión algorítmica empresarial y tutela colectiva de los derechos laborales. Cuadernos de relaciones laborales, 40(2), 283-300.

[157] XXIV Convenio Colectivo de Banca 2019/2023 (XXIV Collective Banking Agreement 2019/2023). Available at https://www.federacionfine.es/recursos/secciones/FINE/documentos/20210129_Texto_definitivo_sin_firmas._XXIV_CONVENIO_DE_BANCA_2019_2023_1_.pdf. See also Navarrete, C. M. (2021). Duelo al sol (digital). ¿Un algoritmo controla mi trabajo? Sí; a tu empresa también. Revista de Trabajo y Seguridad Social. CEF, 5-21.

[158] Resolución de 29 de diciembre de 2021, de la Dirección General de Trabajo, por la que se registra y publica el Convenio colectivo laboral de ámbito estatal para el sector de agencias de viajes, para el período 2019-2022, https://www.boe.es/eli/es/res/2021/12/29/(10)

exist" and to evaluate "the consequences that they may report in terms of work organization" in order to "protect the interests of workers".

Also, the Annex of the **second Collective Bargaining Agreement (CC) of the Spanish ports and port authorities**[159] includes some provisions on AM used to assess workers.

A **company collective agreement**, the "Collective agreement of Renault Spain, SA"[160], includes provisions on information and consultation as regards technology application. More specifically, the firm's management undertakes to provide prior information on new technologies, sufficiently broad, to the workers' representatives, as well as its impact on employment and working conditions. For this to happen, a joint committee on new technologies needs to be set up.

In the context of platform-mediated work, a **collective agreement** has been negotiated between the Just Eat company and the trade unions CCOO and UGT in December 2021. Article 68 of this agreement requires human supervision of the use of algorithms and prohibits the use of data (for example, gender and nationality) that could produce discrimination. The agreement also acknowledges that the workers' representatives may request the company to facilitate explanations from the person responsible for supervising the algorithm.[161]

As argued by Mercader,[162] the **importance of CBAs** as instruments to co-regulate the application of AM is confirmed by an opinion of the Catalan Data Protection Authority.[163] The Authority reports that: "The consent of the affected personnel cannot be considered an adequate legal basis for the implementation of a time control system using facial recognition […]. It would be necessary to [authorize] this control system in a legal provision or in an applicable *collective agreement*, or if applicable, in a pact or agreement resulting from collective bargaining, circumstances that do not seem to occur in the case analyzed. In any case, before the implementation of a system of this type, it is necessary to carry out an evaluation of the impact on data protection in view of the specific circumstances in which the treatment is carried out to determine the legality and proportionality, including the analysis of the existence of less intrusive alternatives, and establishing the appropriate guarantees."[164]

The two major Spanish trade unions have focused their attention on the questions posed by the rapid digital transformation of the labour market. A **hands-on guide**, "Collective negotiation and digitization" (*"Negociación colectiva y digitalización"*), has been published by the Spanish trade union C*omisiones Obreras* in 2020.[165] According to an AlgorithmWatch report, the guide "can be considered a starting point for directly addressing worker representatives and how they can ensure that workers' interests are safeguarded when [AM] systems become implemented in their respective

[159] https://www.boe.es/boe/dias/2006/01/11/pdfs/A01231-01326.pdf

[160] Resolución de 19 de agosto de 2021, de la Dirección General de Trabajo, por la que se registra y publica el Convenio colectivo de Renault España, SA https://www.boe.es/eli/es/res/2021/08/19/(15)

[161] Muñoz Fernández, A. (2021, December 17). Just Eat firma con UGT y CCOO el primer acuerdo colectivo en España para los 'riders' Empresa y sindicatos pactan un sueldo base de 8,5 euros la hora en un texto que equilibra la protección social del empleado y la innovación. El Español. Retrieved from https://www.elespanol.com/invertia/observatorios/digital/20211217/just-eat-ugt-ccoo-acuerdo-colectivo-espana/635436519_0.html

[162] Mercader Uguina, J. R. (2022). Algoritmos e inteligencia artificial en el derecho digital del trabajo, 66.

[163] Opinion 2/2022, 2nd February, "Implantación de un sistema de control horario mediante reconocimiento facial". https://apdcat.gencat.cat/web/.content/Resolucio/Resolucions_Cercador/Dictamens/2022/Documents/es_cns_2022_002.pdf

[164] Emphasis added.

[165] Guía Negociación Colectiva Y Digitalización 2020, https://www.ccoo.es/cms/cli/000001/o/af/af6e35ab004a61334480e3b2bcae0e93000001.pdf

work environment".[166] The guide advocates for **workers to participate directly in the application of AM systems**. It also calls for the regulation of data collection and processing through collective bargaining and to provide workers with the "right to explanation" when AM is used for human resources purposes. Workers should be able to access, manage, and control any data processed by AM. The General Union of Workers (*Unión General de Trabajadores,* UGT) advocated for the enactment of a **"Law of algorithmic justice in the employment context"**.[167] Its purpose is to "regulate the use of these computer tools in Spain and Europe. It is not about regulating technology per se, but how it is applied in the context of labour relations since it has been shown that it can be discriminatory and detrimental to workers".[168] The UGT suggests considering AM tools and practices at work as "high-risk" systems, borrowing the classification of the proposed AI Act. At the same time, it encourages the effective implementation of the right not to be subject to a decision based solely on automated means, if the decision produces legal effects concerning you or significantly affects you in a similar way, in line with Art. 22(1) GDPR and promotes the strengthening of Articles 13, 14 and 15 on information and access rights, as laid down in the GDPR.

Social partners at the national level have adopted a **pilot programme on digitalization**. The multisectoral association of Information Technology, Communications and Electronics Companies (*AMETIC, Asociación Multisectorial de Empresas de Tecnologías de la Información, Comunicaciones y Electrónica*), the *UGT,* and the Workers' Commissions (*CCOO, Comisiones Obreras*) have agreed on a text with "Recommendations on the Impact of Technology in Productive Work Centers".[169] The guiding principles to avoid risks and facilitate the implementation process are the following: (i) informing the workforce and union representatives, indicating that the company's intention is not to replace workers with machines, (ii) informing the workforce and union representatives as regards data protection and storage of the information, (iii) training appropriately (including by means of reskilling) for the use of technology, (iv) presenting the Action Plan for the implementation of the technology, which allows for the creation of complementary jobs before the incorporation of technology. A committee for the technologies implemented in the workplace will be created and will meet periodically to continue improving these recommendations based on the experiences collected, also in order to resolve any discrepancies or doubts that may arise in the implementation process. It will consist of two representatives from Ametic and one from CCOO and UGT. The agreement includes references to the paramount importance of respecting workers' fundamental rights while striking a balance between competing interests with a view to increasing companies' competitiveness. In addition, the text envisages a participatory, iterative and experimental model, based on the impact assessment approach.

Unions have also organized several training sessions for their delegates. They feel the need to strengthen their abilities to understand the logic behind AM tools. At the same time, unionists admit that the campaign on raising workers' salaries has priority over AM accountability.

Policy developments

[166] AlgorithmWatch (2021), Algorithmic transparency and accountability in the world of work A mapping study into the activities of trade unions, https://algorithmwatch.org/en/wp-content/uploads/2023/02/2023_AlgorithmWatch_ITUC_Report.pdf. More resources are available at https://algorithmwatch.org/en/algorithms-and-the-world-of-work/?country=spain

[167] https://www.ugt.es/sites/default/files/no_20_-_210208_las_decisiones_algoritmicas_en_las_rrll.pdf

[168] Ibid, page 3.

[169] Recomendaciones sobre el Impacto de la Tecnología en los Centros Productivos de Trabajo, https://www.orgdch.org/wp-content/uploads/2020/02/Documento-Firma.-Recomendaciones-sobre-el-Impacto-de-la-Transformaci%C3%B3n-Digital-VF2.pdf

The additional provision number 130 of Law 22/2021, 18th December 2021, authorized the Government to enact a law to create the **"Spanish Authority to Supervise Artificial Intelligence in Spain"** (*Agencia Española de Supervisión de Inteligencia Artificial en España*). This State Authority is endowed with public legal personality, its own assets and autonomy in its management, with administrative powers.[170] Its mission includes the development of "actions aimed at reducing the risks for the health and safety of people [exposed to AI] and their fundamental rights, deriving from the usage of artificial intelligence systems". The Authority will oversee the development, supervision and follow-up of the projects framed within the National Artificial Intelligence Strategy, as well as those promoted by the European Union, those related to the regulatory development of artificial intelligence, and its uses.

In May 2022, the Spanish Ministry of Labour and Social Economy published the **Guidelines on "Algorithmic information in the workplace.** Guide to corporate obligations on the use of algorithmic information in the workplace and instrument for practical application".[171] The text was prepared by the Committee of Experts on algorithms in the workplace.[172] The purpose of the Guidelines is to "present in a single document the obligations and rights pertaining to algorithmic information in the Spanish legal-labour system". The guide presents a company's obligations regarding algorithm negotiation and auditing and impact assessment. It also includes a questionnaire that can be used to identify and systematise information obligations arising from the use of algorithms and automated decision-making systems in the workplace.[173] The text distinguishes between company "obligations at the individual level" (Articles 13.2.f, 14.2.g and 15.1.h GDPR) and company "obligations at the collective level" (Article 64.4.d of the Spanish Workers' Statute).[174]

Similarly, in terms of the content of the decisions, the Guidelines cover "decision[s] based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her" and decisions on "working conditions, access to employment and maintenance of employment, including profiling". Interestingly enough, and despite their non-binding nature, the Guidelines refer to the possibility of a forthcoming amendment of the Workers' Statute "with respect to collective bargaining, for example, obliging the company not only to inform but also to negotiate with the workers' legal representation concerning the variables, parameters or other characteristics of the algorithm or automated decision system that affect decision-making on working conditions, access to employment and maintenance of employment, including profiling". According to one of the interviewees, there are scarce signs of its utilisation.

A significant strand of opinions and communications has been issued by the Spanish Data Protection Authority (*Agencia Española de Protección de Datos [AEPD]).*[175]

5.5.5. Conclusions

Spain is witnessing a slow but gradual process of digital transformation of the labour market. AM tools are mainly used in two phases of the employment lifecycle: personnel selection and worker

[170] Ley 22/2021, de 28 de diciembre, de Presupuestos Generales del Estado para el año 2022. Link: https://www.boe.es/eli/es/l/2021/12/28/22

[171] Available at https://prensa.mites.gob.es/WebPrensa/noticias/laboral/detalle/4125

[172] Coordinated by Gemma Galdon Clavell and including Anna Ginès i Fabrellas, Ana Belén Muñoz Ruiz, Javier Sánchez Monedero and Adrián Todolí Signes.

[173] Ibid., p. 5.

[174] Ibid., p. 11.

[175] Agencia Española de Protección de Datos (AEPD) (2021), La protección de datos en las relaciones laborales, https://www.aepd.es/es/prensa-y-comunicacion/notas-de-prensa/aepd-publica-guia-pd-y-relaciones-laborales

monitoring. The use of AM tools in Spain's workplaces must comply with employment-related and data protection frameworks. As detailed in this report, Spain has adopted an AM-specific regulation through Law 12/2021, which reformed the Workers' Statute Law. The law also requires companies to inform works councils of the parameters, rules, and instructions behind algorithms or artificial intelligence systems that impact working conditions. This applies to all workers, including those in traditional workplaces. Much remains to be done at the level of enforcement. There have been some notable achievements, such as the collective agreement in the banking sector and other firm-level agreements, which establish an "algorithmic committee" to promote social dialogue, participation, information, and workers' involvement. Spain's major trade unions are committed to addressing the implications of digital transformation in workplaces by focusing on training, capacity building, and negotiation. All in all, the country represents an interesting case whose promising developments must be closely observed.

5.5.6. Interviewees

Table 20: List of interviewees

Person		Reason of involvement	Date
1	Emma Rodríguez	Advisory to Secretary of State Ministry of Labour and Social Economy Professor of Labour Law and Social Security, University of Vigo	March 14
2	Jose Varela	UGT Digitalization Manager Secretary of the Technical Cabinet Communications and Culture Sector	March 14
3	Raquel Boto	CCOO Deputy Secretary of Collective Action and Employment	March 24

Source: Authors' own elaboration.

5.6. Sweden case study

The case explores the application of algorithmic management (AM) in Swedish workplaces. The case is mostly based on **three main data sources:**

4. **Literature review and desk research**
5. **Interviews with stakeholders** (Table 21: List of interviewees at the end of the document presents the list of interviewees).
6. **Quantified data from the EU and international surveys** (e.g., ECS-2019, EWCTS, ESENER-3, and DESI).

It is important to highlight that the case study only presents the most important data in Sweden, while more data can be found in **Annex 6 – Quantified data for the country case study.xls**.

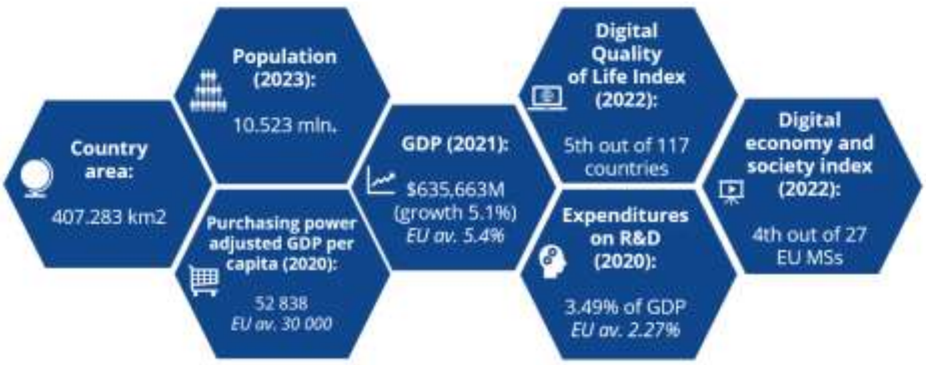
The structure of this case study is as follows. The first section explores the background of the AM application in Sweden, presenting the digitalisation context and AM use. The second section presents the quantitative data on AM usage in Swedish workplaces, focusing on the general situation, as well as on AM use in companies of different types, economic sectors, and sizes. The third section discusses the employees' perception of AM use, differentiating the results based on the gender, age, and education of employees. Finally, we will present a comprehensive review of the AM-related regulatory context in Sweden.

5.6.1. The context of AM application at the workplace in Sweden

The context of the AM application: general digitalisation process, public debates, and the economic background

Based on economic data (see **Figure 89**), Sweden has a high level of country preparedness to adopt AM tools. This is specifically reflected in the high level of digitalisation (5th out of 117 countries on the Digital Quality of Life Index and 4th out of 27 EU countries on the Digital Economy and Society Index). In addition, Sweden also has high economic performance (incl. high GDP growth, higher than EU average purchasing power and expenditures on R&D). The aforementioned indicators create a good base for the application of AM in Sweden.

Figure 89: General quantified indicators about Sweden



Source: Authors' own elaboration, based on official data sources.

Therefore, it is no surprise that the application of AM is not a new phenomenon in Sweden. To illustrate, according to DESI data, 9.9% of companies in Sweden use at least some AI technologies (as a rough proxy for AM use). Comparatively, on average in the EU 7.9% of companies use AI. Furthermore, when looking at the percentage of enterprises using AI technologies specifically for human resource management or recruitment, this percentage is 1.1% for Sweden, while for the EU-27 it is 0.7%. This indicates that AM technologies, at least the ones using AI features, are more frequently applied in Sweden than in the EU-27 on average.

The implementation of the digital technologies in Sweden can be contextualised with the governmental strategic framework "Smart Industry: a strategy for new industrialisation for Sweden", announced in 2016. This strategic framework seeks to put the Swedish industry at the forefront of digital transformation.[176] The key areas of this strategy are as follows: (i) developing and spreading digital technologies, (ii) exploiting the potential of digitalisation irrespective of industry, company size, and geographical location, (iii) encouraging new business models and organisational models, and (iv) improving and adapting new knowledge and infrastructure.[177] Although the concept of digital technologies is used in this context in a broad sense, they also refer to AM applications. The Swedish strategy for digitalisation is believed to create an optimistic picture in which the "augmented" worker will have extended senses and memory through technology that supports human skills, improves situational awareness (such as through embedded sensors in their clothing), and allows for uninterrupted operational vigilance. Given that this picture encapsulates algorithmic management, the expansion of the strategy in the defined areas can contribute to understanding the scope of AM application in Sweden.

The use of AM in Sweden

Based on the literature review, the AM tools are more frequently used in Swedish workplaces for monitoring, rather than for work pace determination purposes. Specifically, according to the case study by Moore (2020), across many Swedish industries, various tools are employed to monitor and track employees' movements and working hours including badges that allow access to workspaces. Additionally, software tools are installed on electronic devices such as laptops, smartphones, and GPS devices to monitor employee locations. GPS monitoring is particularly prevalent in the transport sector and in jobs such as carpenters, electricians, and painters. Video surveillance of workers is common in banks, stores, buses, and trains. In many other industries, electronic systems are used for logging in and out of workspaces or computers.[178]

Furthermore, according to Moore (2020), microchip implants can serve as swipe cards, allowing workers to open doors, operate printers, or purchase food and drinks at the company cafe. A start-up hub in Sweden began offering its own workers and members the option of getting microchips implanted in 2017, which quickly gained popularity in the tech sector. Since then, some individuals in Sweden have opted to implant themselves with microchips (e.g., using them to pay for public transportation). While microchip insertions remain voluntary and not as prevalent as other AM practices, they have attracted considerable international attention.[179]

[176] Abrahamsson L. & Johansson J. (2021). Digitalisation and sustainable work – obstacles and pathways. European Journal of Workplace Innovation 6(1-2): 187-197.

[177] Johansson, J., Abrahamsson, L., Kåreborn, B. B., Fältholm, Y., Grane, C., & Wykowska, A. (2017). Work and organization in a digital industrial context. *Management Revu*, *28*(3), 281–297. https://doi.org/10.5771/0935-9915-2017-3-281

[178] Phoebe V. Moore. (2020). *Data subjects, digital surveillance, AI and the future of work.* Publications Office. https://data.europa.eu/doi/10.2861/879078

[179] Phoebe V. Moore. (2020).

According to the interviewed academic in Sweden, with the increasing usage of AM tools, some negative effects appear. Specifically, the application of AM may imply an increased work pace, more health and work environment risks, social isolation, increased complexity of tasks, and increased workload. In addition, it may also lead to an increased sense of meaninglessness and fear of losing a job. To mitigate these issues, authorities must step in to ensure the safety and transparency of the AM application.

Currently, the Swedish Work Environment Authority plays an important role in the AM regulation. Specifically, based on the interview with the manager of the regulation unit at the Swedish Work Environment Authority, there are a few cases where this institution actively steps in. These cases are discussed further:

1. **Platform and gig work.** In this type of work young people, mainly students, are the main employees. They are often self-employed and exposed to AM. There is no employer-employee relationship, which means that one is responsible for the work environment. This situation leads to many complaints about health and safety problems, which are being submitted and reviewed by the Swedish Work Environment Authority.

2. **Employees in large companies (e.g., Bolt, Wolt),** established in Sweden, are also being monitored by an app. Specifically, employees working in these companies log in to a geographical area and AM-based apps assign them the task based on their location. To avoid AM-related risks to employees in this case, the Swedish Work Environment Authority has stepped in and made demands, which resulted in the embryonic collective agreement.

3. **Health and social care** staff are controlled in detail via an app (including their location). This creates problems in the work environment, making employees vulnerable due to continuous monitoring. Here, the Swedish Work Environment Authority required employers' responsibility (including data protection and privacy of employees).

As can be seen from the presented qualitative indicators, and insights from the existing relevant academic literature and conducted interviews, AM is used in some companies / institutions in Sweden. However, to get a better understanding of the overall use of AM by employers and workers, a more quantitative analysis was carried out, which is covered in the next two sections.

5.6.2. The use of AM by employers

This section explores how extensively AM is being used in Swedish companies. It is important to note that some of the data refers to digital (AI) tools, rather than strictly to AM-based tools. This is because, on the national level, there is almost no data specifically about the application of AM, mainly due to the novelty and complexity of AM. However, the available data on the usage of digital tools, presented in this study, directly includes AM features, such as employee monitoring, determination of the pace of work, use of robots in the working process, and others.

In addition, a majority of the data comes from 2019, before the COVID-19 pandemic, which had a strong effect on the usage of some AM technologies, such as those that monitor workers when they telework. Nevertheless, it gives good (preliminary) indications of how prominent AM is in Sweden.

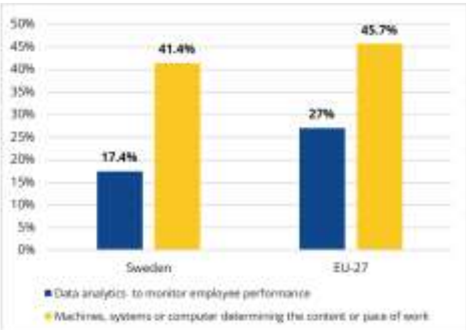
To obtain more relevant estimates of AM usage, survey results from ECS-2019, EWCTS-2021, and ESENER-3 (2019) were extrapolated to determine the number of employers and workers using such tools. This was done by applying relevant weights from each survey. For more information on how the data was weighted, please refer to **Annex 6 – Quantified data for the country case study.xls**.

Overall usage of AM in companies / organisations

Based on ECS-2019, around 17.4% of companies that have more than 9 employees (i.e., 9,603 of such companies) use data analytics[180] to monitor employee performance. This is lower than the EU-27 average, which is around 27%. Similarly, according to ECS-2019, for 41.4% of employers (i.e., 22,695), the pace of work is determined by machines or computers for at least some workers, while in the EU-27, this percentage is 45.7% (see **Figure 90**).

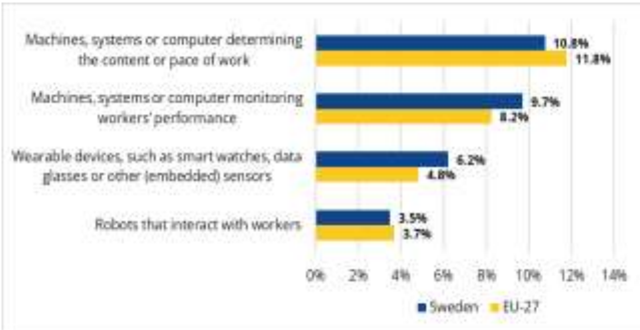
In addition, based on ESENER-9, which provides information on companies that have 5 or more employees, 3.5% use robots that interact with workers, 6.2% use wearables, 9.7% use technologies that monitor worker performance, and 10.8% use machines, systems, or computers that determine the content and pace of work.[181] In the EU-27 these percentages are 3.7% (robots), 4.8% (wearables), 8.2% (monitor workers), and 11.8% (pace of work). These figures show that the use of AM-related technologies in Sweden is quite similar to the EU-27 average (see **Figure 91**).

Figure 90: Percentage of companies (with more than 9 employees) using specific AM tools



Source: Authors' own elaboration, based on ECS-2019 data..

Figure 91: Percentage of companies (with 5 or more employees) using specific AM tools



Source: Authors' own elaboration based on ESENER-3 data.

A quite active application of AM in Sweden can be gauged from the fact that the majority of Swedish companies and public institutions pay attention to discussing AM-related impacts. To illustrate, more than 60% of Swedish companies have discussed issues related to introduction of AM-based technologies with their employees, such as need for continuous training (76.4%), increased work intensity and time pressure (68.3%), more flexibility for employees (65.9%), and information overload (61.7%). Meanwhile, such AM-related impacts as prolonged sitting, repetitive movements and fear to loss job were discussed in less than a half of Swedish companies (see **Figure 92**). When comparing this data to the EU-27 average, the situation there is quite similar (see **Figure 93**).

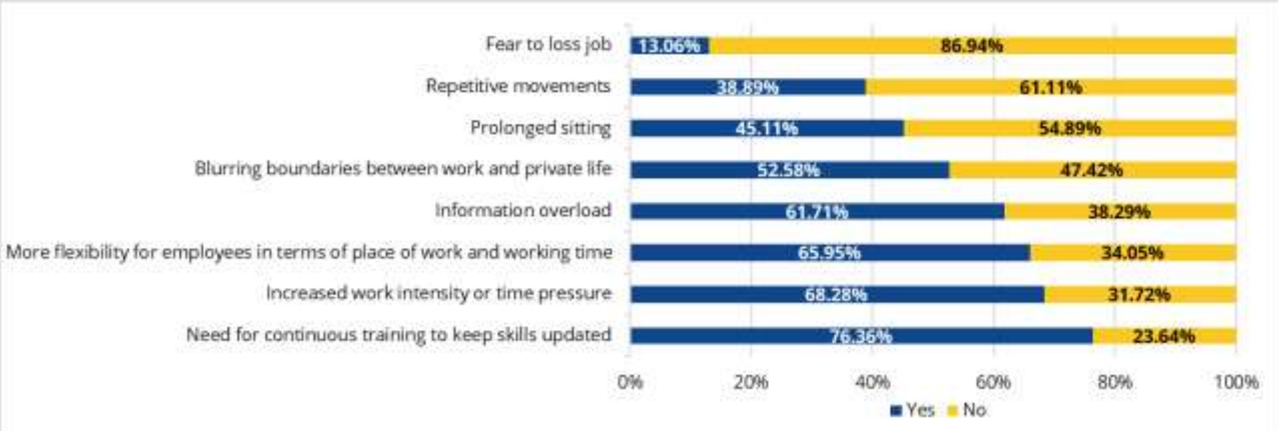
[180] Data analytics is the collection, transformation, and organization of these facts in order to draw conclusions, make predictions, and drive informed decision making. Companies need data analysts to sort through this data to help make decisions about their products, services or business strategies.

[181] The discrepancy between ESENER-3 and ECS-2019 on some questions could be attributed to the fact that companies of different size and not from the same sectors. were covered in the two surveys, and that the formulation of the questions is a bit different.

The extent to which each topic is discussed is likely to be determined by the relevance of the topic to employees. In this case, for example, it can be seen that the majority of Swedish workplaces are focused on the narrative of adapting to AM (developing needed skills, maintaining balance) rather than fear and abandonment. The possible reason for this is that the Swedish digitalisation strategy highlights that with the technological transformation (incl. AM application) the reduced need for employees is not expected. Rather, the technological transformation will create new jobs.[182]

However, it should be noted that a large proportion of respondents did not answer these questions at all (around 95 thousand based on the question), implying that a higher (than indicated) share of companies might not discuss the aforementioned impacts.

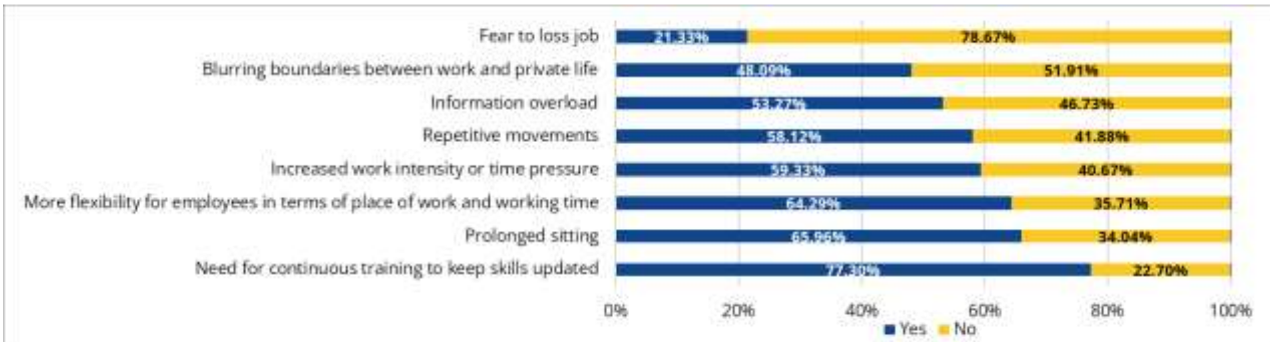
Figure 92: Percentage of enterprises in Sweden discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Figure 93: Percentage of enterprises in EU-27 discussing different possible impact of new technologies



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data.

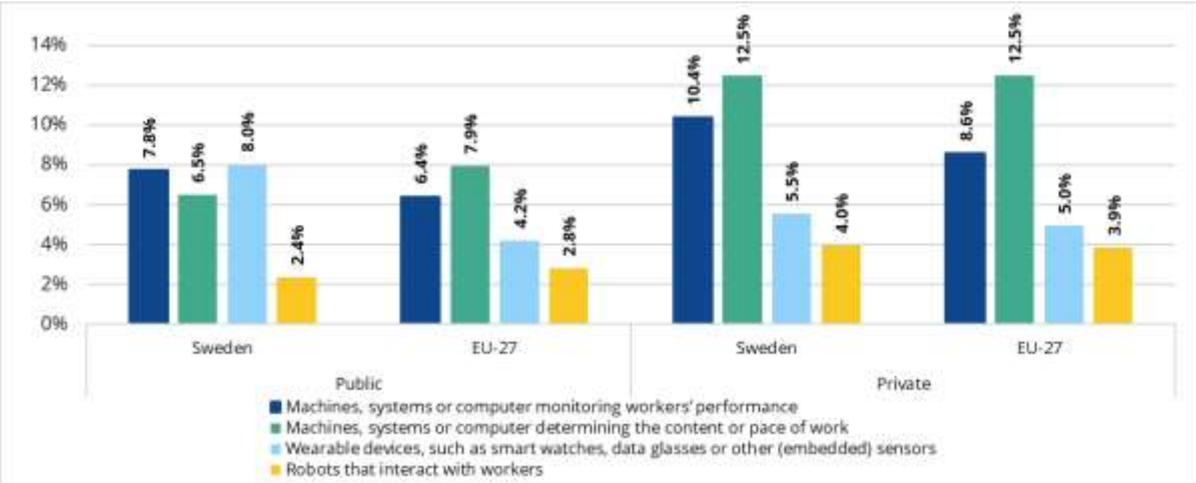
[182] Johansson, J., Abrahamsson, L., Kåreborn, B. B., Fältholm, Y., Grane, C., & Wykowska, A. (2017). Work and organization in a digital industrial context. Management Revu, 28(3), 281–297. https://doi.org/10.5771/0935-9915-2017-3-281

Usage of AM by public / private sector

When it comes to the usage of technologies associated with AM in public and private sector organisations, some interesting differences can also be observed. First, as **Figure 94** below indicates, private companies in Sweden and in the EU use AM more prominently than public ones. There are a few possible explanations for this. In particular, private companies are usually in a better position to make larger investments in the application and use of such tools (mostly due to their for-profit approach and hence higher financial capabilities). Moreover, private companies are generally more flexible than public ones. They can make decisions more quickly and are not as bound by bureaucracy and detailed monitoring, allowing them to take more risks and experiment with new ideas.[183]

In addition, Swedish companies use machines, systems, or computers to monitor workers' performance more frequently than the EU-27 average in both private (10.4% compared to 8.6%) and public sectors (7.8% compared to 6.4%). Furthermore, public companies in Sweden also use wearable devices more often than the EU-27 average (8.02% and 4.20% respectively), but there is almost no discrepancy between the usage of wearable devices in the private sector. Notably, the discussed differences are not significant and hence do not indicate any strong patterns.

Figure 94: Percentage of public and private enterprises using different technologies associated with AM



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data

Usage of AM by economic sector

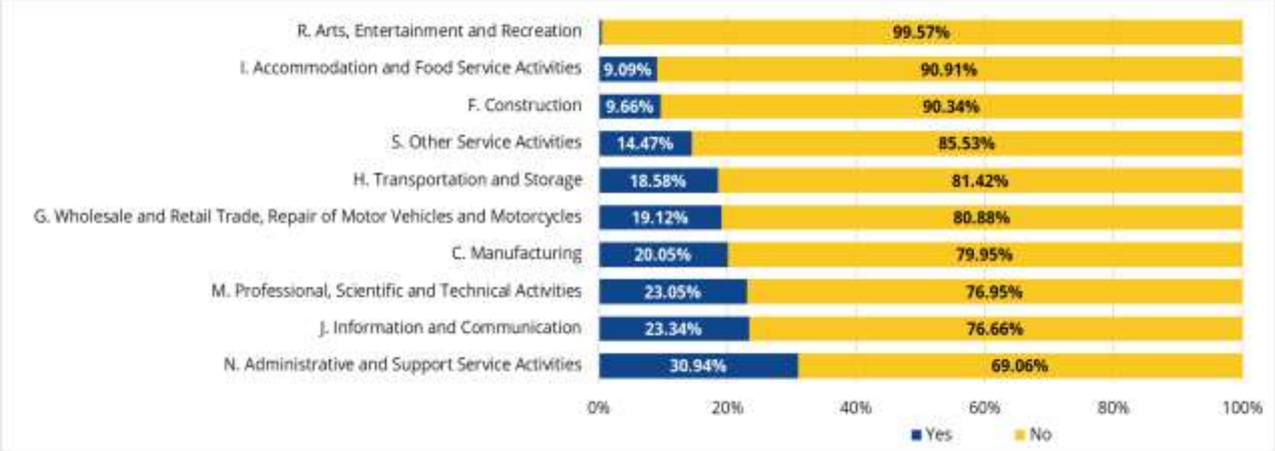
The use of AM technologies slightly varies between economic sectors. According to the ECS-2019, companies operating in the administrative and support service sector are more likely to monitor employee performance (see **Figure 95** below for details). At the same time, enterprises from the art, entertainment and recreation sector use such technologies the least. Lower percentages of AM use can also be noticed in such sectors as construction and accommodation and food service activities. When comparing this data to the EU-27 level average, the situation at the EU level is a bit different,

[183] De Stefano, V. and Taes, S. (2022) 'Algorithmic management and Collective Bargaining', Transfer: European Review of Labour and Research, 29(1), pp. 21–36. doi:10.1177/10242589221141055.

as transportation and storage; financial and insurance activities; and professional, scientific, and technical activities stand out as the most active users of data analytics to monitor employee performance (see **Figure 96**).

The existing differences between sectors might be explained considering several reasons. First, it can be determined by industry-specific needs. Different sectors have different asset types, equipment, and facilities that require varying levels of maintenance and monitoring. Moreover, some sectors may be subjected to more stringent regulations that require companies to implement robust AM technologies. Specifically, the manual implementation of AM processes in large-sized enterprises may be expensive, hence innovative solutions (e.g., AM-based technologies) are being employed. Finally, cost considerations should also be taken into account, as companies operating in sectors with lower profit margins or higher competition may be less likely to invest in the application of AM technologies (meanwhile, focusing on other "urgent" areas of investment).

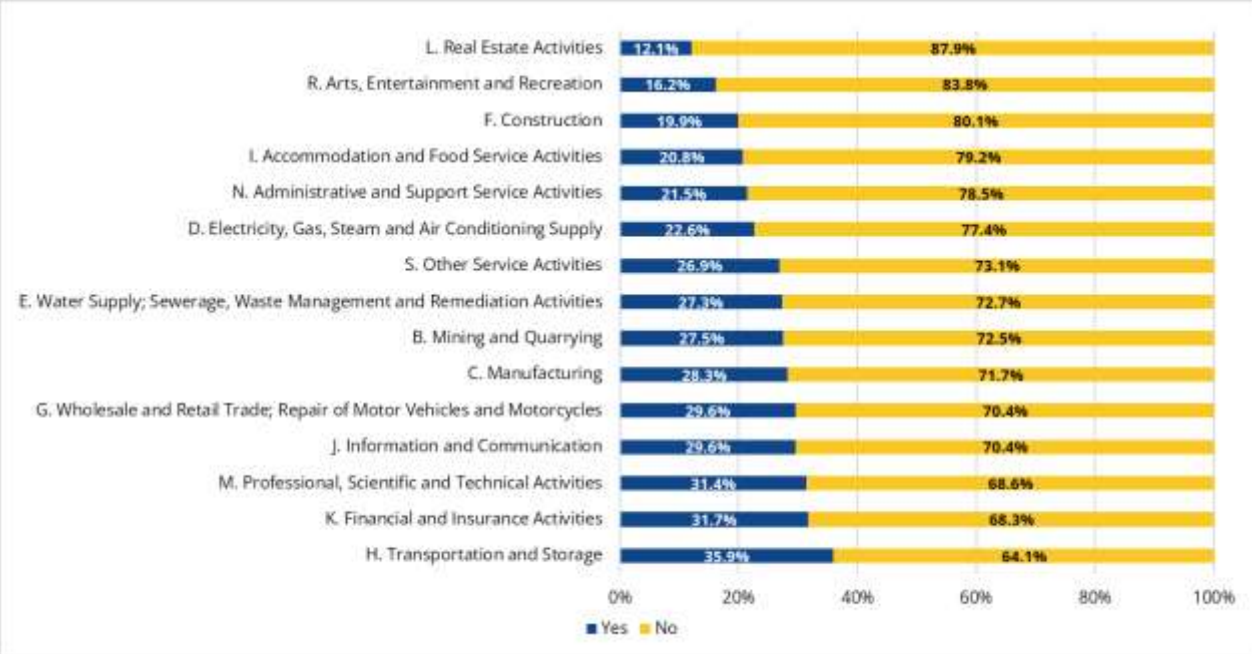
Figure 95: Percentage of companies in Sweden, by sector, using data analytics to monitor employee's performance



Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Note: Only companies with over 9 employers are covered.

Figure 96: Percentage of companies in EU-27, by sector, using data analytics to monitor employee's performance



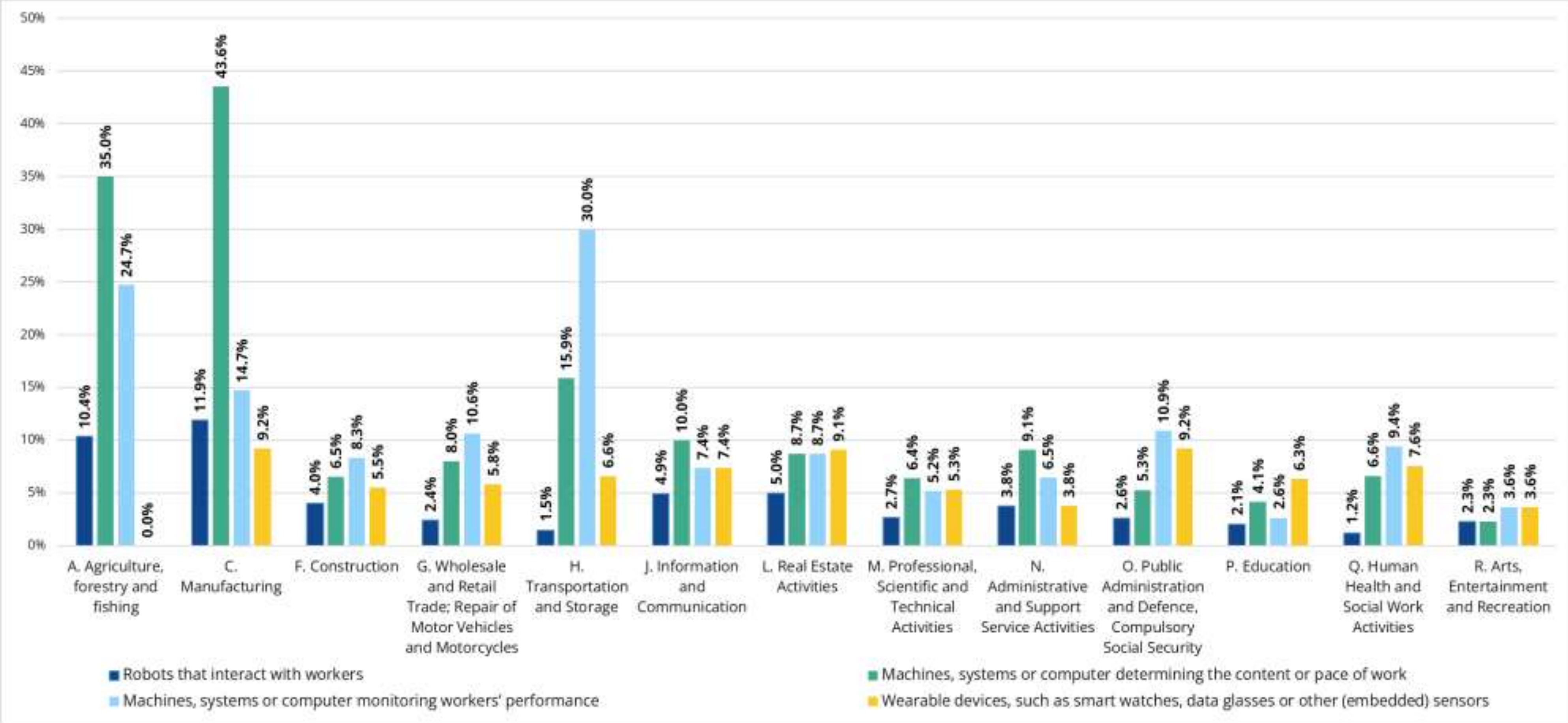
Note: Only companies with over 9 employers are covered.

Source: Authors' own elaboration, based on ECS 2019 data.

In addition, the data also indicates that machines, systems, or computers determining the content or pace of work are most frequently used in sectors related to manufacturing and agriculture, forestry, and fishing (43.6% and 35% of companies respectively do so) (see **Figure 97** below). The situation is also similar at the EU-27 level with 23% and 19.6% of companies applying these AM-based tools respectively (see **Figure 98** below). Regarding the machines, systems or computers that monitor workers' performance, these are most prominent in the transportation and storage sector (30%). Meanwhile, at the EU-27 level, economic sectors related to transportation and storage, and financial and insurance activities are identified as the most active users (17.2% and 17.5% respectively)

The remaining AM-related technologies are applied quite similarly in all the sectors. These results further highlight the multifaceted nature of AM and that different types of organisations in Sweden focus only on select types of technologies which better address their needs.

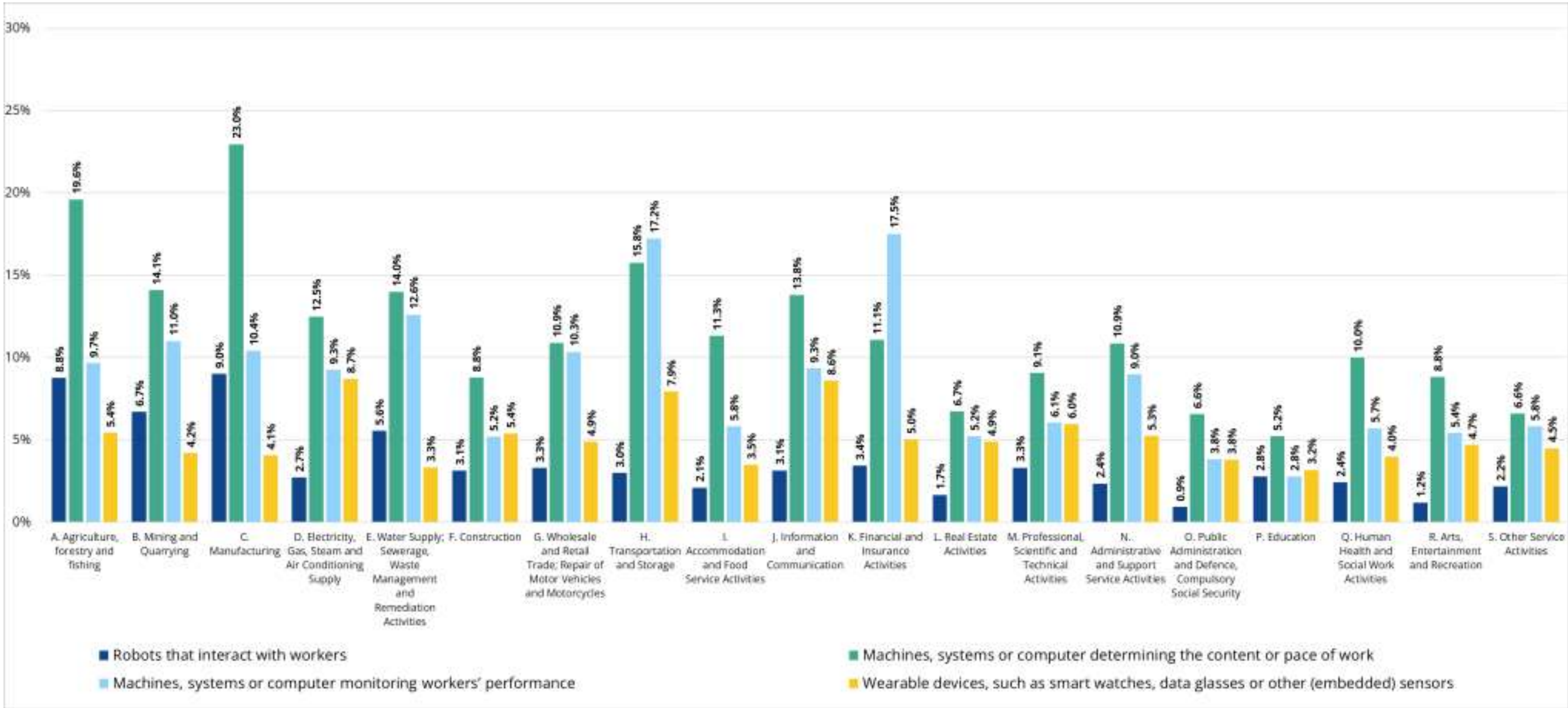
Figure 97: Percentage of companies in Sweden that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered

Source: Authors' own elaboration, based on ESENER-3 (2019) data

Figure 98: Percentage of companies in EU-27 that use different technologies associated with AM by economic sector



Note: Only companies with over 4 employers are covered

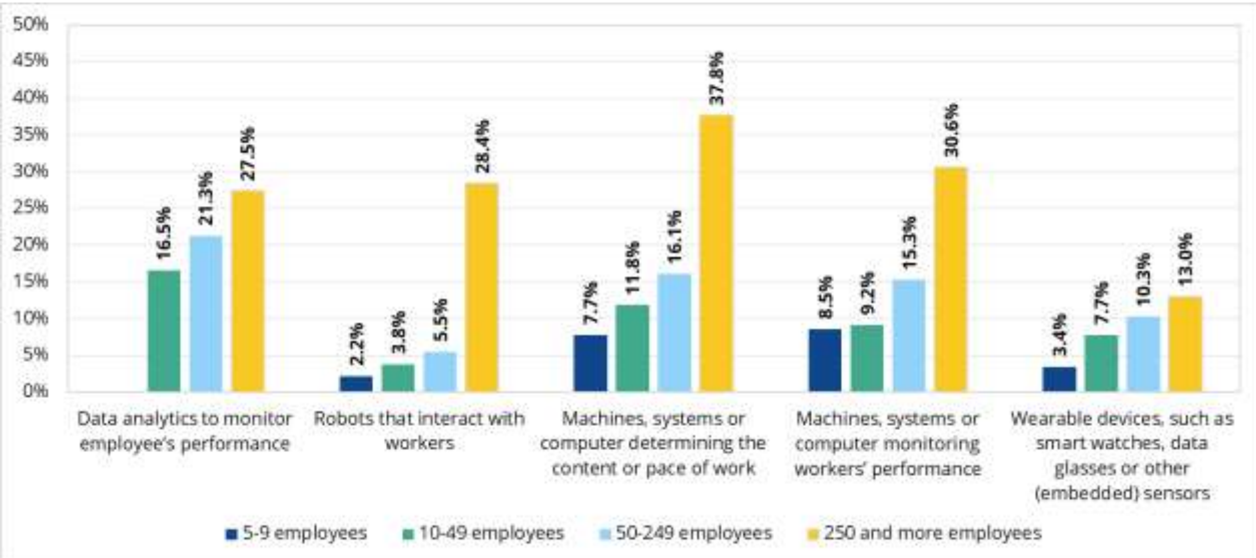
Source: Authors' own elaboration, based on ESENER-3 (2019) data.

Usage by company size

Regarding the size of enterprises, larger companies use AM-related technologies more frequently than smaller enterprises (see **Figure 99** below). This pattern is consistent for all the analysed AM technologies. To illustrate, 27.5% of large companies (with 250 and more employees) use data analytics to monitor employees' performance, 28.4% use robots that interact with workers, 37.8% apply machines, systems, or computers to determine the content or pace of work, 30.6% use these technologies to monitor workers' performance, and 13% use wearable devices. Meanwhile, these numbers for small enterprises (with 5-9 employees) are as follows: 0% (data analytics), 2.2.% (robots), 7.7% (pace of work), 8.5% (workers' performance), and 3.4% (wearable devices). Notably, when comparing, this situation is very similar to the EU-27 average (see **Figure 100** below).

Such a situation is quite evident when considering the following factors. First, adopting new technologies is often costly, and hence less affordable for smaller enterprises, which usually decide to invest their funds into more pressing issues rather than new technologies. Besides this, larger enterprises also have more employees. Hence, manual HR processes become too costly to proceed with, which is often not an issue for smaller enterprises. However, usage of AM in smaller-sized enterprises is likely to grow in Sweden. This can be expected as the various experiences of digitisation and innovation show new technologies (incl. AM-based systems) are becoming cheaper and more affordable over time.

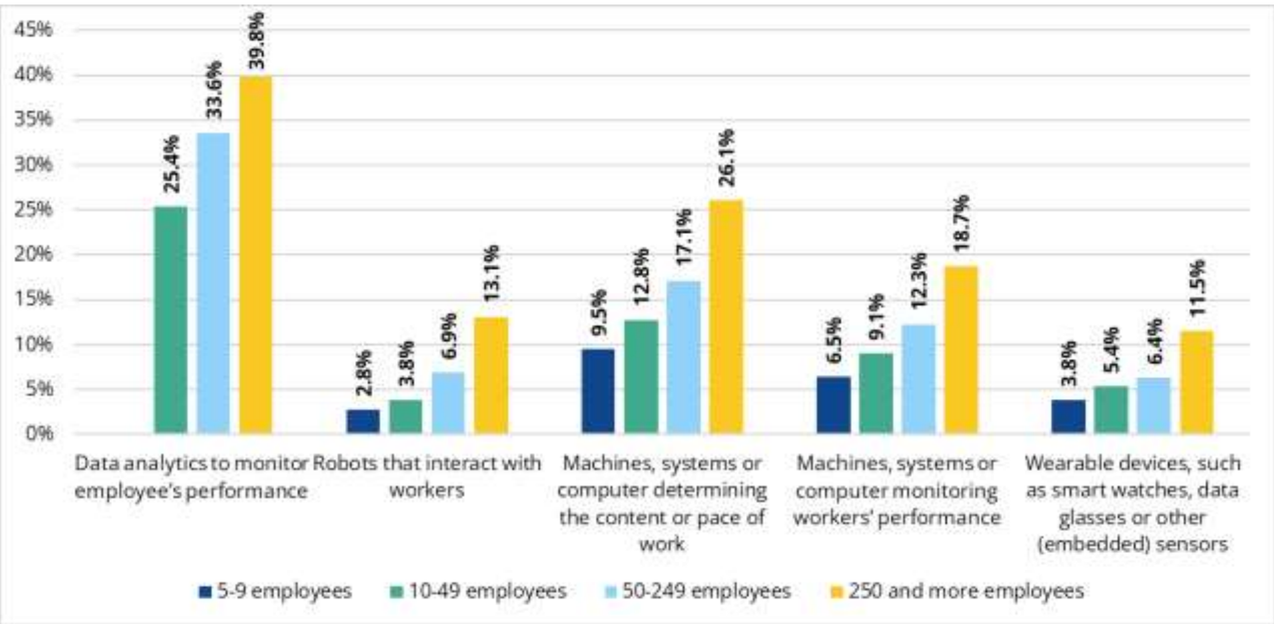
Figure 99: Percentage of companies in Sweden that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".

Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

Figure 100: Percentage of companies in Sweden that use different technologies associated with AM by type



Note: No data on companies with 5-9 employees is available for "data analytics to monitor employee's performance".

Source: Authors' own elaboration, based on ESENER-3 (2019) and ECS-2019 data.

5.6.3. Employees' experience with AM

Overall usage by workers

According to EWCTS-2021, which covers companies of all sizes, for around 63.8% of employees in Sweden (around 1.6 million employees) computer systems influence what they do at work, compared to 57.6% in EU-27. This can include the automated allocation of working hours or the planning of tasks and resources. However, this stands as proxy evidence of the AM application, as it may not only refer to the automatic allocation of working hours or the planning of tasks and resources (which is an AM-based functionality) but also to simple digitalisation solutions which automate working processes.

In addition, when assessing this data, it is important to note that these percentages do not include individuals who did not answer this question on the conducted survey (around 107 thousand individuals in Sweden), implying that the real usage may be lower. The reasons for not including these non-answers in the calculation of the percentage are discussed in the footnotes.[184]

The possible lower usage is supported by ESENER-3 data, which is focused only on companies with more than 5 employees. According to this data:

[184] The reason for not including these non-answers in the calculation of the percentage is related to the fact that a high number of such responses as "Don't know" and refusals distorts the broad picture and does not allow us to assess for how many people computer systems influence what they do at work. In addition, it also would not allow us to compare Sweden's data with the EU-27 average, as the higher response rate at the EU-27 level also implies a higher number of "Don't know" responses or refusals. Considering these arguments, the inclusion of this type of answer does not have an added value here.

- 10.1% of Swedish employees working in companies with over 5 employees (around 393 thousand) interact with robots at work.
- 17.9% (around 691 thousand) of employees are subject to machines, systems, or computers determining their pace of work.
- 15.5% (around 599 thousand) of employees are subject to machines, systems, or computers monitoring their performance.
- 9.2% (around 356 thousand) of employees must wear wearable devices and similar.

In contrast, these percentages for EU-27 are 7.3% (interaction with robots), 17.3% (pace of work), 12.2% (monitoring workers), and 7.2% (wearables).

The data presented above shows that the two surveys indicate quite different results. Specifically, the EWCTS-2021 shows much higher estimates of the application of AM to employees than the ESENER-3 survey. There are two possible reasons for this. First, EWCTS data in this case serves as proxy evidence of the AM application as it may include not only direct AM tools, but also simple digital solutions, which can imply higher percentage of users. Second, ESENER-3 provides data for 2019 and EWCTS for 2021. This makes the EWCTS more reliable (especially since it was conducted in the middle of the COVID-19 pandemic, which may have led to an increase in teleworking and thus the possible increase of AM use). In addition, the EWCTS-2021, in contrast to ESENER-3, covers companies of all sizes, which may also ensure more reliable results.

Despite the discrepancies between the two studies, this data may serve as evidence that Swedish employees use AM-based tools and, according to the ESENER-3 results, they are more frequently used to determine the pace of work. Considering that the AM determination function is one of the most advanced and most influential on workers, this indicates that the introduction of AM in Sweden is in a relatively active phase.

Usage by gender and age group

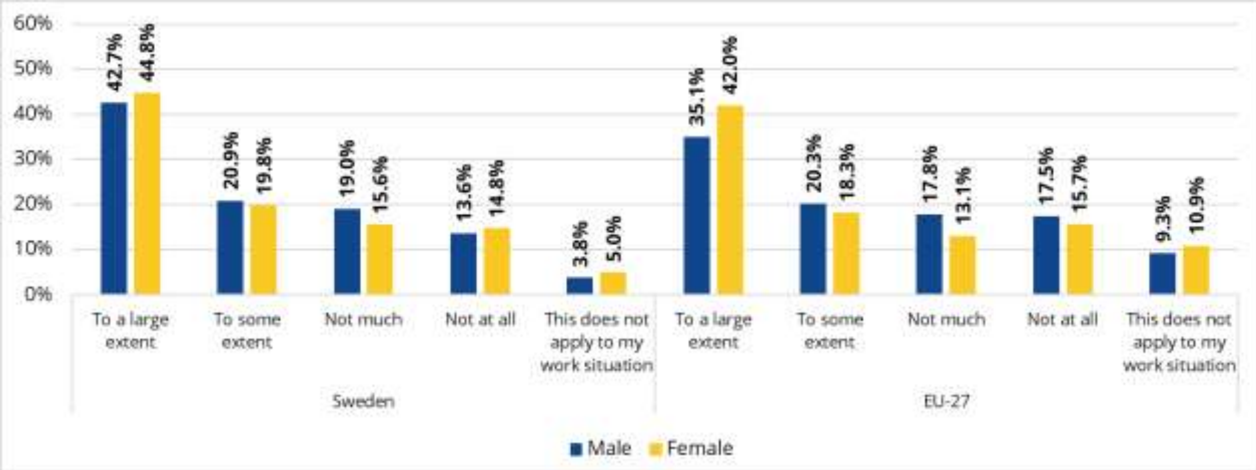
When it comes to AM usage by gender and age group, available quantitative data is relatively limited as only EWCTS-2021 provides such information. Nevertheless, some insights can be derived from it.

The available data show that both males and females have a similar experience with computer systems influencing what they do at work, both in Sweden and in the EU-27 (see **Figure 101** below). However, it can be noticed that for females AM-based technologies influence what they do more frequently to a large extent than for males. One possible reason explaining this phenomenon is that women are overrepresented in specific sectors or occupations that are more likely to be affected by AM. For instance, women may be more likely to work in jobs that involve customer service or data entry, which can be automated and monitored using algorithms more easily.

In addition, gender biases in the workplace may also lead to more active AM-based management of female workers than of males. For example, if women are perceived to be more submissive and less likely to challenge authority, they may be placed in more rigidly algorithm-controlled jobs. Furthermore, academic works in this field also argue the existing gender-based discrepancies in terms of digital technologies and the potential for career growth. According to Eklund et al. (2020), women may be assigned to tasks with lower qualification demands and less authority, as they may be presumed to lack interest or proficiency in digital technology. As a result, female employees may be more frequently assigned simple routine tasks, which are better exposed to AM-based regulation.

On the other hand, the current Swedish government is working to improve working life policies and ensure good working conditions and equal career opportunities for men and women.[185] Hence, in the future, we can expect AM-based management equality in the workplace regardless of employee gender.

Figure 101: Percentage of workers by gender for whom computer systems influence what they do at work



Source: Authors' own elaboration, based on EWCTS (2021) data.

When looking at the distribution of employees whose work is being influenced by computers by different age groups, no strong patterns can be observed. As EWCTS-2021 data indicates, for around 35-50% of employees' computers strongly influence what they do at work (see Figure **102** below). Notably, when comparing different age groups, data indicates that the influence of computer systems on the employees' work is lower among the youngest generation (i.e., 20-29 years old). This can be specifically seen from the higher percentage of people for whom AM-based technologies have no impact among the youngest groups of employees. When comparing this to the EU-27 level average data, a quite similar situation can be observed there (see **Figure 103**).

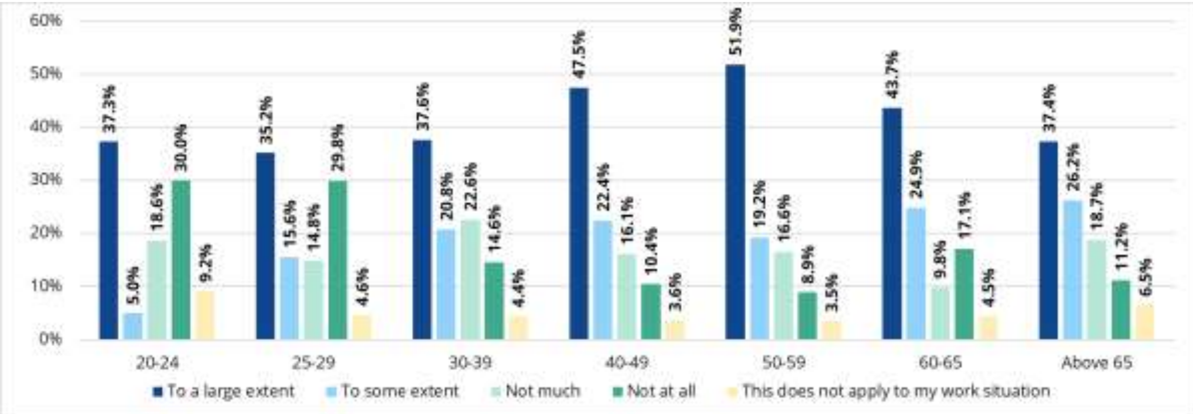
The possible explanation for this phenomenon is that younger employees usually work at entry-level job positions and have limited responsibilities. They may therefore not require the same level of decision-making or independent judgement as senior employees. Also, younger employees are usually those with limited working experience, hence they are more likely to require hands-on training and supervision, which can be hardly ensured by AM.

In addition, the data also show that such technologies have a greater impact on the work of employees aged 40-59 (compared to other age groups). This may be since workers aged 40-59 tend to be in more senior (including managerial) positions, which increases the demands for productivity and efficiency in their work. In this case, AM can be used to monitor their performance. Moreover, it can help them to automate routine tasks and to focus on activities that have a higher added value. Finally, because of their seniority, they usually do not need detailed guidance from their managers like their younger colleagues do and AM-based management can be more suited for them.

[185] Johansson J., Abrahamsson L. (2018) National Report SWEDEN – Case Study on IF Metall. Available at: https://suniproject.adapt.it/wp-content/uploads/2018/07/sweden-1.pdf

On the other hand, the current Swedish government strategy for sustainable working lives highlights the generational change in the Swedish labour market, which is based on the high retirement rate and the lower share of the younger generation in the labour market. This in turn leads to imbalances and a high tax burden on the Swedish workforce. To address this challenge, Sweden, like many EU countries, is increasing the length of service rate, keeping people in the labour market longer.[186] In line with this labour market trend, AM technologies can also be extended to the older category of workers in the future (with a natural increase in their share in the labour market).

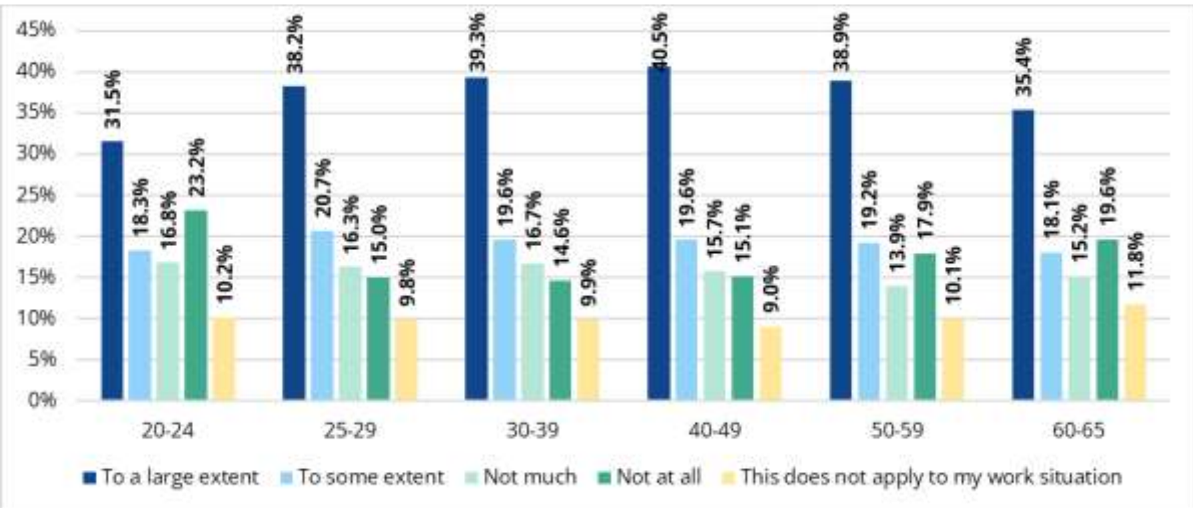
Figure 102: Percentage of Swedish workers by age for whom computer systems influence what they do at work



Note: 15-19 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data

Figure 103: Percentage of EU-27 workers by age for whom computer systems influence what they do at work



Note: 15-19 age individuals were removed from the visual due to small sample size.

Source: Author's own elaboration, based on EWCTS (2021) data

Usage by the level of education

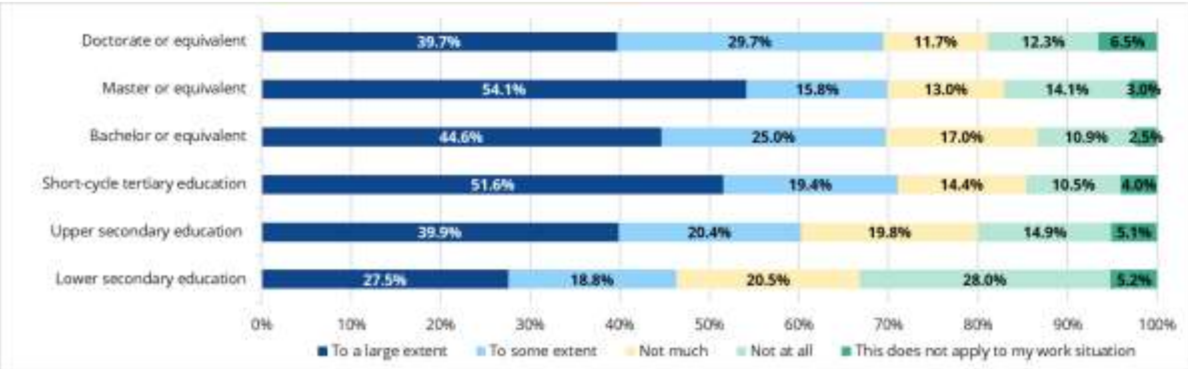
According to EWCTS (2021) data, employees with higher than secondary education are more likely to be affected by AM-based systems in Swedish workplaces. To illustrate, only for around 27.5%

[186] Gillberg, N. (2018). Nya sätt att organisera arbete – betydelsen för arbetsmiljö och hälsa.

and 39.9% of individuals with lower and upper secondary education degrees respectively do computer systems influence what they do at work to a large extent. Meanwhile, for employees holding a bachelor's or master's degree this percentage grows to 44.6%, and 54.1% respectively (see **Figure 104** below). This implies that in Swedish workplaces more educated employees are more susceptible to AM (quite similar when compared to the EU-27 average – see **Figure 105**). There are a few possible reasons for this situation.

In particular, people with higher education levels are more likely to hold more senior positions in their workplace, which include more complex tasks and higher responsibilities, requiring greater precision and attention to detail. In this case, AM-based technologies can help to ensure that their tasks are performed correctly and in an efficient manner. In addition, people with higher education levels may also have more autonomy in their jobs (incl. flexible working hours, and teleworking), which makes it more difficult for managers to assess their performance using traditional methods. Finally, people with higher education levels may also have higher digital skills and be more familiar with AM-based technologies, which in turn makes it easier to employ these technologies to monitor their performance.

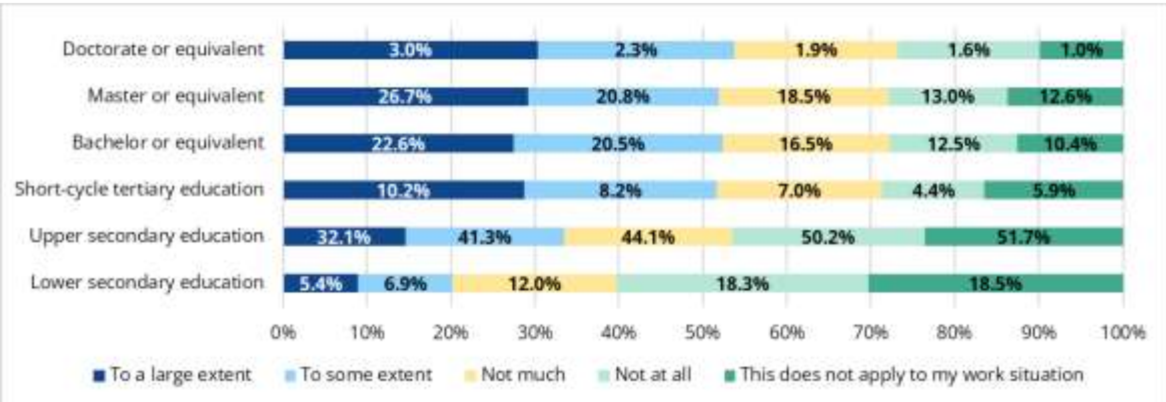
Figure 104: Percentage of Swedish workers by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.

Source: Author's own elaboration, based on EWCTS (2021) data.

Figure 105: Percentage of workers in EU-27 by education level for whom computer systems influence what they do at work



Note: Individuals with early childhood education and primary education were excluded due to lack of data.

Source: Author's own elaboration, based on EWCTS (2021) data.

On the other hand, it can be also noticed that the application of AM-based technologies decreases for employees holding doctorate or equivalent educational degrees. This may be since employees holding a doctoral or equivalent degree tend to perform mentally intense assignments rather than technical or routine tasks. For example, this may include doctors, university professors, IT developers, etc. Therefore, their performance is unlikely to be monitored by AM-based measures, as their performance indicators cannot usually be quantified.

5.6.4. Review of AM-related regulatory context in Sweden

Currently, there is no specific regulation in Sweden directly addressing the use of AM. The most AM-related regulation in Sweden is the **National Strategy on Artificial Intelligence** (AI), launched in 2019. The strategy highlights the general direction for AI in Sweden and aims at providing a base for future policy actions and priorities related to AI, focusing on education and training, research, innovation and use, framework, and infrastructure. In this sense, the strategy document serves as a reference to help the Swedish government to outline forthcoming policy initiatives aimed at strengthening Sweden's welfare and competitiveness by fully exploiting the benefits of AI.[187]

Despite the absence of legislation addressing AM specifically, the application of AM tools in Swedish workplaces (in both private and public sectors) must comply with the general employment-related laws and data protection frameworks, including:

- **The Work Environment Act:** the aim of the act is to prevent health problems and accidents at work and to ensure a good working environment. The act applies to every workplace where workers carry out work on behalf of an employer.[188]

- **The Discrimination Act:** the Discrimination Act was introduced to prevent discrimination against employees. According to the act, all employees must have equal rights and opportunities, regardless of gender, ethnicity, religion, disability, sexual orientation, or age. The act contains rules that apply both in the labour market and in other areas of public life.[189]

- **The Employment Protection Act:** the act protects employees who are dismissed or laid off. It contains rules on forms of employment and on dismissal.[190]

- **The Act on the prohibition of discrimination against part-time and fixed-term workers:** the purpose of this law is to protect part-time and fixed-term employees from being discriminated against compared to their full-time, permanent colleagues. An employer may not disadvantage part-time and fixed-term workers by applying less favourable pay or employment conditions. This may include, for example, pay, scheduling of working hours, conditions for occupational pensions and rules for sickness pensions.[191]

- **Systematic Work Environment Management (SWEM):** SWEM stands for the responsibility of employers to examine both physical / chemical and psychosocial factors in the workplace that may affect employees' wellbeing and productivity. This includes making informed decisions and implementing effective strategies to address any issues that arise, as well as taking preventative measures to reduce the risk of accidents and injuries. SWEM is being

[187] National strategies on Artificial Intelligence A European perspective in 2019, available at: https://knowledge4policy.ec.europa.eu/sites/default/files/sweden-ai-strategy-report.pdf

[188] The Work Environment Act, available at: http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Arbetsmiljolag-19771160_sfs-1977-1160/?bet=1977%3A1160

[189] The Discrimination Act, available at: http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Diskrimineringslag-2008567_sfs-2008-567/?bet=2008%3A567

[190] The Employment Protection Act, available at: http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-198280-om-anstallningss_sfs-1982-80/?bet=1982%3A80

[191] Law on the prohibition of discrimination against part-time and fixed-term workers, available at: https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/lag-2002293-om-forbud-mot-diskriminering-av_sfs-2002-293

used in 40% of Swedish workplaces, according to a report by the Swedish Work Environment Authority.[192]

- **General Data Protection Regulation (GDPR):** the GDPR was implemented in Sweden in 2018 when the former Data Protection Act (1998:204) was repealed and replaced. The rules established under this regulation include requirements for data transparency, law-based data proceeds, personal data minimisation, data accuracy, protection, and storage limitation.[193]

In addition to the aforementioned labour market legislation acts, which must be followed when applying AM tools in the workplace, the Swedish government also developed the **Work Environment Strategy 2021-2025**. The aim of this strategy is to ensure that both women and men have good working conditions and the opportunity to develop at work. Through this strategy, the government also aims to create a working environment that prevents illness and accidents, keeps people out of work, takes account of people's different circumstances and encourages personal development and performance. For this purpose, the strategy focused on a sustainable, healthy, and safe working life.[194] As a result of this strategy, new or updated regulations specifically addressing the use of AM can be expected in the future.

5.6.5. Conclusions

This case study examined the application of algorithmic management (AM) in Swedish workplaces. It relies primarily on quantitative data and provides relevant contextual information and examples of AM usage in Sweden. The aim is to present an overview of the overall situation of the AM usage in Sweden, showcase AM implementation examples, and discuss the opportunities and challenges that come with it.

The quantitative data presented in this study, as well as the qualitative insights into the use of AM in Swedish workplaces, indicate that the use of AM-based technologies is not a relatively new phenomenon in Sweden (compared to the average data from EU-27). Based on the Swedish case study findings, it seems that AM technologies are equally frequently used for monitoring, as well as for work content or pace determination purposes. Considering the AM-based determination functions as the advanced and most influential ones for employees, the application of AM-based technologies in Sweden can be considered progressive.

One of the key obstacles that may limit the further progress of the AM application in Sweden is related to the existing legal framework. Specifically, the Swedish legislation framework lacks acts directly targeted at the use of AM. This legal gap, on the hand, can create uncertainties for employers regarding the more active AM application in the legally correct way. On the other, it creates risks for employees that their fundamental rights to privacy and the protection of their personal data may be violated. However, despite this, it is important to note that the Swedish government starts to take an active role in ensuring the transparency and safety of the AM application. Specifically, the Swedish Work Environment Authority stands as an important character in ensuring workers' rights in the context of AM application. In addition, the current Swedish government's strategies (e.g., Work Environment Strategy 2021-2025 and other policy measures ensuring the improved working life quality based on gender equality) suggest that we can expect significant developments on this issue in the future.

[192] Systematic Work Environment Management, available at: https://www.eurofound.europa.eu/publications/article/2004/systematic-work-environment-management-in-sweden

[193] General Data Protection Regulation (GPDR). Available at: https://www.dataguidance.com/jurisdiction/sweden

[194] Work Environment Strategy 2021-2025, available at: https://www.government.se/legal-documents/2021/03/skr.-20202192

5.6.6. Interviewees

Table 21: List of interviewees

Person		Reason of involvement	Date
1	Carin Håkansta	Researcher (previous analyst at Swedish Work Envirenment Authority) at Karolinska institutet (and Karlstad University).	March 30
2	Torben Vincentsen	Manager for the regulation unit at the Swedish Work Environment Authority.	April 4

Source: Authors' own elaboration.

Annex 6: Quantified data on the AM adoption in six countries selected for case studies

Submitted as a separate file titled *Annex 6 – Quantified data for the country case study.xls.*

Annex 7: Case study reports on AM tools

7.1. Thematic case study: Employee management[195]

7.1.1. Background: Case study focus

Thematic focus	This case study covers tools that (semi-)automate HR functions related to managing employees' work and performance, such as rating, rewarding, or profiling employees (excluding profiling for recruitment purposes) and scheduling their work.	
Analysed tools	FactorialHR, Flair, HeavenHR, HR-assistant, HRForecast, Kenjo, KiwiHR, Leapsome, Payfit, Papershift, PeopleForce, Personio, Shyftplan	
Tool explored in-depth	***PeopleForce*** § *Company name: PeopleForce Ltd.* § *Company website: https://peopleforce.io/* § *Headquarters: Ukraine*	§ *No of employees: 58* § *Economic activity (NACE code): 58.29 - Other software publishing*

7.1.2. Context: The employee management tool market

Employee management software solutions automate and streamline repetitive HR tasks, aiming to offer a consistent and systematic approach to organising work. Tools analysed in this case study can cover a wide spectrum of HR functions. The two most relevant categories (from the perspective of this case study) include:

- **Time management**, including work time tracking, automated shift scheduling, and absence management (e.g., filing in holiday requests)
- **Talent management** often focuses on assessing employee performance and tracking goals or Key Performance Indicators (KPIs), but also covers mechanisms for feedback exchange and gauging employee engagement, solutions that facilitate onboarding and offboarding or track skills and training progress of employees[196]

We identify two main approaches of tool creators to delivering products to the market. **Some tools specialise in a specific area** and provide a handful of selected functionalities - for example, Papershift and Shyftplan focus specifically on time management (Papershift also adds a connected payroll management option). Leapsome offers solutions centred around productivity and performance, including performance reviews, engagement surveys, feedback mechanisms, skill tracking, and promotion processes. **Other tool creators position themselves as all-in-one platforms for comprehensive HR management** and cover all or most of the HR functions (see the Appendix for a detailed breakdown of functionalities of all analysed tools). PeopleForce is an example of such a solution – **Box 4** below summarises its scope.

[195] The case study is based on: (1) literature review and desk research on the effects of the specific tool types; (2) analysis of 13 tools based on information available on the providers' websites, including their functions and features; and (3) an in-depth analysis of one selected tool based on an interview with the tool creator (i.e., representatives of the company providing the selected tool) and two tool users (i.e., representatives of two companies which implement the selected tool in their operations).

[196] Many tools also include recruitment modules - these, however, are outside the scope of this case study - for a detailed analysis, see the case study on recruitment and hiring. Similarly, some tools provide solutions for HR finance, including automated payroll management and budgeting (e.g., assigning HR costs to projects).

Box 4: PeopleForce's products

PeopleForce consists of six main modules. The most relevant modules and functions for this case study include the following:

- PeoplePerform facilitates employee performance assessment through performance reviews, managing Objectives and Key Results (OKR), tracking KPIs, and organising 1-on-1 and 360-degree feedback.
- PeoplePulse helps create scheduled employee surveys to collect employee feedback on their engagement and measure satisfaction and motivation.
- PeopleTime tracks work time and the 'efficiency' of working hours and provides a dashboard to analyse working time and associated labour costs.

Source: Authors, based on https://peopleforce.io/ and interview results (2023).

It is difficult to estimate the uptake of employee management tools (see the Appendix for an overview of the number of companies using the selected tools).[197] Generally, **tool providers do not specifically target or offer tailor-made solutions for any particular sector**, although some market their products differently to different industries. For instance, Kenjo emphasises the shift planning and time management modules for the healthcare sector,[198] while for manufacturing companies, it highlights support with finding employees and training the workforce.[199] Several providers also promote their tools as solutions for remote or hybrid teams (including FactorialHR and Kenjo). Finally, although most tools are promoted as solutions for companies of all sizes, several providers cater specifically to SMEs (such as HR-assistant, KiwiHR, Payfit, and Personio).

Looking at the example of PeopleForce, the company representatives have also emphasised the versatility of their tool and that they cater to companies of different sizes (although usually between 50 and 500 employees). At the same time, however, **PeopleForce clients tend to come from high-tech sectors** – the most prominent being software development, computer games, fintech, information services, e-learning, engineering, e-commerce, auditing, consulting, marketing, charity, advertising, e-learning, or aviation.[200] PeopleForce seems to exemplify the 'born global' approach characterised, among other things, by early internationalisation and the low cost of entering new markets (PeopleForce has only an average of about 12 clients per country). This is somewhat contrary to the approach of several EU-based providers which tend to focus only on a handful of big European markets (see the Appendix).

7.2. Analysis: The impact on firms and employees

7.2.1. Drivers of tool uptake

Based on the interview with the PeopleForce representative as well as the analysis of other tool creators' websites and marketing material, **the most prominent selling point of employee management software tools is time-saving**. They promise to help firms cut down on repetitive administrative HR tasks (and the associated costs) and streamline the work of HR managers. This rationale is reaffirmed in the literature, which has suggested that employers adopt automated

[197] See also section 'Outlook: Possible future trends' for more market data.

[198] See: https://www.kenjo.io/hr-software-healthcare.
[199] See: https://www.kenjo.io/hr-software-manufacturing-industry.
[200] Interview results (2023).

(including AM) HR tools to save management time and make more informed decisions.[201] Besides time-saving, some providers emphasise their gains for businesses from using HR tools such as reducing errors (HR-assistant, Shyftplan) or facilitating employee productivity and engagement (Leapsome). Finally, providers sometimes highlight specific tool features, for example, data security (HeavenHR, Personio), integration of HR into a single platform (HeavenHR, Kenjo, PeopleForce), customisation options (KiwiHR, PeopleForce), or integration with other tools such as Slack or Salesforce (Flair, PeopleForce).

External drivers can also potentially lead to increased uptake of employee management tools. One such driver is **market competitiveness** – some have argued digitalisation of HR is a "new strategic imperative" for firms to survive and thrive in the fourth industrial revolution.[202] For example, for one company using PeopleForce, the need to use employee management software was obvious – the only question was which solution to choose.[203] Furthermore, **the rise of remote work** after the COVID-19 pandemic might have increased the demand for online tools to manage a dispersed workforce.[204] Several tools market their offering to remote teams specifically (see above), and the company using PeopleForce also emphasised that remote work and expanding operations across borders exacerbate the need to both check on employees and centralise the HR information in one place.[205] Finally, interviewees emphasised that **the importance of well-being and work-life balance for a modern workforce** can further encourage the use of tools that promise to boost employee engagement and retention and manage working time.[206]

Nevertheless, some **obstacles in the mass adoption of highly automated employee management tools** in "standard organisations" (i.e., outside gig work) also emerge, such as high cost and uncertain returns, the necessity to source software from a third-party vendor, the challenge of aligning human and algorithmic cognitive systems, and still insufficient digitalisation of business processes required for data-driven management.[207] For example, PeopleForce's clients tend to be concentrated in high-tech sectors.

7.2.2. Opportunities and risks in tool adoption

The table below summarises the key opportunities and risks in adopting employee management tools by HR functions and stakeholders.

[201] Briône, P. (2020). *My boss the algorithm: Research An ethical look at algorithms in the workplace.* London: ACAS. https://www.ipa-involve.com/my-boss-the-algorithm-an-ethical-look-at-algorithms-in-the-workplace; Garg, S., Sinha, S., Kar, A. K., & Mani, M. (2022). A review of machine learning applications in human resource management. *International Journal of Productivity and Performance Management*, *71*(5), 1590-1610.

[202] Malik, A., Budhwar, P., & Kazmi, B. A. (2022). Artificial intelligence (AI)-assisted HRM: Towards an extended strategic framework. *Human Resource Management Review*, 100940. https://www.sciencedirect.com/science/article/pii/S1053482222000596?pes=vor#s0040, p. 1.

[203] Interview results (2023).

[204] Baiocco, S., Fernández-Macías, E., Rani, U., & Pesole, A. (2022). *The algorithmic management of work and its implications in different contexts.* JRC Working Papers Series on Labour, Education and Technology (No. 2022/02).

[205] Interview results (2023).

[206] Interview results (2023).

[207] Ibid.; Jarrahi, M. H., Newlands, G., Lee, M. K., Wolf, C. T., Kinder, E., & Sutherland, W. (2021). Algorithmic management in a work context. *Big Data & Society, 8*(2), 20539517211020332.

Table 22: Key opportunities and risks in adopting employee management tools*

	Firms	Employees
Human Resource Management (HRM)	• Cost efficiencies through process automation and standardised HR function • Improved communication	• Streamlining administrative tasks and freeing time for core or ‘strategic‘ activities
		• Decreased demand for HR staff
Time management (including time tracking and shift scheduling)	• Maximised utility • Increased productivity	• Higher predictability • Reduced bias
	• Time theft (i.e., false time registering by employees)	• Ethical issues • Health and safety concerns • Unempathetic HR • Reduced employee voice
Talent management (including skills and performance)	• Better intelligence • Workforce with relevant skills • Employee retention	• Effective and personalised upskilling • Improving worker engagement and satisfaction • Reduced bias
		• Pressure from excessive scoring

(*) Opportunities are marked in green, and risks in red.

Source: Authors’ own elaboration, based on sources cited in this section.

In the realm of **HRM** itself, adopting automated tools can lead to time-saving (as advertised by the tool creators), establishing a more consistent and systemic approach to HRM, and, ultimately, efficiency gains.[208] Furthermore, digitalisation often leads to a shift from repetitive to more complex tasks,[209] which also holds true for HR staff. For example, PeopleForce estimates that its clients reduce the time required to handle routine tasks from 15 hours per week to an average of 5 hours per week.[210] Similarly, McKinsey has suggested that companies using AI were more likely to report a reduction in HR staff’s time spent on administrative tasks (53%, compared to 34% for companies not using AI).[211] Automated tools can replace routine, methodical tasks (such as scheduling or payroll), freeing employees in HR departments to focus on tasks requiring more problem-solving,

[208] McKinsey (2022). *Smart scheduling: How to solve workforce-planning challenges with AI.* https://www.mckinsey.com/capabilities/operations/our-insights/smart-scheduling-how-to-solve-workforce-planning-challenges-with-ai

[209] See, for example, Smith, C. (2019). An employee’s best friend? How AI can boost employee engagement and performance. *Strategic HR Review*, *18*(1), 17-20.

[210] Interview results (2023).

[211] Eightfold AI (2018). *Talent Intelligence & Management Report.* https://pages.eightfold.ai/rs/278-NXO-307/images/Talent_Intelligence_%26_Management_Report_Eightfold.pdf

leadership, emotional intelligence, empathy, and creative skills.[212] Although not evidenced explicitly in the HR context or corroborated by interviewees, this reduction in working time could also potentially lead to decreasing the working time of HR staff or making some HR jobs redundant.[213]

Nevertheless, **the efficiency effects are not limited to HR staff only** – according to both the tool creator and one of the companies using the tool, streamlining of operations also applies to managerial staff – for example, they can use templates and easily access information for the purpose of periodical check-ups or performance reviews.[214] Employees can also enjoy the benefits of automation – submitting cases (like reimbursement of expenses or purchase of equipment) or planning workflows becomes more seamless, while employees can focus on their core tasks. Finally, setting up the systems and procedures can also help improve internal communication transparency and openness.[215]

Automated time management can benefit employers and employees through increased predictability. For example, the software can algorithmically schedule workers based on forecast demand (based on historical sales data, seasonal patterns, weather, etc.), thus ensuring people work when needed.[216] This brings value to employers by maximising labour utility, but also to employees – by receiving clearer advance notice of the scheduled working time and making it easier to swap and change them.[217] It can also reduce bias and improve fairness by establishing clear rules and removing any potential personal favouritism or even harassment – for example, threatening to withhold leave as a tool to pressure employees.[218] On the other hand, employers might suffer from "time theft": according to two polls of workers (conducted by tool providers) about half of workers admit to lying about the number of hours they worked.[219] Automated tracking and scheduling can also pose some risks for employees, including:

- **(Un)ethical use of tools**: The broader "black box" challenge – employees not knowing how the automated system makes the decision – also applies in this context.[220] Furthermore, some employers may manipulate the tools' features – for example, they can automatically round down employees' reported time or apply automatic break deductions on time tracking apps.[221]

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[212] PwC (2017). *Artificial Intelligence in HR: A no-brainer.* https://www.pwc.at/de/publikationen/verschiedenes/artificial-intelligence-in-hr-a-no-brainer.pdf

[213] Baiocco, S., Fernández-Macías, E., Rani, U., & Pesole, A. (2022). *The algorithmic management of work and its implications in different contexts.* JRC Working Papers Series on Labour, Education and Technology (No. 2022/02).

[214] Interview results (2023).

[215] Interview results (2023).

[216] Briône, P. (2020). *My boss the algorithm: Research An ethical look at algorithms in the workplace.* London: ACAS. https://www.ipa-involve.com/my-boss-the-algorithm-an-ethical-look-at-algorithms-in-the-workplace; Wood, A. J. (2021). *Algorithmic management consequences for work organisation and working conditions* (No. 2021/07). JRC Working Papers Series on Labour, Education and Technology.

[217] Briône, P. (2020). *My boss the algorithm: Research An ethical look at algorithms in the workplace.* London: ACAS. https://www.ipa-involve.com/my-boss-the-algorithm-an-ethical-look-at-algorithms-in-the-workplace

[218] Briône, P. (2020). *My boss the algorithm: Research An ethical look at algorithms in the workplace.* London: ACAS. https://www.ipa-involve.com/my-boss-the-algorithm-an-ethical-look-at-algorithms-in-the-workplace; Jarrahi, M. H., Newlands, G., Lee, M. K., Wolf, C. T., Kinder, E., & Sutherland, W. (2021). Algorithmic management in a work context. *Big Data & Society, 8*(2), 20539517211020332; McKinsey (2022). *Smart scheduling: How to solve workforce-planning challenges with AI.* https://www.mckinsey.com/capabilities/operations/our-insights/smart-scheduling-how-to-solve-workforce-planning-challenges-with-ai

[219] TSheets and HR.com, cited in: IMR (2022). Time Tracking Software Market By Type (On-Premises deployment, Cloud-Based deployment), Application Type (Tracking and Reporting, Project Management, Payroll), Region- Global Market Analysis And Forecast, 2022 -2028. https://introspectivemarketresearch.com/reports/time-tracking-software-market/. Note: the methodology of the survey, including the sample sizeand geographical coverage is not disclosed in the cited source and thus its reliability and relevance for the EU market cannot be validated by the research team.

[220] Meijerink, J., Boons, M., Keegan, A., & Marler, J. (2021). Algorithmic human resource management: Synthesising developments and cross-disciplinary insights on digital HRM. *The International Journal of Human Resource Management*, *32*(12), 2545-2562.

[221] Mateescu, A., & Nguyen, A. (2019). Workplace monitoring & surveillance. *Data & Society*, 1-18. https://datasociety.net/wp-content/uploads/2019/02/DS_Workplace_Monitoring_Surveillance_Explainer.pdf; Tippett, E., Alexander, C. S., & Eigen, Z. J. (2017). When timekeeping software undermines compliance. *Yale JL & Tech.*, *19*, 1.

- **Health and safety concerns**: Strict time tracking can lead to undesirable behaviours. For example, truck drivers have been found to "cut corners" on activities that are not tracked, or to "absorb" the risks of external conditions such as bad weather, possibly putting them at OSH risk.[222]

- **Unempathetic HR**: While automated scheduling can remove bias and favouritism, it can also remove the element of human compassion.[223] Employees facing special circumstances might be granted extraordinary leave by a human manager but could find it difficult to "convince" an algorithm to make an exception.[224]

- **Reduced employee voice**: Some have warned that algorithmic scheduling may reduce worker autonomy and limit workers' voices by decreasing their active role in determining their schedule.[225]

In the talent management area, **tools that track skills and training** can particularly benefit employees. They help identify skill gaps, provide personalised career development recommendations, and integrate training in the job, increasing the individual employee value as well as the overall human capital levels in the company.[226] For example, one of the tools generates training needs based on skills gaps (automatically linked with the feedback mechanisms and performance review results) and career advancement goals.[227] Furthermore, skill gap identification can make firms more adaptive and pursue training or talent acquisition to respond to future skills demands.[228] Managers can view competency frameworks at the company- or team-level, and react accordingly to fill those needs.[229] The same applies to measuring employee engagement – engagement surveys can identify job satisfaction levels across the workforce, and algorithms can even predict which employees are likely to leave the organisation.[230] This information can feed into decisions about strategies to address problems, boost morale, and increase retention.[231] For instance, higher retention rates were one of the top benefits of the tool usage suggested by PeopleForce representatives, and the company using the tool also highlighted the usefulness of the automated solutions to track employee mood and satisfaction.[232]

Finally, software can streamline **performance tracking**, once again, by providing a systematic approach reducing bias in career progression and determining pay raises. Human managers may be more prone to gender and race bias but also, for example, "recency bias", where recent actions are given more weight than actions that occurred, say, 11 months ago for a yearly assessment.[233]

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[222] Levy, K. (2015). The future of work: What isn't counted counts. *Pacific Standard*; Mateescu, A., & Nguyen, A. (2019). Workplace monitoring & surveillance. *Data & Society*, 1-18. https://datasociety.net/wp-content/uploads/2019/02/DS_Workplace_Monitoring_Surveillance_Explainer.pdf

[223] Kinowska, H., & Sienkiewicz, Ł. J. (2022). Influence of algorithmic management practices on workplace well-being–evidence from European organisations. *Information Technology & People*, (ahead-of-print).

[224] Briône, P. (2020). *My boss the algorithm: Research An ethical look at algorithms in the workplace.* London: ACAS. https://www.ipa-involve.com/my-boss-the-algorithm-an-ethical-look-at-algorithms-in-the-workplace

[225] Parent-Rocheleau, X., & Parker, S. K. (2022). Algorithms as work designers: How algorithmic management influences the design of jobs. *Human Resource Management Review*, *32*(3), 100838.

[226] Oracle (2019). *AI in human resources: The time is now.* https://www.oracle.com/a/ocom/docs/applications/hcm/oracle-ai-in-hr-wp.pdf; Wiblen, S., & Marler, J. H. (2021). Digitalised talent management and automated talent decisions: the implications for HR professionals. *The International Journal of Human Resource Management*, *32*(12), 2592-2621.

[227] See: https://www.leapsome.com/product/competency-framework.

[228] Horesh, R., Varshney, K. R., & Yi, J. (2016). Information retrieval, fusion, completion, and clustering for employee expertise estimation. In *2016 IEEE International Conference on Big Data (Big Data)* (pp. 1385-1393).

[229] See: https://www.leapsome.com/product/competency-framework.

[230] Meijerink, J., Boons, M., Keegan, A., & Marler, J. (2021). Algorithmic human resource management: Synthesising developments and cross-disciplinary insights on digital HRM. *The International Journal of Human Resource Management*, *32*(12), 2545-2562.

[231] Garg, S., Sinha, S., Kar, A. K., & Mani, M. (2022). A review of machine learning applications in human resource management. *International Journal of Productivity and Performance Management*, *71*(5), 1590-1610.

[232] Interview results (2023).

[233] Briône, P. (2020). *My boss the algorithm: Research An ethical look at algorithms in the workplace.* London: ACAS. https://www.ipa-involve.com/my-boss-the-algorithm-an-ethical-look-at-algorithms-in-the-workplace; Meijerink, J., Boons, M., Keegan, A., & Marler, J.

On the flip side, AM tools can *systematically* favour employees based on the quantified performance scores (e.g., by assigning "better" shifts to high performers).[234] Furthermore, quantified monitoring and evaluation (the rules of which may not be fully transparent) can lead to work alienation and detachment from work, decreasing well-being, job dissatisfaction, and increased emotional exhaustion.[235] Nevertheless, none of these problems were flagged by the tool user, while PeopleForce suggested their tool enables "monitoring effectiveness without invasive or toxic intervention".[236]

7.2.3. Conclusions

Several key takeaways emerge from the analysis, including:

- **The take-up of automated employee management tools is set to increase**, driven by competitive forces and the evolving workforces (including the shift to remote work and greater emphasis on employee well-being). This increasing take-up is evidenced in the survey data from HR tool providers as well as trade unions (indicated in the section above) and confirmed by the interview results.

- Opportunities from using such tools can be identified for both firms and employees, but **employees are exposed to more risks and challenges** (particularly stemming from the use of time-tracking tools.

- Nevertheless, **the analysed tools generally do not seem extremely intrusive** – they automate repetitive administrative tasks and streamline information flows, but do not seem to significantly alter how companies operate. This, however, likely varies across companies and sectors and might evolve as (some of) the tools incorporate more algorithmic functions.[237]

- Finally, the tool analysed in-depth as part of this case study seems to be designed in a neutral, or agnostic, way and **its impact can depend on how it is deployed by users**.[238] Furthermore, the analysis of the companies' tools has not unveiled any significant negative consequences of using this particular AM tool. However, the same employee management technology can produce different outcomes in different companies or even different teams within one organisation, depending on the underlying motivations and procedures put in place.[239]

(2021). Algorithmic human resource management: Synthesising developments and cross-disciplinary insights on digital HRM. *The International Journal of Human Resource Management*, *32*(12), 2545-2562; Parent-Rocheleau, X., & Parker, S. K. (2022). Algorithms as work designers: How algorithmic management influences the design of jobs. *Human Resource Management Review*, *32*(3), 100838.

[234] Parent-Rocheleau, X., & Parker, S. K. (2022). Algorithms as work designers: How algorithmic management influences the design of jobs. *Human Resource Management Review*, *32*(3), 100838.

[235] Keith, M. G., Harms, P. D., & Long, A. C. (2020). Worker health and well-being in the gig economy: A proposed framework and research agenda. *Entrepreneurial and Small Business Stressors, Experienced Stress, and Well-Being*, *18*, 1-33.

[236] Interview results (2023).

[237] Furthermore, the in-depth analysis (based on interviews with the tool creator and users) within this case study did not cover a tool focused specifically on time-tracking, which can potentially cause more challenges regarding working conditions and employee well-being.

[238] Interview results (2023).

[239] Wiblen, S., & Marler, J. H. (2021). Digitalised talent management and automated talent decisions: the implications for HR professionals. *The International Journal of Human Resource Management*, *32*(12), 2592-2621.

7.2.4. Appendix

Table 23: Overview of selected employee management tools

Tool	Key focus area	Key features	Key selling point(s)	Users	Countries
FactorialHR	Mixed	Absence tracking Time tracking Scheduling Employee performance Onboarding/Offboarding Goal tracking	Time saving	60,000	65 (including France, Germany, Italy, Portugal, Spain as well as the US, the UK, and several countries in Latin America)
Flair	Mixed	Absence tracking Time tracking Scheduling Employee performance Feedback management Onboarding/Offboarding Goal tracking	Time saving Integration with other tools	Unknown	Unknown
HeavenHR	Mixed	Absence tracking Time tracking Scheduling Goal tracking	Integration of HR into one platform Data security	1,300	Germany
HR-assistant	Mixed	Absence tracking Scheduling Employee performance Feedback management Training/skills Health tracking	Time saving Error reduction	Unknown	Unknown
HRForecast				100+	Germany
Kenjo	Mixed	Absence tracking Time tracking Employee performance Onboarding/Offboarding Workflows E-signature Employee profiles	Time saving Integration of HR into one platform	Unknown	Unknown
KiwiHR	Mixed	Absence tracking Time tracking Employee profiles	Time saving Customisation	6,000	France, Germany
Leapsome	Talent management	Employee performance Feedback management Training/skills Goal tracking	Facilitating employee development, productivity, and engagement	Unknown	Unknown
Payfit	Mixed	Absence tracking Employee performance	Time saving	Unknown	Unknown
Papershift	Time management	Absence tracking Time tracking Scheduling	Time saving	Unknown	Unknown

Tool	Key focus area	Key features	Key selling point(s)	Users	Countries
PeopleForce	Mixed	Absence tracking Time tracking Employee performance Feedback management Onboarding/Offboarding Goal tracking Employee profiles	Time saving Integration of HR on one platform	500+	40 (mostly in Europe and the CIS (Commonwealth of Independent States) area)
Personio	Mixed	Absence tracking Time tracking Employee performance Training/skills Onboarding/Offboarding Workflows E-signature Employee profiles	Time saving Data security	8,000	France, Germany, Italy, the Netherlands, Spain
Shyftplan	Time management	Absence tracking Time tracking Scheduling	Time saving Error reduction Employee satisfaction	Unknown	Unknown

Source: Authors' own elaboration based on tools' website.

7.3. Thematic case study: Employee monitoring and surveillance

7.3.1. Background: Case study focus

Thematic focus	The thematic focus is on tools that, in some way, monitor workers such as through wearables (hardware) and programmes (software), presence monitoring systems, keystroke loggers, speech and writing monitoring, webcams and CCTV, voice and image recordings, facial recognition, facial movement tracking, telephone call recording, movement and location tracking, and so on.
Analysed tools	Teramind, ActivTrak, Veriato, Interguard, RescueTime, Humanyze. For more information on the tools see the Append at the end of the case study.

7.3.2. Context: The monitoring and surveillance tool market

The employee monitoring solution industry was valued at USD 1.12 billion in 2021 and is predicted to reach USD 2.10 Billion by 2030, growing at a compound annual growth rate of 7.2% from 2021-2030.[240] Worker monitoring and surveillance tools tend to provide data-backed behaviour analytics, with insights for productivity, worker wellness, data security, and a range of compliance mechanisms.

Tools analysed in this case study cover a wide spectrum, but two thematic categories encompass the main areas that these tools offer. These themes are: 1) data-based behavioural analytics; and 2) health and wellness worker monitoring. Many tools offer more than one function. Tools take the form of software programmes in the backend of computers, where workers sometimes are not aware that they are installed. The other major type of surveillance and monitoring tools is hardware, where wearable technologies, and/or devices attached to desks or worn on bodies, are evident.

Data-based worker behaviour analytics. The practice of employee monitoring and surveillance via behavioural analytics involves technological measurement and monitoring of employee performance, looking at productivity, engagement, and idle time, as well as identifying insider information about both positive and potentially deviant behaviour.[241] Surveillance occurs via the use of webcams, CCTV, screenshots, keystroke tracking, web history, email recording, recording and viewing online chats, and listening to and recording phone calls.[242] These tools have historically been used in physical working environments and are now also intensified in hybrid and remote working environments.

Health and wellness worker management. The practice of employee monitoring and surveillance is also often oriented around promoting better wellness and health for a better work/life balance, for increased productivity. Not all of the tools used for wellness management were originally designed for corporate use but for the fitness industry. 243 The case of FitBit Wellness is one of these, where FitBits are typically used for sports but are also part of the recommended 'behaviour change'

[240] See: https://www.globenewswire.com/en/news-release/2022/11/10/2553615/0/en/Global-Employee-Monitoring-Software-Market-Size-To-Reach-USD-2-10-Billion-By-2030-CAGR-Of-7-2.html

[241] See: https://hbr.org/2022/12/toward-fairer-data-driven-performance-management?ab=hero-subleft-3

[242] See: https://www.sanantonioemploymentlawblog.com/2022/04/articles/general/monitoring-work-from-home-employees/

[243] See: Moore, P. (2019). *The Quantified Self in Precarity, Work, Technology and What Counts* (Routledge).

programme that is offered by this company.[244] In that light, these products identify worker behaviour such as diet, biometrics such as heartrate, sleep, steps taken, tone of voice, presence, and pace.[245]

There are **two main areas** that surveillance and monitoring software provide for companies. The areas are firstly to do with **employee presence and performance**, where a product aids the user to identify whether they are at workstations and for what duration; what employees are doing when they work; worker's health; and also to measure productivity. Products provide the capacity to detect how much and for how long workers have worked, by tracking time spent on specific activities, detected by how long a worker uses a certain software, like Microsoft Word. **Performance** can be measured and monitored by identifying the duration of presence and also determined by management, based on whether productive work is happening or not.

Productivity measure could be, for example, related to the types of work facilitated by MS Word, such as composition, text preparation and editing. Where time spent using MS Word is applied, a manager can identify how long a worker has been writing and editing based on, for example, RescueTime data preparation. This data can be used to identify workers' e.g., 'composition' which is considered **productive work** and therefore, linked to better or worse **performance** depending on time spent using that software.

Productive 'composition' can, technically, be done anywhere, as long as a worker has a mobile working station such as a laptop. Other environments where employee presence and performance are monitored and surveyed are within a more traditional office building. Some products provide GPS tracking. This aids management in identifying how long a worker spends at one station; which stations workers visit; and how long workers spend at other stations or in other locations, such as common rooms or the restroom. Location and duration of physical presence are both detected, thus.

The data gathered by Humanyze,[246] for example, can indicate location and duration which may be analysed by management to determine how productivity can be facilitated. For example, if a team that is detected to spend more time visiting each other's work stations has higher productivity scores like company revenue, then a manager can decide on the best arrangements for where desks and other office furniture should be located.

To detect time spent at a workstation both in terms of a laptop and in terms of the presence in physical offices, which usually means a worker's use of a computer, products can identify how many keystrokes are deployed and/or how often the mouse is used. Other functions to do this involve random screenshots of a worker's screen, conducted internally, and sent to management. Screenshots allow managers to see what work is being carried out. Other products make use of computers' webcams directly to detect presence at workstations. Further to this, performance is measured in a variety of methods by-products. according to specifically tailored productivity measures. Heat sensors have also been placed under desks and on chairs to determine worker presence likewise.

The second area has to do with **security and compliance**. **Security** is associated with ensuring both employees/workers and companies keep within data and privacy protection rules. **Compliance** can refer to both the company and individual workers. Data and privacy protection law differs across jurisdictions and when installing software, companies are invited to indicate where they are located so that the provider can be aware of which functions are compliant with local law.

However, there are very few laws internationally that prevent employers from reading workers' emails. The tendency in this domain is that employers do not read workers' emails, but take the

[244] See: https://healthsolutions.fitbit.com/corporatewellness/ x

[245] A good review of technological monitoring and tracking of workers including machines, systems or computers determining the content or pace of work; machines, systems or computers monitoring workers' performance; and wearable devices, such as smart watches, data glasses or other (embedded) sensors is found here https://osha.europa.eu/en/publications/artificial-intelligence-worker-management-overview

[246] See: https://humanyze.com/

liberty to do so only where the company believes there may be some malpractice or deviant activity underway. In other words, employers might resort to reading emails if they suspect that there may be, and then, to identify whether there are fraudulent or industrial espionage activities underway. There is no specific software that allows corporations to gain access to emails, but in general, emails are stored unencrypted on company servers, meaning that anyone with admin access, such as those working in the IT department, can read these. Cases have gone to the European courts however including one whereby an employer read worker's communications, claiming that they should not use company services to communicate about personal matters.[247] Workers should not give up the right to privacy when they enter the workplace, whether physically in an office or online.[248]

Worker compliance with job descriptions and contracts is another area covered by monitoring and surveillance technologies. This is seen in cases, for example, whereby employers want to ensure that workers are not spending time on their own activities, rather than working. Companies regularly carry out GPS tracking on taxi cabs, delivery vans and garbage disposal trucks.[249]

Industry uptake. Though there is speculation of industry saturation where experts value this market at USD 1.12 billion in 2021,[250] it is difficult to estimate the exact reflection of the uptake of worker monitoring and surveillance tools. The box below provides an overview of selected tools and the number of global customers for each one, but data is limited and likely not representative of the whole market. Generally, tool providers do not specifically target or offer tailor-made solutions for any particular sector, although some market their products differently to different industries. For instance, RescueTime is a tool that emphasises personal timekeeping and has good functionality around composition, which would be useful in the book publishing and freelance writing industries.[251] Manufacturing companies, on the other hand, may find that wearable devices are useful as they allow workers to swipe in and out of work, keep track of where workers are in the distribution centre, record how quickly they move from one part of the floor to another and even track whether they are meeting picking and stacking quotas.[252]

Many providers also promote their tools as solutions for remote or hybrid teams. Hubstaff, for instance, is a workforce management software that 'helps teams manage remote work better with time tracking, productivity and monitoring features'.[253] This software helps employers track activity levels through a variety of indicators, including mouse and keyboard usage, to ensure high company productivity levels and avoid wasting time overseeing and checking-in with workers.

Box 5: Teramind

TERAMIND: 'Available as a cloud-based, on-premise, or private cloud solution, Teramind's insider threat management and user behaviour analytics for business brings organizations peace of mind by providing data-backed workforce insights.' These descriptions are taken from the company website.

Core areas of operation:

- **Employee monitoring**: Goes beyond basic employee monitoring with data-backed behaviour analytics that provides actionable insights for productivity, data security and compliance while (as the product description indicates) maintaining employee privacy.

[247] See: https://globalfreedomofexpression.columbia.edu/cases/case-barbulescu-v-romania/

[248] See: https://ggulawreview.com/2021/02/22/employee-privacy-rights-while-working-from-home/

[249] Woodcock, J. and Graham, M. (2019). *The Gig Economy: A Critical Introduction.* Polity.; Levy, K. (2022) *Data Driven: Truckers, Technology, and the New Workplace Surveillance* Princeton University Press.

[250] See: https://www.globenewswire.com/en/news-release/2022/11/10/2553615/0/en/Global-Employee-Monitoring-Software-Market-Size-To-Reach-USD-2-10-Billion-By-2030-CAGR-Of-7-2.html

[251] See: https://www.rescuetime.com/

[252] See: https://www.nist.gov/blogs/manufacturing-innovation-blog/wearable-technology-manufacturing-workplace

[253] See: https://hubstaff.com/

- **Insider Threat Detection**: Protect sensitive and confidential company data from loss caused by accidental, negligent or compromised insiders with insider threat prevention fueled by data-driven endpoint monitoring.
- **Business process optimisation**: Helps companies reimagine how business gets done with business process optimization data that creates more efficient systems, increases productivity and streamlines processes.
- **Forensics**: Strengthen data loss prevention with a robust endpoint monitoring system that identifies and blocks malicious user activity.

Source: Authors, based on https://www.teramind.co/

Whilst the digital tools surveyed for this case study do not tend to indicate their purpose for particular sectors, they can be grouped based on 1) thematic category, 2) area of focus, and 3) technical features and functions (see Monitoring and Surveillance Taxonomy, Appendix 1).

Worker management software can be divided into two distinct thematic categories: data-based worker analytics; and health and wellness management. The former category is designated by software its two areas of focus, namely, surveillance (i.e. the measurement of worker presence) and monitoring (i.e. the measurement of worker performance). The latter category emphasises worker wellness through data collection and use, where at times, tools that were originally intended for the fitness market are also used for wellness at work.

Our Taxonomy was developed through a grounded approach. That is, if one starts by looking at the specific functions provided by each tool, then, the areas of focus for different tools start to emerge. Take for instance Teramind (represented in **Box 5**). The wide-ranging list of functions outlined in the 'features' column includes: business intelligence reports, scriptable rule logic, live & recorded screen capture, smart rules & automated alerts, remote desktop control, application & website monitoring, email monitoring, instant message monitoring, keystroke logger, printed document tracking, online meeting monitoring. Each of these features can be grouped into three areas of focus: surveillance, monitoring, and security. The same finding applies to the other surveyed tools like ActivTrak and Veratio. Thus, the identification of a natural grouping arises: what we are calling data-based worker analytics.

The same process unfolded for the second thematic category of wellness. Consider the features provided by FitBit Health Solutions, a software used by employers to help 'actively support employee health and wellness': activity tracking, sleep tracking, heart rate tracking, sleep and stress management, heart health, skin temperature, in-app workouts, guided programs, among others.[254] Inkin is a virtual wellness programme that includes tracking and monitoring technologies.[255] Rescuetime, furthermore, provides software features that provide a form of coaching to reduce workers' distraction.[256]

The features do not appear at first glance perhaps, to map onto the two main areas of surveillance and monitoring, because they do not directly measure performance. Instead, the features offered by wellness tracking tools contain the expectation that such improvements will indirectly lead to enhanced workplace productivity due to reduced sickness and enhanced wellbeing.

[254] See: https://healthsolutions.fitbit.com/corporatewellness/

[255] See: https://www.inkin.com/

[256] See: https://www.rescuetime.com/

7.3.3. Analysis: The impact on firms and employees

Drivers of tool uptake: Analysing tool creators' websites and marketing material, the most prominent selling points of monitoring and surveillance technologies are their capacity to 1) provide data to identify worker productivity through monitoring website usage, and to enhance productivity via promoting good time management and good health and wellness; and 2) to spot risks and threats, and aid both worker and company compliance.

Productivity: Tool providers emphasise time tracking, task orientation, scoring, digital coaching and other monitoring methods applied for management observation and utility; as well as the enhancement of workers' productivity. The tendency is for visualisations in the forms of pie charts or using other visuals (for an example see figure below) that show managers how much time workers are spending on specific websites; how many keystrokes they have made during the day; and videos and sensors identify how long workers spend at their work stations.

Figure 106: Example of how information about workers can be presented to managers

Source: Veriato Workforce Behavior Analytics

A significant amount of work was conducted online before the COVID-19 pandemic, but this global health crisis meant that online traffic surged by 48% from the middle of 2019 through to the middle of 2020.[257] Online meetings became increasingly useful during the COVID-19 pandemic. A new form today is the use of such software as Zoom and Microsoft Outlook, which can be used to record meetings. Previous to this, it was relatively rare to record meetings. Now, it is seen as fairly standard practice. Not enough discussion, however, has emerged to identify what can or will be done with the data from such recordings.[258]

Risk identification and compliance: Tool providers promise to help firms gain significant insights based on real-time alerts and notifications when potential insider risk emerges, via behavioural analytics. Teramind, for example, promises security and compliance features that allow for insider threat prevention via employee monitoring and compliance management, where user and 'entity'

[257] See: https://hbr.org/2021/03/the-state-of-globalization-in-2021

[258] Aloisi, A. & De Stefano, V. (2022). Essential jobs, remote work and digital surveillance: Addressing the Covid 10 pandemic panopticaon *International Labour Review* 161(2)https://onlinelibrary.wiley.com/doi/ftr/10.1111/ilr.12219 ;

behaviour analytics allow a company to prevent data loss and detect the potential for fraud internally.[259]

Regulatory compliance is particularly important today such as within the EU, where GDPR regulations require quick reporting of data breaches. Companies are interested in preventing data breaches not least because the cost is up to 10 million euros, or, in the case of an undertaking of that amount, up to 2% of its entire global turnover of the preceding fiscal year, whichever is higher.[260] Several tools are offered to help companies keep within GDPR rules.

7.3.4. Opportunities and risks in tool adoption

Monitoring and surveillance activities provide significant amounts of data, which is needed to write algorithms that aid in employer decision-making.[261] Data can be used to enhance worker evaluations, and to make recommendations for promotion based on high rates of productivity or wage increases. Data can also be used to make choices about the distribution and allocation of worker rewards. It can also be used for more disciplinary functions of restrictions or replacements.[262]

The benefits of tools and their usage are efficiency,[263] accuracy in decision-making, savings, [264]and business optimisation. 265 Firstly, statisticians might be able to gather and assess the data about productivity and compliance that tools accumulate, but it would take significantly longer and cost a lot more.[266] Indeed, a new job role is linked to the rise in monitoring and surveillance technologies: that of the data scientist, and the data analyst.[267] The granular data that is accumulated by the discussed tools can be used to assist employers in making more accurate decisions than those based on heuristics or traditional in-person meetings. However, while 'employers tout the efficiency gains from the surveillance workers, what they leave unsaid is the cost to workers themselves'.[268]

The risks are that the benefits listed above are not possible or are somehow blocked and restricted, due to 1) operational and procedural, and 2) psychosocial issues.[269] A research piece in the Certified Public Accountant (CPA) Journal indicates that worker monitoring is occurring in 'fundamentally broken environments' which are deemed to be 'full of fragmented or non-standardized processes and tasks, user-unfriendly IT applications, poor UX [user experience] design, bottlenecks and other factors.'[270] One survey indicates that over ½ of tech workers would consider quitting if employers recorded them or used facial recognition to monitor productivity.[271]

Operationally, 'dirty data',[272] software failures, and incorrect usage of tools lead to risks. Furthermore, if there is insufficient training provided for those implementing the tools as well as the workers being

[259] See: https://www.teramind.co/

[260] See: https://gdpr-info.eu/issues/fines-penalties/

[261] Levy, K., & Barocas, S. (2018). Privacy at the Margins|refractive surveillance: Monitoring customers to manage workers. International Journal of Communication, 12, 23.

[262] Kellogg, K. C., Valentine, M. A., & Christin, A. (2020). Algorithms at work: The new contested terrain of control. *Academy of Management Annals,* 14(1), 366-410.

[263] See: https://www.processmaker.com/blog/employee-monitoring-to-optimize-business-processes/

[264] Young, M. M., Bullock, J. B., & Lecy, J. D. (2019). Artificial discretion as a tool of governance: a framework for understanding the impact of artificial intelligence on public administration. *Perspectives on Public Management and Governance,* 2(4), 301 – 313.

[265] See: https://www.processmaker.com/blog/employee-monitoring-to-optimize-business-processes/

[266] See: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet

[267] See: https://www.coursera.org/articles/data-analyst-vs-data-scientist-whats-the-difference

[268] Ajunwa, I., Crawford, K., Schultz, J. (2017). Limitless worker surveillance. *California Law Review*: 735-776

[269] Moore, P. (2018). *The Threat of Violence and Harassment in the Digitalized World of Work*. ACTRAV: International Labour Organization, Geneva. https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---actrav/documents/publication/wcms_617062.pdf

[270] See: https://hbr.org/2022/10/monitoring-individual-employees-isnt-the-way-to-boost-productivity

[271] See: https://morningconsult.com/2022/05/31/tech-workers-survey-surveillance/

[272] See: https://www.cpajournal.com/2022/10/25/detecting-and-resolving-dirty-data/

monitored, and insufficient participation with related representative groups, risks can emerge. Psychosocially, workers who are monitored are reported to feel that their employers do not fully trust them.[273] Another risk is the perceived depletion of autonomy and agency.[274] Monitoring can be linked to work intensification and, in turn, to rates of burnout.[275] Constant surveillance and monitoring can lead to negative sentiments or perceptions that undermine workers' health, where the experience of unceasing surveillance can contribute to heightened levels of anxiety and stress.[276] Anxiety is not only a harm in itself, but is associated with other health conditions ranging from heart failure to chronic obstructive pulmonary disease.[277] Psychological distress 'is associated with increased risk of mortality from several major causes'.[278] Previously, the USA had very light data and privacy protections in place for workers, but this is changing.[279] The EU has the strongest privacy and data protection law in the world, but it is still very easy for employers to track workers within the remit of legality. One *Forbes* author asked this rhetorical question, when looking at the risks and hazards of worker monitoring and surveillance: 'Yes, it's legal, but is it ethical?'[280]

7.3.5. Appendix

Table 24: Overview of select AM tools that monitor workers

Tool Name	Description	Thematic Category	Areas of focus	Features	Users	Countries
ActivTrak	'ActivTrak is a workforce productivity and analytics software… that helps teams understand how people work, whether in the office or remotely… and analyzes data and provides insights that help mid-market enterprises be more productive and compliant.'	Data-based worker analytics	Surveillance & monitoring, productivity, security	Dashboards, productivity reports, location insights, impact analysis, application and website usage, workload management, productivity coaching, personal Insights, integrations, team summaries, alarms & website blocking, activity classification, activity logs, data privacy, user management.	9,000+	94

[273] Chan, M. (2003). Corporate espionage and workplace trust/distrust. *Journal of Business Ethics* 42: 45-58.Bernstrøm, V. H. and Svare, H. (2017). Significance of Monitoring and Control for Employees' Felt Trust, Motivationa and Mastery *Nordic journal of working life studies* 7(4), 29 - 49; Bråten, M. (2010). 'Kontroll og overvåking i arbeidslivet', Oslo: Fafo-rapport (22); Chan, M. (2003). Corporate espionage and workplace trust/distrust. *Journal of Business Ethics* 42: 45-58.

[274] Moore, P. (2023). Workers' right to the subject: Datafied social relations and limitations in regulation. *Convergence,* forthcoming.

[275] Franke, F. (2015). Is work intensification extra stress?. *Journal of Personnel Psychology* 14(1), 17–27.

[276] Charbonneau, É. & Doberstein, C. An empirical assessment of the intrusiveness and reasonableness of emerging work surveillance technologies in the public sector. Public Administration Review 80, no. 5 (2020): 780-791; Giacosa, E., Mahabubul Alam, G., Culasso, F., Crocco, E. (2023). Stress-inducing or performance-enhancing? Safety measure or cause of mistrust? The paradox of digital surveillance in the workplace. *Journal of Innovation & Knowledge* 8(2): 100357.

[277] Celano, C. M., Villegas, A. C., Albanese, A. M., Gaggin, H. K. & Huffman, J. C. (2010). Depression and anxiety in heart failure: a review. *Harvard review of psychiatry* 26(4); Eisner, M. D., Blanc, P. D., Yelin, E. H. Katz, P. P., Sanchez, G., Iribarren, C., and Omachi, T. A. (2010) Influence of anxiety on health outcomes in COPD. Thorax 65(3): 229-234.

[278] Russ, T. C., Stamatakis, E., Hamer, M, Starr, J. M., Kivimäki, M., Batty, G. D. (2012). Association between psychological distress and mortality: individual participant pooled analysis of 10 prospective cohort studies. Bmj 345 (2012).

[279] See: https://www.dentons.com/en/insights/articles/2023/february/16/privacy-in-the-us-workplace-a-rapidly-changing-landscape

[280] See: https://www.forbes.com/sites/carolinecastrillon/2022/11/16/why-employee-monitoring-is-doomed-to-backfire/?sh=555c0d281729

Tool Name	Description	Thematic Category	Areas of focus	Features	Users	Countries
Teramind	'Available as a cloud-based, on-premise, or private cloud solution, Teramind's insider threat management and user behaviour analytics for business bring organizations peace of mind by providing data-backed workforce insights.'	Data-based worker analytics	Surveillance & monitoring, productivity, security	Business intelligence reports, scriptable rule logic, live & recorded screen capture, smart rules & automated alerts, remote desktop control, application & website monitoring, email monitoring, instant message monitoring, keystroke logger, printed document tracking, online meeting monitoring.	5,000	12+
Veriato	'Veriato is… [a] provider of workforce behaviour analytics, helping businesses monitor and analyze remote or hybrid workforce activity to boost productivity and keep sensitive data secure.'	Data-based worker analytics	Surveillance & monitoring, productivity and wellness	Idle & active time tracking, web applications and use, screenshots, file & document tracking, customisable settings, reports & real-time alerts, application tracking, psycholinguistic analysis, email monitoring, network activity, web, chat & IM monitoring, keystroke logging	Unknown	Unknown
RescueTime	A time management software to help workers be "more focused, productive, and motivated."	Health and wellness management	Monitoring, wellness	Dashboard, personalised goals, smart coaching, focus sessions, app use monitoring, automatic time-tracking & distraction blocking.	2,000,000+	Unknown
Fit Bit Health Solutions	'Fitbit Health Solutions delivers health and wellness solutions designed to increase engagement, improve health outcomes and drive positive returns for employers, health plans and health systems… our solutions help companies, plans and providers engage more meaningfully with individuals throughout their daily lives.'	Health and wellness management	Surveillance & monitoring, productivity and wellness	Activity tracking, sleep tracking, heart rate tracking, sleep and stress management, heart health, skin temperature, in-app workouts, guided programs, nutrition management.	111,000,000 (registered users across all platforms and uses)	Unknown

Tool Name	Description	Thematic Category	Areas of focus	Features	Users	Countries
Humanyze	‘Humanyze connects and combines essential company data to reveal how behaviours, conditions, and decisions impact people and performance across an enterprise.’		Surveillance & monitoring, productivity and wellness	Identify key patterns & trends, quantify related opportunities & risks, make data-driven recommendations, prioritize targeted actions, continuously validate & improve.	Unknown	Unknown

7.4. Thematic case study: HR Recruitment

Thematic focus	The thematic focus is on digital software tools that help businesses with the recruitment process. The core functions of these tools are to assist in a range of basic tasks like job posting, application tracking, and interview scheduling, but also more complicated tasks like identifying and assessing candidates.
Analysed tools	Workable, Jobvite, Hiretual, Recruit CRM, Bamboo HR, Pymetrics

7.4.1. Context: The HR recruitment tools market

The global HR recruitment software market is expected to continue growing at a healthy rate in the years to come. Verified Market Research reports that the recruitment software market ''was valued at USD 2,366.21 Million in 2021 and is projected to reach USD 3,873.98 Million by 2030, growing at a CAGR of 5.85% from 2023 to 2030'.[281] The rapid expansion of this market is explained by the increasing rate at which firms are adopting HR software, the pressing need for recruitment automation, and the mounting imperative to focus on talent acquisition. Cloud-based HR software is the segment analysts anticipate will grow at the fastest rate for the foreseeable future.[282] Businesses of all sizes are turning to cloud-based options instead of traditional on-site solutions due to their lower cost, easier deployment, and better scalability.

However, AI-powered recruitment tools are expected to take up a larger share of the market. AI-powered tools offer several advantages that make them highly attractive to firms operating in competitive marketplaces for talent: job posting, applicant screening, interview scheduling, identifying candidates, and even assessing candidates. In short, AI-powered tools are helping to automate the recruitment process and render the hiring process much more efficient.[283] Speeding up these processes is an ever more important objective for tech firms that struggle to find candidates with the specific talents and capacities in demand. In this sense, businesses are viewing 'talent acquisition' as a crucial business strategy for gaining a competitive advantage and HR recruitment tools and software are thus critical in realising this strategy.

The HR recruitment software industry is expected to be shaped by other emerging dynamics beyond the transition to cloud-based and AI-powered tools. For instance, there is also a growing demand for mobile-friendly HR software.[284] The increasing use of mobile devices by workers, and firms' interest in HR processes being seamless and positive for the candidate, means that the capacity to reach and integrate candidates across devices is a key development. Mobile-friendly HR recruitment software is therefore being designed to post jobs and manage applications from anywhere and conduct interviews and assessments on mobile devices. The benefits of increased efficiency, improved candidate experiences, and heightened reach will continue to drive the shift to mobile-focus HR recruitment techniques and software.

Another key dynamic that will influence the HR recruitment market is the demand for integrated systems.[285] Businesses are always looking for new ways to streamline their operations for greater efficiency, and integrated recruitment systems help businesses do that by providing a single platform

[281] https://www.verifiedmarketresearch.com/product/recruiting-software-market/

[282] https://blog.grovehr.com/cloud-hr-software

[283] Maxime Legardez Coquin, "HR Recruiting Software in the Era of AI," Forbes, April 11, 2023, https://www.forbes.com/sites/forbeshumanresourcescouncil/2023/04/11/hr-recruiting-software-in-the-era-of-ai/.

[284] Nosa Omoiggui, "HR Services Failing to Make Software Mobile-Friendly," HR Magazine, 28 April, 2022. https://www.hrmagazine.co.uk/content/news/hr-services-faliing-to-make-software-mobile-friendly/.

[285] https://www.globenewswire.com/en/news-release/2019/06/20/1871705/0/en/Recruitment-Software-Market-to-reach-US-3-095-8-Mn-by-2025-exhibiting-a-CAGR-of-7-4.html

for all their recruitment needs. Integrated software helpfully eliminates the need for manual data entry thereby reducing the possibility of errors and ensuring accurate, up-to-date information on candidates. Integrated systems also have the benefit of facilitating collaboration between members of the hiring team and supporting their sharing of relevant data and feedback in a seamless manner.

Box 6: WORKABLE

Core areas of operation:

- **Sour and Attract:** Workable provides several tools that help firms advertise, identify, recruit, and retain needed talent, Examples include job board integration, building careers pages, recruiting in local languages, passive sourcing of candidates.
- **Evaluate and Collaborate**: This software helps with the evaluation of candidates and organising discussions amongst the hiring team about applicants.
- **Automate and Hire**: Workable is used to render the hiring process more efficient by automating repetitive tasks, managing the steps of the hiring process, producing e-documents and obtaining e-signatures, and ensuring regulation compliance.
- **Onboard and Manage**: Features within Workable guide the onboarding process of new hires, and helps to manage current employee information, company documents, and holiday scheduling.

7.4.2. Analysis: The impact on firms and workers

The previous section set out the status of the HR recruitment software industry and the key technological and business-incentive dynamics shaping its development. We now consider how these tools are impacting and changing the operations, experiences, or behaviours of firms and employees.

Sourcing and attracting talent. HR recruitment software helps firms develop customised job postings that accurately reflect the duties associated with a position. Such programs have a suite of options to help with posting and promoting job vacancies on popular job boards, career websites, or social media platforms. These tools play an important role in boosting the visibility of these openings, helping firms reach a wider audience and attract a larger pool of qualified candidates. There are also HR tools that track the performance of job advertisements which provides valuable feedback on what techniques and methods work best for achieving recruitment objectives. These tracking features help recruiters analyse the effectiveness of their content and where it is posted, and therefore make data-driven decisions about what recruitment strategies to implement. Not only are these outcomes beneficial in themselves, by streamlining the process of posting and advertising, HR recruiters have more time to engage with prospective candidates.

Applicant Tracking System. A key feature offered by many HR recruitment software packages is an applicant tracking system (ATS). ATS simplifies the hiring process by automating a variety of tasks traditionally performed by human HR workers. A central benefit of such automation is that it makes an ATS capable of efficiently managing a high volume of applications. Unlike its human counterpart, an ATS isn't slowed down by burdensome manual sorting and organising of application forms and supporting documents and parsing through applicant details. ATS also economises the recruitment process by screening applications with customisable criteria and automated filters, helping recruiters quickly identify the best-suited applicants for further consideration. This allegedly helps to ensure that the most qualified candidates move to subsequent stages and removes bias from the selection process – something that is contested by numerous examples of biased HR algorithms.[286] One of the more sophisticated capabilities of ATS is the generation of key recruitment metrics such a time-to-fill, source of hire, and cost-per-hire. These outputs help recruiters and other HR staff make data-supported decisions and discern areas for improvement in their recruitment strategies.

Candidate Relationship Management. The impact of candidate relationship management (CRM) is considerable, as it plays a meaningful role in helping recruiters build and maintain positive relationships with applicants. CRM systems assist with this by facilitating engagement and communication between candidates and the firm throughout the entire application process, from first contact to onboarding new hires. A reported benefit of CRM is that it promises an improved application experience for candidates. When communication between firms and candidates is centralised, recruiters can offer more time-sensitive and personalised feedback and interactions. This is achieved through a variety of features offered by CRM systems including automated email campaigns, interview scheduling, and status updates – all of which provide clarity and reassurance to workers who are applying for new jobs. It also provides a positive image for the firm which is hoping to attract top candidates. Just as with the previous functions CRM (a) improves collaboration between members of HR departments through shared access to and interactions with these tools and (b) generates important data sets that can be used to optimise recruitment strategies.

Interview Assessment and Management. HR recruitment software is also impacting how interviews are assessed and managed with consequences for both firms and workers or candidates. Like many of the features discussed already, streamlining the process is the key outcome. These tools aid in the development of pre-defined assessment criteria and the structuring of interview formats which can result in more standardised and objective evaluations and comparisons of candidates. In other words, consistency in the application process should ensure a more meritocratic approach where candidates are assessed on relevant characteristics like qualifications, skills, and overall suitability for the role. Again, like other functions noted above, these features help with collaboration amongst the hiring team and help generate important data analytics for optimising recruitment and hiring strategies.

7.4.3. Opportunities and risks in tool adoption

The prior sections have already begun to reveal the major opportunities associated with the implementation of HR recruitment software. They can largely be sorted into four overarching categories.

- **Streamlined and economised process:** HR recruitment software and digital tools significantly streamline and economise the processes of finding, assessing, hiring, and onboarding new hires. We have seen the many ways in which they do this, including: creating customisable adverts and posting them across numerous job boards; automating application tracking and manual sorting; facilitating improved communication and collaboration among hiring teams; centralising candidate information and interview notes; scheduling interviews with automated reminders; among numerous other functions. All of these features associated with HR recruitment software simplify and organise the recruitment process, bringing greater efficiency to the search and securement of needed skills and top talent for firms.

- **Improved candidate experience:** Another noted opportunity associated with HR recruitment software is how it may result in improved experiences for candidates. To start, these software packages provide a more user-friendly platform where candidates can enter personal information and upload application materials and supporting documents, As noted

[286] Jeffrey Dastin, "Amazon scraps secret AI recruiting tool that showed bias against women," Reuters, October 8, 2018, accessed on May 27, 2023, https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G.

previously, ATS systems provide candidates with the opportunity to track their application status in real-time and know immediately when important decisions are made. This has the benefit of keeping candidates better informed and reducing uncertainty about whether their application has been received and a decision made. Furthermore, HR software can help recruiters provide customised feedback at different stages of the application process, which improves candidate engagement. A more personalised process improves morale and offers candidates more insight into how their applications can be improved for future pursuits.

- **Improved analytics and reporting:** For the firm, perhaps the biggest opportunity presented by HR recruitment software is improved analytics and reporting. A core function of these digital tools is to help recruiters make data-driven decisions that lead to optimised recruitment processes. The automation of data collection and analysis means that recruiters can obtain immediate insight into how their strategies are performing across a number of relevant metrics like time-to-fill, cost-per-hire, source of hire, as well as keeping track of other significant applicant demographics. Moreover, these tools can output performance metrics in the form of reports, data visualisations, and other accessible forms, providing a clear picture that recruiters can use to evaluate different approaches. These functions are crucial for evaluating the effectiveness of new and old strategies and identifying areas for improvement. Such evaluations allow recruiters to make informed decisions, implement optimised strategies, and allocate their limited resources in the most efficient way – outcomes that should lead to the hiring of better candidates and greater overall success for the firm.

- **Improved teamwork and collaboration:** An important innovation of HR recruitment software is that it creates a centralised place (inside a digital portal) where members of a hiring team can access all the same materials and collaborate with one another directly. Specifically, these tools help team members collate and share candidate information, resumes, and interview feedback with real-time updates thereby keeping everyone seamlessly up to date. The major benefit of this innovation is that a streamlined collaboration brings about more efficient decision-making processes and minimises the chances that miscommunications occur – to the detriment of both the firm and candidates. These tools also facilitate a smoother work environment through features like automated task assignment, deadline setting, and task tracking. In sum, HR recruitment tools reproduce a more coordinated and integrated approach to recruitment and hiring which yields major benefits for team members and the firm itself.

There are, however, risks associated with HR recruitment tools – risks that accompany the advance of all kinds of new technologies into the world of work.

- **Technical issues and overreliance:** Like all other kinds of software, HR recruitment tools can lead to technical failure because of system glitches, software bugs, or compatibility and integration issues. These failures can negatively impact the recruitment process through needless delays, data loss, and at worst, the system going offline. These problems are exacerbated to the extent that HR recruitment teams are over-reliant on this technology, On top of that, overreliance without proper human oversight may result in candidates being overlooked who do not fit algorithmic criteria. As noted elsewhere, a key limitation of algorithmic assessments is their inability to incorporate important contextual information, something that is of great concern when evaluating candidates. In this sense, it is important for firms to try and establish a good balance between automation and human judgement in hiring practices.

- **Data security and privacy concerns:** HR recruitment software raises data security and privacy concerns as it is involved in the handling of often highlighted confidential candidate information. These digital tools are tasked with collecting and storing substantial sources of personal data in the form of resumes, contact details, immigration and identification documents, and so on. Data breaches, unauthorised access, or other kinds of violations pose serious risks for both candidates and employers. To guard against these possibilities, it is imperative that organisations implement stringent security measures, use encryption protocols, safely store data, and monitor access controls. Beyond technical measures, firms should also adopt policies and procedures for the government of data access, sharing, and retention that ensure the safety of those whose data they are handling.

- **Bias and discrimination:** A repeated theme in this document is that algorithms are capable of perpetuating biased outcomes based on unfair discrimination. HR software that was trained on data sets that contain historically informed biases or prejudices may filter candidates through discriminatory criteria. This can occur in a variety of ways. If HR software makes determinations predicated on gendered, racial, ethnic, or educational background associations of chosen candidates in the past, the software may continue to sediment those associations in the selection of candidates in the future. This puts both workers and firms at risk. Workers may be unfairly evaluated not on their merit or suitability for the position but instead screened out because their CV contains words of phrases that are proxies for prejudgement. Firms also risk using software that violates the rights of prospective applicants and thereby be exposed to civil suits and other forms of regulatory crackdown.

7.4.4. Conclusions

Several key takeaways emerge from the analysis, including:

- The competitive environment for top talent acquisition is going to continue driving the uptake of HR software, as recruitment is already regarded as a critical business strategy,

- HR recruitment software is set to increasingly incorporate AI into its operations. The speed at which AI can complete tasks related to sourcing candidates, parsing applications, scheduling interviews, among other functions, far outpaces human recruiters. As one interviewee explained, they are uncertain what their role will be in the future.

- The uses and functions of HR digital tools are expanding well beyond the mere automation of simple tasks. These software packages are capable or producing customised reports based on advances analytics and statistical modelling. In this sense, the software may, and in some cases do, take on the role of shaping and guiding recruitment strategies.

- There are many opportunities associated with the growth of this industry, including improved candidate experiences, collaboration amongst hiring teams, and an overall faster and smoother application process. However, there are notable risks associated with reduced human oversight of the process and the possibility for bias to be perpetuated at scale.

- Lastly, the overall impact of these tools will depend on how they are implemented. We have in many cases noted or suggested how companies can encourage the upsides of HR recruitment software and minimise the downsides. Firms will have to be diligent in their use of them.

7.4.5. Appendix

Table 25: Overview of select AM tools that used for HR Recruitment

Tool Name	Description	Areas of focus	Features	Users	Countries
Workable	‘’Workable Software is a software-as-a-service that provides applicant tracking system and recruitment software to support and manage the hiring process. It was founded in Athens, Greece, but it is now based in Boston, Massachusetts.’	Sourcing & Attracting ATS CRM Interview Assessment & Management Onboarding	One-click posting, passive candidate sourcing, AI-powered recommendations, resurface past candidates, advanced referrals and internal mobility portal, customisable careers pages, mobile-friendly application forms, language options, interview self-scheduling	27,000+	Uknown
Jobvite	‘Our brand promise is to streamline and improve the entire talent acquisition lifecycle from sourcing and recruiting to hiring and onboarding. We serve as a trusted partner for organizations by offering innovative, purpose-built technology that optimizes and automates recruiting success, drives positive growth, delivers business outcomes, and differentiates enterprise organizations in a competitive labor market.’	Sourcing & Attracting ATS CRM Interview Assessment & Management Onboarding	Career sites, job broadcast, CRM, text messaging, chatbots, ATS & onboard, video screening, employee referrals, internal mobility, analytics, integration marketplace	18,000+	Uknown
HeroHunt.Ai	‘Find profiles that others can't find, get verified contact details and send automated messages to hundreds of candidates and get responses quickly.’	Sourcing & Attracting	Platform outreach, AI skills and analytics, verified contact details, hyper-personalised messaging, automated follow ups, sending analytics, GDPR and privacy proof,	Unknown	Unknown
RecruitCRM	‘Recruit CRM's ATS + CRM is a **single solution to streamline and automate your recruitment process**. ‘	Sourcing & Attracting ATS CRM	Candidate management and visualisation, resume parser, candidate hotlisting, interview scheduling, job management, customisable hiring pipeline, advanced searchers, client management, invoice generator and tracker, team conversation organiser, call logs, calendar integration	Uknown	100+

Tool Name	Description	Areas of focus	Features	Users	Countries
BambooHR	‘’BambooHR is an American technology company that provides human resources software as a service. Founded in 2008 by Ben Peterson and Ryan Sanders, the company is based in Lindon, Utah. BambooHR's services include an applicant tracking system and an employee benefits tracker.’	Sourcing & Attracting ATS CRM Interview Assessment & Management Onboarding	Secure employee database, automated reporting, mobile app, applicant tracking, dynamic dashboards, electronic signature tracking,	30,000+	Unknown
Pymetricse	‘pymetrics is a soft skills platform redefining hiring and talent management – using data-driven behavioral insights and audited AI to create a more efficient, effective, and fair hiring process across the talent lifecycle.’	Sourcing & Attracting ATS Interview Assessment and Management	Numerical and logical reasoning assessments, digital interviews, structured evaluation process, internal collaboration support,	Unknown	Unknown

Annex 8: Legislation and policy mapping

Submitted as a separate file titled *Annex 8 - Legislation and policy mapping.xlsx.*

Annex 9: Workers survey questionnaire

Dear Respondents,

To proceed with the survey, please select your preferred language in the upper right corner. The survey questions will automatically appear in the language that you have selected. You can also change the language at any time.

Visionary Analytics, contracted by the European Commission, is conducting a study to better understand the trends and barriers in using algorithms that automate managerial functions in the workplace, their effects on workers and employers, including what challenges and opportunities these can create.

Main concepts relevant for the study include:

- **Algorithms:** list of instructions describing how a computer could perform an action, solve a problem, or complete a task in a semi or fully automated manner (e.g., search engines, sorting algorithms, facial recognition software, automated data collection tools).

- **Technologies, computer programmes, and apps: some examples include wearables** (e.g., a badge that tracks workers), cameras, chatbots, keystrokes trackers, online collaborative platforms, shared email environments, scheduling apps.

- **Managerial functions that can be automated through algorithms**: some examples include allocation of work tasks, providing recommendations / instructions to workers (incl. binding and non-binding), monitoring workers, collecting data on workers, training, rewarding, firing and hiring workers.

For more information on the study please click here (hyperlink).

Filling the survey should not take longer than 10-15 minutes. We kindly ask you to complete this survey by **April 30**.

If you have questions about the survey or the study, please contact us by email at employees@visionarysurveys.lt.

Thank you in advance for your cooperation!

Kind regards,

Visionary Analytics team

* Asterisk refers to a mandatory (required) question.

Data Privacy and Informed Consent Information

Do you agree that your personal data will be processed in line with Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons regarding the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data? Your data will only be processed by Visionary Analytics employees entrusted with implementation of the project.

Do you agree that your answers will be anonymised and published as part of the study

report? None of your personal details (e.g., institution and affiliation, e-mail address) will be published or disclosed. The full information regarding data protection is provided in the privacy statement that can be found here (hyperlink).

¨ Agree ¨ Disagree (If "Disagree", "Thank you for expressing interest!" and end survey)

This survey is intended for nonmanagerial staff, that is **employees not holding a management position**. What best describes your position in your organisation (tick only one option)?

☐	Full-time worker	Go to A
☐	Part-time worker	
☐	Fixed term or temporary contract worker	
☐	Manager or similar (this answer option will redirect you to the employers' survey)	Redirect to employers' survey
☐	Self-employed	"Thank you for expressing interest" and end of survey
☐	Unemployed	
☐	Retired	
☐	Student	

A – Your current work arrangement

A1. Please rate your **typical experience at your current workplace**:

	Strongly disagree	Partially disagree	Indifferent	Partially agree	Strongly agree	Don't know
I often feel stressed and/or uneasy at work						
I often work overtime						
I often have to work with tight deadlines						
I often have to work at a high speed						
At work I am sometimes put in risky situations prone to accidents						
I have sufficient freedom to schedule my own tasks						
I have full information about how decisions about my work or my career are made						

	Strongly disagree	Partially disagree	Indifferent	Partially agree	Strongly agree	Don't know
I often feel discriminated						
I am exposed to constant surveillance						
I often feel productive						
My work motivation and engagement are high						
Other, please specify						

B – Your experience with algorithms automating managerial tasks

Please base your answers on your experience working in your current workplace.

B1. Are you aware about the use of any of the following (or other) **technologies, computer programmes, and apps in your current workplace**? Select all options that apply.

☐ Wearables (for example, wearing a security equipment with a badge/sound/notification)

☐ Monitoring and surveillance technologies (e.g., cameras)

☐ Chatbots

☐ Keystrokes trackers

☐ Apps/ software that interact with workers (e.g., automatically assign work / tasks)

☐ Online collaborative platforms

☐ Shared email environments

☐ Other apps or hardware (please specify)

☐ To my best knowledge, I am not aware of the usage of any of the aforementioned tools in my workplace à Go to "About you"

B2. To the best of your knowledge, provide an estimate on the extent to which the specific managerial processes are automated through algorithms at your current workplace? If algorithms are used to automate some other managerial function, please write it down and rate it below.

	Never	Very rarely	About half the time	Very frequently	Always	Don't know
Allocation of worker shifts, resources, and tasks (e.g., algorithms calculate the optimal way to allocate shifts)						

	Never	Very rarely	About half the time	Very frequently	Always	Don't know
Collection of worker personal data for the purpose of paying, tracking sick leave, or vacations						
Talent management, trainings (e.g., using algorithms to identify possible skill gaps and/or recommend training programmes)						
Worker performance evaluation (rating and ranking workers performance)						
Providing recommendations / instructions to workers (e.g., providing market trend information to office workers; wearables that through vibrations guide workers to a particular item in a warehouse)						
Monitoring and surveillance of workers (e.g., using facial recognition software to identify relevant workers and monitoring if they are wearing necessary safety equipment)						
Recruitment of workers (e.g., automatically gathering relevant information from CVs; matching candidates and vacancies)						
Firing / terminating workers (e.g., automatically letting go underachieving workers based on a performance review)						
Rewarding workers (e.g., using algorithms to estimate the size of a bonus a worker should receive according to their performance)						
Other, please specify	______					

B3: Regarding using algorithms at the workplace, does your employer?

	Yes	No	Don't know
Involve workers or the worker representatives (e.g., trade unions, work council) in the design and/or development of the algorithms			
Ensure that the way in which algorithms are used is transparent (e.g., clearly communicates directly or via email how the algorithms are used to the workers)			
Provide clear information on how your personal data is used			
Provide training to workers on how to use the algorithms			
Implement transparent and clear rules and procedures on monitoring and surveillance			
Introduce a reporting mechanism on misuses of algorithms			
Have a clear policy who is accountable for misuse of algorithms or risks related to them			
Take accountability for misuse of algorithms, mistakes, or issues connected to them			
Dedicate efforts to understand and protect the health, safety, and wellbeing of workers affected by algorithms			
Take other actions to protect workers and their rights (if you select this option, you will be prompted to specify these actions in the text box below)			

Only ask if the respondent answered "Yes" to the last B3 question.

B4. Please specify other actions that your employer takes to protect workers and their rights**.**

C – Effects of algorithms on workers

In this section, please highlight how the algorithms that you selected in the previous section either help or hinder you at your current workplace.

C1. In your view and based on your personal experience, **what kind of impact do algorithms you selected prior had on you and your workplace?**

	Strong negative impact	Medium negative impact	Small negative impact	No impact	Small positive impact	Medium positive impact	Strong positive impact	Don't know
Your productivity								
Quality of your work								
Clarity of what you should do								
Communication quality between and among workers and employers								
Your autonomy								
Your engagement								
Your motivation								
Your fatigue levels (positive impact refers to reduced fatigue levels)								

	Strong negative impact	Medium negative impact	Small negative impact	No impact	Small positive impact	Medium positive impact	Strong positive impact	Don't know
Your work intensity (positive impact refers to reduced intensity)								
Your privacy								
Your safety at work								

C2. In your view and based on your personal experience, **what kind of impact do algorithms you selected prior had on you and your workplace?** If a particular impact is not listed, please insert and rate it using the text box below.

Please note that this question is a continuation of the previous one.

	Strong negative impact	Medium negative impact	Small negative impact	No impact	Small positive impact	Medium positive impact	Strong positive impact	Don't know
Your physical well-being								
Your anxiety levels (positive impact refers to reduced anxiety)								
Your general mental health								
Micromanagement of your work (positive impact refers to reduced micromanagement)								
Competition between workers								
Transparency of decision-making at your workplace								
Discrimination levels at your workplace								
Ability to exercise your rights (e.g., freedom of expression, trade union participation, etc.)								
Other, please specify								

C3: Overall, **to what extent are you satisfied with how algorithms that automate managerial functions are used at your workplace?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Very dissatisfied Very satisfied

D – About you

For this section, please give us some details about yourself and the place where you work

D1. What is your country of residence?

Select from a drop-down menu including EU countries + UK, US, Japan, China, other

D2. What is your gender?

- ☐ Female
- ☐ Male
- ☐ Other
- ☐ Prefer not to answer

D3. How old are you?

- ☐ Below 15
- ☐ 15-19
- ☐ 20-24
- ☐ 25-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60-65
- ☐ Above 65

D4. How long have you been working for your current employer?

- ☐ Less than a year
- ☐ Between one year and three years
- ☐ Longer than three years

D5. Which is your highest educational level?

- ☐ Primary education
- ☐ Lower secondary education
- ☐ Upper secondary education
- ☐ Post-secondary non-tertiary education

- ☐ Tertiary education (bachelor or above)

D6. Do you have a disability?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

D7. What best describes your role or activity?

- ☐ Armed forces occupation (e.g. marshal, captain or other officer in air force, navy, or army branches)
- ☐ Clerical support worker (e.g. clerk, secretary, receptionist, bank teller)
- ☐ Craft and related trade worker (e.g. house builder, roofer, jeweller)
- ☐ Elementary occupation (e.g. cleaner, helper, civil engineering labourer, courier)
- ☐ Plant and machine operator or assembler (e.g. mining and mineral processing plant operator, mechanical machinery assembler, driver)
- ☐ Platform worker (e.g. app based delivery worker / driver)
- ☐ Professional (e.g. architect, healthcare worker, teacher, lawyer, chemist, engineer, journalist)
- ☐ Sales worker (e.g. salesperson, shopkeeper, cashier, ticket clerk)
- ☐ Service worker (e.g. cook, guide, waiter, beautician)
- ☐ Skilled agricultural forestry and fishery worker (e.g. gardener, animal or dairy producer, farmer)
- ☐ Technician or junior professional (e.g. production process controller, technician, instructor, assistant or associate professional)
- ☐ Other (please specify)

D8. What is the main activity of your workplace?

- ☐ Agriculture, forestry, and fishing
- ☐ Mining and quarrying
- ☐ Manufacturing
- ☐ Electricity, gas, steam, and air conditioning supply
- ☐ Water supply, sewerage, waste management, and remediation activities
- ☐ Construction
- ☐ Wholesale and retail trade, repair of motor vehicles, and motorcycles
- ☐ Transporting and storage
- ☐ Accommodation and food service activities
- ☐ Information and communication
- ☐ Financial and insurance activities
- ☐ Real estate activities
- ☐ Professional, scientific, and technical activities
- ☐ Administrative and support service activities

- ☐ Public administration and defence, compulsory social security
- ☐ Education
- ☐ Human health and social work activities
- ☐ Arts, entertainment, and recreation
- ☐ Other services activities
- ☐ Other (please specify)

D9. What type of organisation do you work for?

- ☐ Private company
- ☐ Public administration (ministry, municipality, etc)
- ☐ Public company operating in the market (electricity, gas, heating provider)
- ☐ Public provider of service (hospital, school, etc.)
- ☐ Non-profit sector
- ☐ Don't know

D10. How many employees/workers do you estimate working in your workplace?

- ☐ 1-9
- ☐ 10-49
- ☐ 50-249
- ☐ 250 or more
- ☐ Don't know

D11. Are there employees' representatives in your workplace?

- ☐ Yes
- ☐ No
- ☐ Don't know

E – Closing question

Only ask if at least one managerial function automated by an algorithm was selected in B1

E1. Please provide any final thoughts or opinions on your experience(s) with algorithms that automate managerial functions. (max. 100 characters)?

Thank you for taking our survey. Your response is very important to us.

Annex 10: Employers survey questionnaire

Dear Respondents,

To proceed with the survey, please select your preferred language in the upper right corner. The survey questions will automatically appear in the language that you have selected. You can also change the language at any time.

Visionary Analytics, contracted by the European Commission, is conducting a study to better understand the trends and barriers in using algorithms that automate managerial functions in the workplace, their effects on workers and employers, including what challenges and opportunities these can create.

Main concepts relevant for the study include:

- **Algorithms:** list of instructions describing how a computer could perform an action, solve a problem, or complete a task in a semi or fully automated manner (e.g., search engines, sorting algorithms, facial recognition software, automated data collection tools).
- **Technologies, computer programmes, and apps: some examples include wearables** (e.g., a badge that tracks workers), cameras, chatbots, keystrokes trackers, online collaborative platforms, shared email environments, scheduling apps.
- **Managerial functions that can be automated through algorithms**: some examples include allocation of work tasks, providing recommendations / instructions to workers (incl. binding and non-binding), monitoring workers, collecting data on workers, training, rewarding, firing and hiring workers.

For more information on the study please click here (hyperlink).

Filling the survey should not take longer than 10-15 minutes. We kindly ask you to complete this survey by **April 30**.

If you have questions about the survey or the study, please contact us by email at employees@visionarysurveys.lt.

Thank you in advance for your cooperation!

Kind regards,

Visionary Analytics team

* Asterisk refers to a mandatory (required) question.

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Do you agree that your answers will be anonymised and published as part of the study

report? None of your personal details (e.g., institution and affiliation, e-mail address) will be published or disclosed. The full information regarding data protection is provided in the privacy statement that can be found here (hyperlink).

☐ Agree ☐ Disagree (If "Disagree", "Thank you for expressing interest!" and end survey)

This survey is intended for nonmanagerial staff, that is **employees not holding a management position**. What best describes your position in your organisation (tick only one option)?

☐	Full-time worker	Go to A
☐	Part-time worker	
☐	Fixed term or temporary contract worker	
☐	Manager or similar (this answer option will redirect you to the employers' survey)	Redirect to employers' survey
☐	Self-employed	"Thank you for expressing interest" and end of survey
☐	Unemployed	
☐	Retired	
☐	Student	

A – Your current work arrangement

A1. Please rate your **typical experience at your current workplace**:

	Strongly disagree	Partially disagree	Indifferent	Partially agree	Strongly agree	Don't know
I often feel stressed and/or uneasy at work						
I often work overtime						
I often have to work with tight deadlines						
I often have to work at a high speed						
At work I am sometimes put in risky situations prone to accidents						
I have sufficient freedom to schedule my own tasks						
I have full information about how decisions about my work or my career are made						
I often feel discriminated						
I am exposed to constant surveillance						

	Strongly disagree	Partially disagree	Indifferent	Partially agree	Strongly agree	Don't know
I often feel productive						
My work motivation and engagement are high						
Other, please specify	____					

B – Your experience with algorithms automating managerial tasks

Please base your answers on your experience working in your current workplace.

B1. Are you aware about the use of any of the following (or other) **technologies, computer programmes, and apps in your current workplace**? Select all options that apply.

☐ Wearables (for example, wearing a security equipment with a badge/sound/notification)

☐ Monitoring and surveillance technologies (e.g., cameras)

☐ Chatbots

☐ Keystrokes trackers

☐ Apps/ software that interact with workers (e.g., automatically assign work / tasks)

☐ Online collaborative platforms

☐ Shared email environments

☐ Other apps or hardware (please specify)

☐ To my best knowledge, I am not aware of the usage of any of the aforementioned tools in my workplace Go to "About you"

B2. To the best of your knowledge, provide an estimate on the extent to which the specific managerial processes are automated through algorithms at your current workplace? If algorithms are used to automate some other managerial function, please write it down and rate it below.

	Never	Very rarely	About half the time	Very frequently	Always	Don't know
Allocation of worker shifts, resources, and tasks (e.g., algorithms calculate the optimal way to allocate shifts)						
Collection of worker personal data for the purpose of paying, tracking sick leave, or vacations						
Talent management, trainings (e.g., using						

	Never	Very rarely	About half the time	Very frequently	Always	Don't know
algorithms to identify possible skill gaps and/or recommend training programmes)						
Worker performance evaluation (rating and ranking workers performance)						
Providing recommendations / instructions to workers (e.g., providing market trend information to office workers; wearables that through vibrations guide workers to a particular item in a warehouse)						
Monitoring and surveillance of workers (e.g., using facial recognition software to identify relevant workers and monitoring if they are wearing necessary safety equipment)						
Recruitment of workers (e.g., automatically gathering relevant information from CVs; matching candidates and vacancies)						
Firing / terminating workers (e.g., automatically letting go underachieving workers based on a performance review)						
Rewarding workers (e.g., using algorithms to estimate the size of a bonus a worker should receive according to their performance)						
Other, please specify	______________________________					

B3: Regarding using algorithms at the workplace, does your employer?

	Yes	No	Don't know
Involve workers or the worker representatives (e.g., trade unions, work council) in the design and/or development of the algorithms			

	Yes	No	Don’t know
Ensure that the way in which algorithms are used is transparent (e.g., clearly communicates directly or via email how the algorithms are used to the workers)			
Provide clear information on how your personal data is used			
Provide training to workers on how to use the algorithms			
Implement transparent and clear rules and procedures on monitoring and surveillance			
Introduce a reporting mechanism on misuses of algorithms			
Have a clear policy who is accountable for misuse of algorithms or risks related to them			
Take accountability for misuse of algorithms, mistakes, or issues connected to them			
Dedicate efforts to understand and protect the health, safety, and wellbeing of workers affected by algorithms			
Take other actions to protect workers and their rights (if you select this option, you will be prompted to specify these actions in the text box below)			

Only ask if the respondent answered “Yes” to the last B3 question.

B4. Please specify other actions that your employer takes to protect workers and their rights**.**

____

____

C – Effects of algorithms on workers

In this section, please highlight how the algorithms that you selected in the previous section either help or hinder you at your current workplace.

C1. In your view and based on your personal experience, **what kind of impact do algorithms you selected prior had on you and your workplace?**

	Strong negative impact	Medium negative impact	Small negative impact	No impact	Small positive impact	Medium positive impact	Strong positive impact	Don’t know
Your productivity								
Quality of your work								
Clarity of what you should do								
Communication quality between and among workers and employers								
Your autonomy								
Your engagement								
Your motivation								
Your fatigue levels (positive impact refers to reduced fatigue levels)								
Your work intensity (positive impact refers to reduced intensity)								

	Strong negative impact	Medium negative impact	Small negative impact	No impact	Small positive impact	Medium positive impact	Strong positive impact	Don’t know
Your privacy								
Your safety at work								

C2. In your view and based on your personal experience, **what kind of impact do algorithms you selected prior had on you and your workplace?** If a particular impact is not listed, please insert and rate it using the text box below.

Please note that this question is a continuation of the previous one.

	Strong negative impact	Medium negative impact	Small negative impact	No impact	Small positive impact	Medium positive impact	Strong positive impact	Don’t know
Your physical well-being								
Your anxiety levels (positive impact refers to reduced anxiety)								
Your general mental health								
Micromanagement of your work (positive impact refers to reduced micromanagement)								
Competition between workers								
Transparency of decision-making at your workplace								
Discrimination levels at your workplace								
Ability to exercise your rights (e.g., freedom of expression, trade union participation, etc.)								
Other, please specify								

C3: Overall, **to what extent are you satisfied with how algorithms that automate managerial functions are used at your workplace?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Very dissatisfied — Very satisfied

D – About you

For this section, please give us some details about yourself and the place where you work

D1. What is your country of residence?

Select from a drop-down menu including EU countries + UK, US, Japan, China, other

D2. What is your gender?

- ☐ Female
- ☐ Male
- ☐ Other
- ☐ Prefer not to answer

D3. How old are you?

- ☐ Below 15
- ☐ 15-19
- ☐ 20-24
- ☐ 25-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60-65
- ☐ Above 65

D4. How long have you been working for your current employer?

- ☐ Less than a year
- ☐ Between one year and three years
- ☐ Longer than three years

D5. Which is your highest educational level?

- ☐ Primary education
- ☐ Lower secondary education
- ☐ Upper secondary education
- ☐ Post-secondary non-tertiary education
- ☐ Tertiary education (bachelor or above)

D6. Do you have a disability?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

D7. What best describes your role or activity?

- ☐ Armed forces occupation (e.g. marshal, captain or other officer in air force, navy, or army branches)
- ☐ Clerical support worker (e.g. clerk, secretary, receptionist, bank teller)
- ☐ Craft and related trade worker (e.g. house builder, roofer, jeweller)
- ☐ Elementary occupation (e.g. cleaner, helper, civil engineering labourer, courier)
- ☐ Plant and machine operator or assembler (e.g. mining and mineral processing plant operator, mechanical machinery assembler, driver)
- ☐ Platform worker (e.g. app based delivery worker / driver)
- ☐ Professional (e.g. architect, healthcare worker, teacher, lawyer, chemist, engineer, journalist)
- ☐ Sales worker (e.g. salesperson, shopkeeper, cashier, ticket clerk)
- ☐ Service worker (e.g. cook, guide, waiter, beautician)
- ☐ Skilled agricultural forestry and fishery worker (e.g. gardener, animal or dairy producer, farmer)
- ☐ Technician or junior professional (e.g. production process controller, technician, instructor, assistant or associate professional)
- ☐ Other (please specify)

D8. What is the main activity of your workplace?

- ☐ Agriculture, forestry, and fishing
- ☐ Mining and quarrying
- ☐ Manufacturing
- ☐ Electricity, gas, steam, and air conditioning supply
- ☐ Water supply, sewerage, waste management, and remediation activities
- ☐ Construction
- ☐ Wholesale and retail trade, repair of motor vehicles, and motorcycles
- ☐ Transporting and storage
- ☐ Accommodation and food service activities
- ☐ Information and communication
- ☐ Financial and insurance activities
- ☐ Real estate activities
- ☐ Professional, scientific, and technical activities
- ☐ Administrative and support service activities
- ☐ Public administration and defence, compulsory social security
- ☐ Education
- ☐ Human health and social work activities
- ☐ Arts, entertainment, and recreation
- ☐ Other services activities
- ☐ Other (please specify)

D9. What type of organisation do you work for?

- ☐ Private company
- ☐ Public administration (ministry, municipality, etc)
- ☐ Public company operating in the market (electricity, gas, heating provider)
- ☐ Public provider of service (hospital, school, etc.)
- ☐ Non-profit sector
- ☐ Don’t know

D10. How many employees/workers do you estimate working in your workplace?

- ☐ 1-9
- ☐ 10-49
- ☐ 50-249
- ☐ 250 or more
- ☐ Don’t know

D11. Are there employees’ representatives in your workplace?

- ☐ Yes
- ☐ No
- ☐ Don't know

E – Closing question

Only ask if at least one managerial function automated by an algorithm was selected in B1

E1. Please provide any final thoughts or opinions on your experience(s) with algorithms that automate managerial functions. (max. 100 characters)

Thank you for taking our survey. Your response is very important to us.

Annex 11: Delphi survey questionnaire

Survey on the future of algorithmic management

Visionary Analytics, contracted by the European Commission, is conducting a study to better understand the trends and barriers in using algorithms that automate managerial functions in the workplace, their effects on workers and employers, including what challenges and opportunities these can create. For more information on the study please click here (hyperlink).

Main concepts relevant for the study include:

- **Algorithms:** list of instructions describing how a computer could perform an action, solve a problem, or complete a task in a semi or fully automated manner (e.g., search engines, sorting algorithms, facial recognition software, automated data collection tools).
- **Managerial functions that can be automated through algorithms**: some examples include: recruitment, work / task scheduling / distribution, nudging / directing workers, worker monitoring / surveillance, worker evaluation, talent management / training, rewarding workers, worker termination / firing.
- **Algorithmic management (AM)**: a diverse set of technological tools and techniques to remotely manage workforces, relying on data collection and surveillance of workers to enable automated or semi-automated decision-making[287]

This survey is designed to explore likely scenarios of future evolution of algorithmic management, drivers behind them, and potential impacts for employers, employees, and wider society. Filling the survey should not take longer than 20 minutes. We kindly ask you to complete this survey by July 13th, 2023.

Please note that this is the first round of the survey on the future evolution of AM. In the second round we will provide you with updated estimates and arguments.

If you have questions about the survey or the study, please contact us by email at delphi@visionarysurveys.lt.

Thank you in advance for your cooperation!

Kind regards,

Visionary Analytics team

* Asterisk refers to a mandatory (required) question.

Data Privacy and Informed Consent Information

Do you agree that your personal data will be processed in line with Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons regarding the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data? Your data will only be processed by Visionary Analytics employees entrusted with implementation of the project.

[287] Mateescu, A., & Nguyen, A. (2019). Explainer: Algorithmic management in the workplace. Data & Society Research Institute.

Do you agree that your answers will be anonymised and published as part of the study report? None of your personal details (e.g., institution and affiliation, e-mail address) will be published or disclosed. The full information regarding data protection is provided in the privacy statement that can be found here (hyperlink).

☐ Agree ☐ Disagree (If "Disagree" → "Thank you for expressing interest!" and end survey)

You are invited to this survey because you were identified as an expert or stakeholder who can provide valuable insights on this topic. What role best describes you (tick only one option)?

- ☐ Academic / Expert
- ☐ Employer / AM tool developer
- ☐ Employer representative (association or similar organisation)
- ☐ Worker representative (association, trade union or similar organisation)
- ☐ Regulator, policy making institution, agency representative
- ☐ Other (please specify)

A – Current AM usage (2023)

Based on our analysis, a very rough estimate is that AM currently around 25%-35% of companies in the EU use at least one or several AM tools. This is based on, first, the European Company Survey 2019, which predicts that around 27% of organisations in EU27 with 10 workers or more use data analytics to monitor worker performance. Though based on the Third European Survey of Enterprises on New and Emerging Risks (2019) carried out by EU-OSHA, only 8.2% organisations in EU27 with 5 workers use machines, systems or computer to monitor workers' performance. Second, based on a survey carried out by UNI Europa in 2022, 38% of employees believe that their employers use automatic projections to schedule shifts, 35% use algorithms to assigns tasks and distribute orders, 30% employing algorithms for approving or denying annual leaves and log sick leave. Third, based on the same survey, 35% of surveyed workers highlighted that in their company CV/resume screening algorithms are used to filter applications, 30% stated that automatic background checks are used in recruitment, and 10% also highlighted that their company employs automated job interviews without a human intervention. Based on this, and other sources, we derived our estimate. However, our estimate could be still wrong.

A1. Based on the provided information and your best knowledge, please indicate whether you agree or disagree that the estimate of 25%-35% of companies in the EU27 using AM is plausible.

- ☐ I agree that the estimate that around 25%-35% of companies in EU27 currently use algorithmic management at the workplace is appropriate.
- ☐ I do not agree with the estimate that around 25%-35% of companies in EU27 currently use algorithmic management at the workplace is wrong (if selected, move to next question)
- ☐ Do not know

Only if "do not agree" is selected – **A2. You answered that you do not agree with the provided estimate. Please indicate what, to your best knowledge, is a more likely estimate, and justify your choice.**

	Provide your best estimate in percentages	Please provide arguments / explain your answer
Please specify the percentage of companies in the EU27 that currently utilize AM tools in general.		________________

B – Drivers and barriers of change

Based on the analysis we carried out, usage of AM will grow in the upcoming years (more on this in the next question). However, the speed of this change will depend on a variety of factors, some of which will materialise themselves while others will not. With this in mind…

B1. Which of the factors outlined below you think will speed up or slow down AM adoption in the next two years? Please select up to 5 most important ones and specify which of them will speed-up and which will slow down AM growth. You are also free to suggest additional drivers and barriers.

	Mostly speed up	Mixed	Mostly slow down	Please provide arguments / explain your answer
Technological development: for example, rapid development of new digital technologies and business models, such as AI and machine learning, growing hyperconnectivity at work and similar.	☐	☐	☐	
Costs: for example, cost pressures, together with potentially increased productivity and efficiency, might increase the usage of AM; high cost of introducing algorithms might slow down widespread use of AM in the short-medium term	☐	☐	☐	
Know-how: for example, growing prevalence of discussions on the benefits of AM might speed up AM adoption or lack of know-how and skills on how such tools work at the company level will slow it down.	☐	☐	☐	
Security: for example, the changing security paradigm, such as the increasing cost of protecting AM technologies from potential cyberattacks, data security issues and similar, might decrease the spread of AM.	☐	☐	☐	
Demographic imbalance and labour shortage: for example, labour shortages might increase the usage of algorithms	☐	☐	☐	
Telework: for example, rise of telework, exacerbated by the COVID-19 pandemic, might increase the usage of AM or telework might not “stick” in many companies, slowing down AM usage.	☐	☐	☐	
Sustainability: for example, sustainable development goals, such as greening of the economy, might create new markets and increase the development of AM, or it might slow down usage as AM often requires increased computing power and energy consumption.	☐	☐	☐	
Employee preference: for example, some employees might not work for companies using AM	☐	☐	☐	

	Mostly speed up	Mixed	Mostly slow down	Please provide arguments / explain your answer
Regulations: introduction of new EU and/or national level regulation might increase the use of AM as it will provide clarity how such tools might be used, or might slow it down	☐	☐	☐	
Ethical considerations and Human-Centric Approach: Organisations and policymakers establish comprehensive ethical frameworks and guidelines to ensure AM respects individual rights, privacy, and promotes fair treatment of employees. Organizations prioritise a human-centric approach to algorithmic management, emphasizing the augmentation of human decision-making rather than complete automation. Algorithms are designed to support employees and enhance their capabilities, fostering collaboration and creativity. In turn, the use of AM is widely accepted.	☐	☐	☐	
Other, please specify ______________________________	☐	☐	☐	
Other, please specify ______________________________	☐	☐	☐	

B2. Which of the factors outlined below you think will speed up or slow down AM adoption in the next 10 years? Please select up to 5 most important ones and specify which of them will speed-up and which will slow down AM growth. You are also free to suggest additional drivers and barriers.

	Mostly speed up	Mixed	Mostly slow down	Please provide arguments / explain your answer
Technological development: for example, rapid development of new digital technologies and business models, such as AI and machine learning, growing hyperconnectivity at work and similar.	☐	☐	☐	
Costs: for example, cost pressures, together with potentially increased productivity and efficiency, might increase the usage of AM; high cost of introducing algorithms might slow down widespread use of AM in the short-medium term	☐	☐	☐	
Know-how: for example, growing prevalence of discussions on the benefits of AM might speed up AM adoption or lack of know-how and skills on how such tools work at the company level will slow it down.	☐	☐	☐	
Security: for example, the changing security paradigm, such as the increasing cost of protecting AM technologies from potential cyberattacks, data security issues and similar, might decrease the spread of AM.	☐	☐	☐	
Demographic imbalance and labour shortage: for example, labour shortages might increase the usage of algorithms	☐	☐	☐	

	Mostly speed up	Mixed	Mostly slow down	Please provide arguments / explain your answer
Telework: for example, rise of telework, exacerbated by the COVID-19 pandemic, might increase the usage of AM or telework might not “stick” in many companies, slowing down AM usage.	☐	☐	☐	
Sustainability: for example, sustainable development goals, such as greening of the economy, might create new markets and increase the development of AM, or it might slow down usage as AM often requires increased computing power and energy consumption.	☐	☐	☐	
Employee preference: for example, some employees might not work for companies using AM	☐	☐	☐	
Regulations: introduction of new EU and/or national level regulation might increase the use of AM as it will provide clarity how such tools might be used, or might slow it down	☐	☐	☐	
Ethical considerations and Human-Centric Approach: Organisations and policymakers establish comprehensive ethical frameworks and guidelines to ensure AM respects individual rights, privacy, and promotes fair treatment of employees. Organizations prioritise a human-centric approach to algorithmic management, emphasizing the augmentation of human decision-making rather than complete automation. Algorithms are designed to support employees and enhance their capabilities, fostering collaboration and creativity. In turn, the use of AM is widely accepted.	☐	☐	☐	
Other, please specify ________________________________	☐	☐	☐	

C – Future evolution of AM

Based on our analysis, we have made a very approximate estimation that the usage of algorithmic management (AM) will experience an annual growth rate of approximately 2%-6% starting from 2024. It is important to note that this estimation is based on proxy data as there is currently no reliable data available specifically on the evolution of AM usage in companies within the EU27.

To support this estimation, we considered the following:

- *According to the International Data Corporation, the AI market is projected to grow by approximately 29.6% annually between 2022 and 2026.*
- *The usage of cloud computing in companies, which was also a relatively new technology, experienced an annual growth rate of 3.3% from 2014 to 2021.*
- *Based on our employer survey conducted in 2023, 44.3% of the surveyed companies indicated that they have increased their usage of algorithms in the past two years to some extent.*

Considering the lack of credible data, instead of attempting to forecast the overall evolution of AM, we have developed various scenarios that incorporate the discussed drivers and barriers. With these factors in mind...

C1. In your best opinion, which of the three scenarios on future of AM (optimistic, neutral, pessimistic) will most likely become reality? You are free to propose your own scenario with your own predictions.

		Please provide arguments / explain your answer
☐	1. **Optimistic** – AM use will **increase significantly** (i.e., an annually usage will increase by around 4%-6% on top of the current usage). Optimistic scenario assumes a significantly faster growth in the prevalence of AM driven by four factors: cost-saving pressure, potential for increased efficiency and productivity, and the rapid growth of digital technologies and business models.	________________
☐	2. **Neutral/baseline** - AM use will **increase moderately** (i.e., 2-4% annually on top of the current usage). This scenario assumes that in the short term, the prevalence of AM will grow, but will be slowed down by costs, skills requirements, desire for human-centered management, and new or existing regulations.	________________
☐	3. **Reservedly pessimistic** – the growth in AM use will **slow down** (i.e., annually AM usage will increase by around 1%-2% on top of the current usage). Under the pessimistic scenario, high costs, lack of know-how, and new of existing regulations will become barriers for more wide-spread AM adoption.	_______________
☐	4. Other (please insert your alternative estimate). For example, the AM use might plateau and then it might decline.	_______________

C2. Based on the selected future scenario and the estimated usage of AM, do you agree/disagree with the following estimates on the usage of AM in the next 5 and 10 years? It is important to highlight that after 5 years, the speed of change is expected to decline across all scenarios as companies that can readily integrate such tools into their day-to-day operations will have already done so.

If the 25%-35% prediction and optimistic scenario was selected **Based on the estimate of current AM usage falling within the range of 25%-35%, the drivers and barriers identified, and considering the optimistic scenario...**		Please provide arguments / explain your answer
☐	I agree that in the next 5 years (i.e., in 2028) **around 55%-65% of organisations will be using AM in EU27**.	________________
☐	I agree that in the next 10 years (i.e., in 2033) **around 70%-85% of organisations will be using AM in EU27**.	________________
☐	I disagree. Other estimate for the next 5 years (please insert your estimates in percentages)	________________
☐	I disagree. Other estimate for the next 10 years (please insert your estimates in percentages)	________________

If the 25%-35% prediction and the neutral scenario was selected **Based on the estimate of current AM usage falling within the range of 25%-35%, the drivers and barriers identified, and considering the neutral/baseline scenario…**		**Please provide arguments / explain your answer**
☐	I agree that in the next 5 years (i.e., in 2028) **around 35%-55% of organisations will be using AM in EU27**.	________________
☐	I agree that in the next 10 years (i.e., in 2033) **around 45%-60% of organisations will be using AM in EU27**.	________________
☐	I disagree. Other estimate for the next 5 years (please insert your estimates in percentages)	________________
☐	I disagree. Other estimate for the next 10 years (please insert your estimates in percentages)	________________

If the 25%-35% prediction and the pessimistic scenario was selected **Based on the estimate of current AM usage falling within the range of 25%-35%, the drivers and barriers identified, and considering the reservedly pessimistic scenario…**		**Please provide arguments / explain your answer**
☐	I agree that in the next 5 years (i.e., in 2028) **around 30%-40% of organisations will be using AM in EU27**.	________________
☐	I agree that in the next 10 years (i.e., in 2033) **around 35%-45% of organisations will be using AM in EU27**.	________________
☐	I disagree. Other estimate for the next 5 years (please insert your estimates in percentages)	________________
☐	I disagree. Other estimate for the next 10 years (please insert your estimates in percentages)	________________

If the own prediction was written in and any scenario was selected **Based on your prediction of the current AM usage, drivers and barriers you selected, and based on your selected scenario, please consider the future evolution of AM…**	**Please provide arguments / explain your answer**
I believe that in the next 5 years (i.e., in 2028) **around X%-Y% of organisations will be using AM in EU27**.	________________
I believe that in the next 10 years (i.e., in 2033) **around X%-Y% of organisations will be using AM in EU27**.	________________

D – Managerial functions that can be automated through algorithms

D1. According to your best estimate, please assess how the usage of algorithms for the managerial functions below will evolve in the next 5-10 years in your selected scenario?

	No growth	Increase slightly	Increase significantly	Don't know	Please provide arguments / explain your answer
Allocation of worker shifts, resources, and tasks (e.g., algorithms calculate the optimal way to allocate shifts)					______________
Collection of worker personal data for the purpose of paying, tracking sick leave, or vacations					______________
Talent management, trainings (e.g., using algorithms to identify possible skill gaps and/or recommend training programmes)					______________
Providing recommendations / instructions to workers (e.g., providing daily market trend information to office workers; wearables that through vibrations guide workers to a particular item in a warehouse)					______________
Monitoring and surveillance of workers (e.g., using face recognition software to identify relevant workers and monitoring if they are wearing necessary safety equipment)					______________
Recruitment of workers (e.g., automatically gathering relevant information from CVs; matching candidates and vacancies)					______________
Firing / terminating workers (e.g., automatically letting go underachieving workers based on a performance review)					______________
Rewarding workers (e.g., using algorithms to estimate the size of a bonus a worker should receive according to their performance)					______________
Other, please specify					______________
AM tools in general					______________

E – Likely impacts of future evolution of algorithmic management

E1. Please assess the impacts that your selected future scenario is likely to have on?

	Negligible	Strong positive impact	Medium positive impact	Mixed impact	Medium negative impact	Strong negative impact	Don't know
Cost savings for employers							
Efficiency, productivity							
Overall competitiveness of companies							
Workplace innovation and digital transition							
Automation of managerial activities							
Transparency in decision making							
Unbiased and accurate decisions							
Accountability for biased/inaccurate decisions							
Routinisation and standardisation of work							
Deskilling of workers							
Autonomy of workers							
Workload and work intensity							
Work scheduling							
Physical health and safety of employees							
Mental health							
Performance pressure, burnout, anxiety							
Social isolation							
Worker privacy							
Workplace relationships							
Discrimination							
Collective rights							
Carbon footprint							
Other, please specify							

END OF QUESTIONNAIRE – THANK YOU!!

Annex 12: Interview questionnaires

12.1. Interview questionnaire: EU level experts and stakeholders

Name of interviewee		
Institutional affiliation		
Level of representation (national or/and EU)		
Relevant experience (AM, OSH, data protection, industrial relations, other)	Based on the respondent's self-evaluation before/at the beginning of the interview	
Date of interview		
Name of interviewer		

Introduction: why are we consulting you?

The European Commission is conducting a study to better understand the trends and barriers in using algorithmic management (AM) in the workplace, how it can affect workers and employers. The results of this study will help to better understand the potential consequences of AM and identify the main challenges and opportunities for prevention, policy and practice, as well as to identify gaps and needs for EU level intervention.

Main concepts relevant for the study include:

- **Algorithms:** list of instructions describing how a computer could perform an action, solve a problem, or complete a task in a semi or fully automated manner (e.g., search engines (e.g., Google, Bing), sorting algorithms, facial recognition software, automated data collection tools).

- **Algorithmic Management** (AM): use of advanced digital technologies and algorithms, including artificial intelligence powered ones, to monitor workers and to automate or support managerial decisions.

- **Technologies and apps**: wearables (e.g., wearing a security equipment with a badge/sound/notification), automatic monitoring and surveillance technologies (e.g., cameras with face recognition), chatbots, keystroke trackers, apps and software that interact with workers (e.g., automatically assign work / tasks, track KPIs).

- **Managerial functions** that can be automated through AM: allocation of work shifts, resources, tasks, collection and processing of worker personal data, training workers, providing recommendations to workers, monitoring workers, evaluating workers performance, recruiting new workers, firing and rewarding workers.

The study is performed by Visionary Analytics and is carried out at the request of European Commission, DG Employment, Social Affairs and Inclusion. Please find the support letter here (support letter here).

Data Privacy and Informed Consent Information

Your personal data will be processed in line with Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons regarding the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data. Your data will only be processed by Visionary Analytics employees entrusted with implementation of the project. For more information see: Protection of your personal data.

Questions on data privacy

Do you agree that this interview will be recorded and its contents used in line with data privacy provisions?

Which of the following options regarding use of the information that will provide, do you prefer?

Can be published with your personal information (I consent to the publication of all the information in my contribution in whole or in part including my name or my organisation's name and I declare that nothing within my response is unlawful or would infringe the rights of any third party in a manner that would prevent publication)

Can be published provided that you remain anonymous (I consent to the publication of any information in my contribution in whole or in part, which may include quotes or opinions I express, provided that it is done anonymously. I declare that nothing within my response is unlawful or would infringe the rights of any third party in a manner that would prevent publication).

Challenges and opportunities of AM

1. To what extent does your organisation analyse **trends** in algorithmic management? What does the main evidence show?
2. What are the key opportunities that the introduction of AM technologies at the workplace present for employers? Which groups of employers/which sectors will benefit the most?
3. What are the **opportunities** these technologies present for workers (for example, AM solutions could ease compliance with health and safety measures, they are sometimes perceived less biased than humans with assignment of tasks, evaluation of workers, such solutions more accurately take into account the physical capabilities of workers when assigning physical tasks)?
4. Does the introduction of AM technologies at the workplace present any challenges (leading to negative effects) for workers? What are the **key challenges** (e.g. impact on worker autonomy, job control, loss of social support/relationships with peers or managers, impact on safety, stress, mental health issues, impact of such systems not taken into account into the workplace risk assessment, incl. aspects such as ethics, data protection, worker consent, etc.)?
5. Which workers' groups are more/less exposed to the negative/positive impacts of such technologies? If such worker management practices will become more widespread, **who** will be subject to the negative effects the most, who will benefit the most?
6. What could be considered as **"failure factors"** (see examples below) that often lead to the identified negative effects?

- ☐ Poorly trained discriminative and biased algorithms
- ☐ Absence of human oversight
- ☐ Lack of flexibility
- ☐ Inscrutable systems

- ☐ Excessive application of AM technologies
- ☐ Lack of transparency about application of AM technologies

7. What could be considered as key **"success factors"** (see examples below) that could lead to minimisation of AM-induced challenges or the maximization of identified positive effects? What should be done during the implementation/usage stage of the technology (not only technically but also from a work organisation point of view) in order to reduce the negative effects and maximise the benefits?

- ☐ Ensure worker inclusion in the design and risks assessment of algorithms
- ☐ Ensure periodical and participatory reassessment of risks and impacts of algorithms
- ☐ Provide more autonomy to workers to schedule their tasks and identify methods to achieve goals
- ☐ Ensure transparency of monitoring and surveillance procedures and data use
- ☐ Protect workers from discriminatory treatment of algorithms
- ☐ Clarify accountability when an algorithmic decision leads to negative effects
- ☐ Introduce a reporting mechanism on misuses of algorithms
- ☐ Dedicate additional efforts to understand and protect the health, safety and wellbeing of employees affected by algorithms
- ☐ Involve the worker representatives such as trade unions in the design and improvement of AM technologies

Existing EU labour acquis

Currently there are no Directives that exclusively focus on algorithmic management. However, several existing or forthcoming Directives and Regulations touch upon the relevant issues. Please find them listed in the Table below.

Relevant *acquis*	Relevant provisions
EU Working Time Directive (Directive 2003/88)	It sets a maximum of 48 working hours per week. This provision is relevant in the light of the risk of overwork and the right to disconnect.
Transparent and Predictable Working Conditions Directive (Directive (EU) 2019/1152)	It requires that employment contract should include provisions in relation to the place of work, organisation and work patterns. This ensures more predictable and transparent working patterns for workers, which could have a positive impact on job quality and security.
Work-Life Balance Directive (Directive (EU) 2019/1158),	It stipulates that working parents and carers are entitled to flexible working arrangements (including remote working arrangements).

Relevant *acquis*	Relevant provisions
General Data Protection Regulation (Regulation (EU) 2016/679),	It contains relevant provisions regarding data collection and processing, and automated decision-making and profiling and requires that employees' consent be given prior to the introduction of any employee monitoring system.
Directive 2000/78/EC on equal treatment in employment and occupation	It sets a framework aimed at ensuring equal treatment and prevent discrimination.
The Directive establishing a general framework for informing and consulting employees (2002/14/EC);	It imposes that workers that are affected by a company decision must be involved in the process.
OSH Framework Directive (Directive 89/391) as well as five individual Directives, addressing particular workplace environments or risks, and the new OSH Strategic Framework 2021 – 2027 (COM/2021/323 final),	They set common minimum standards and oblige employers to take appropriate preventive OSH measures. The new Framework outlines a set of priorities and actions, in particular aimed at adapting to digitisation of workplaces and management of stress and psychosocial risks
Regulation (EU) 2019/1150 of the European Parliament and of the Council of 20 June 2019 on promoting fairness and transparency for business users of online intermediation services (Platform to Business Regulation)	It enshrines a model of transparency and accountability vis a vis self-employed workers using platforms.
Proposal for a Directive on improving working conditions in platform work (COM/2021/762 final).	It regulates automated monitoring and full and semi-automated decision-making in the context of platform work.
Proposal for a Regulation of the European Parliament and the Council laying down harmonized rules on Artificial Intelligence (Artificial Intelligence Act) (COM/2021/206 final)	It will set requirements regarding risk management (including of fundamental rights and discrimination risks), transparency and human oversight of AI systems used in the area of employment, workers management and access to self-employment.

8. To what extent does this legal framework and its key provisions remain suitable and fit-for-purpose in the face of trends and evolving challenges as well as opportunities posed by AM? In particular:
   a. Does it address the most relevant risks and challenges, posed by AM?
   b. Is this an adequate legal framework to cover the challenges raised by AM? For example, is it sufficient to guarantee workers' health and safety?
9. Are you aware of any factors that hinder successful implementation of these legislations regarding AM technologies at the workplace?
10. To what extent is there a need to supplement or change EU level regulation in order to address *main challenges or opportunities of AM*? If yes, why – what is the supporting evidence? What important aspects of existing regulations should be addressed and how?
11. To what extent do the EU and national legal frameworks provide an appropriate point of departure for social partners, when developing EU or national-level agreements?

Possible intervention / agreement at the EU level and future outlook

12. To what extent is there a need for new EU level policies/initiatives/strategies/etc. on AM?

a. If yes, which areas should it specifically target? How should the EU intervene [*if the respondent is not sure, please provide some alternatives e.g., set common minimum standards, facilitate sharing of good practices, etc.]*?
b. If not, why (not)?

13. What should be the role of the EU social dialogue in the regulation of AM?

12.2. Interviews with national stakeholders

Name of interviewee		
Institutional affiliation		
Level of representation (national or/and EU)		
Relevant experience (AM, OSH, data protection, industrial relations, other)	Based on the respondent's self-evaluation before/at the beginning of the interview	
Date of interview		
Name of interviewer		

Introduction: why are we consulting you?

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Main concepts relevant for the study include:

- **Algorithms:** list of instructions describing how a computer could perform an action, solve a problem, or complete a task in a semi or fully automated manner (e.g., search engines (e.g., Google, Bing), sorting algorithms, facial recognition software, automated data collection tools).

- **Algorithmic Management** (AM): use of advanced digital technologies and algorithms, including artificial intelligence powered ones, to monitor workers and to automate or support managerial decisions.

- **Technologies and apps**: wearables (e.g., wearing a security equipment with a badge/sound/notification), automatic monitoring and surveillance technologies (e.g., cameras with face recognition), chatbots, keystroke trackers, apps and software that interact with workers (e.g., automatically assign work / tasks, track KPIs).

- **Managerial functions** that can be automated through AM: allocation of work shifts, resources, tasks, collection and processing of worker personal data, training workers, providing recommendations to workers, monitoring workers, evaluating workers performance, recruiting new workers, firing and rewarding workers.

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Questions on data privacy

Do you agree that this interview will be recorded and its contents used in line with data privacy provisions?

Which of the following options regarding use of the information that will provide, do you prefer?

Can be published with your personal information (I consent to the publication of all the information in my contribution in whole or in part including my name or my organisation's name and I declare that nothing within my response is unlawful or would infringe the rights of any third party in a manner that would prevent publication)	
Can be published provided that you remain anonymous (I consent to the publication of any information in my contribution in whole or in part, which may include quotes or opinions I express, provided that it is done anonymously. I declare that nothing within my response is unlawful or would infringe the rights of any third party in a manner that would prevent publication).	

Challenges and opportunities of AM in your country

1. To what extent does your organisation analyse trends in algorithmic management in your country? What does the main evidence show?
2. Which challenges and opportunities posed by AM are the most relevant and widely discussed in your country?
3. Looking into future what key drivers will affect the scale and scope of AM in the future? Do you think that the current challenges and opportunities will remain? Or maybe new ones will emerge?

National policies and measures put in place

4. We have collected information on the legal framework and social partners agreements in *insert country*. We would like to check with you, if it is complete. Please name the national policies / initiatives / strategies / programmes / code of practices implemented or under discussion that you are aware of and believe are relevant to the discussion about algorithmic management and its possible effects. Please describe the named policies/initiatives/strategies/programmes/codes of practices: what are their names, on what level are they initiated (workplace, professional, sectoral, national, etc.) what actors are involved in their design/implementation, what are the target groups, and any other relevant information.

Insert summary Table here, based on policy mapping in selected country

5. In your view, how effective is the existing policy framework in making full use of opportunities and tackling the challenges of AM? If not, what is missing and/or what are the key implementation challenges? For example, is it sufficient to guarantee workers' health and safety?
6. What is the role of tripartite social dialogue and collective bargaining at cross-sectoral level, sectoral level and company level in designing policies/practices related to AM?

Existing EU labour acquis

7. Currently there are no Directives that specifically focus on algorithmic management. However, several existing or forthcoming Directives and Regulations touch upon the relevant issues. Please find them listed in the Table below.
8. To what extent are the national policies, social partners' agreements and debates around them shaped by the existing EU labour *acquis*?
9.

Relevant *acquis*	Relevant provisions
EU Working Time Directive (Directive 2003/88)	It sets a maximum of 48 working hours per week. This provision is relevant in the light of the risk of overwork and the right to disconnect.
Transparent and Predictable Working Conditions Directive (Directive (EU) 2019/1152)	It requires that employment contract should include provisions in relation to the place of work, organisation and work patterns. This ensures more predictable and transparent working patterns for workers, which could have a positive impact on job quality and security.
Work-Life Balance Directive (Directive (EU) 2019/1158),	It stipulates that working parents and carers are entitled to flexible working arrangements (including remote working arrangements).
General Data Protection Regulation (Regulation (EU) 2016/679),	It contains relevant provisions regarding data collection and processing, and automated decision-making and profiling and requires that employees' consent be given prior to the introduction of any employee monitoring system.
Directive 2000/78/EC on equal treatment in employment and occupation	It sets a framework aimed at ensuring equal treatment and prevent discrimination.
The Directive establishing a general framework for informing and consulting employees (2002/14/EC);	It imposes that workers that are affected by a company decision must be involved in the process.
OSH Framework Directive (Directive 89/391) as well as five individual Directives, addressing particular workplace environments or risks, and the new OSH Strategic Framework 2021 – 2027 (COM/2021/323 final),	They set common minimum standards and oblige employers to take appropriate preventive OSH measures. The new Framework outlines a set of priorities and actions, in particular aimed at adapting to digitisation of workplaces and management of stress and psychosocial risks
Regulation (EU) 2019/1150 of the European Parliament and of the Council of 20 June 2019 on promoting fairness and transparency for business users of online intermediation services (Platform to Business Regulation)	It enshrines a model of transparency and accountability vis a vis self-employed workers using platforms.
Proposal for a Directive on improving working conditions in platform work (COM/2021/762 final).	It regulates automated monitoring and full and semi-automated decision-making in the context of platform work.

Relevant *acquis*	Relevant provisions
Proposal for a Regulation of the European Parliament and the Council laying down harmonized rules on Artificial Intelligence (Artificial Intelligence Act) (COM/2021/206 final)	It will set requirements regarding risk management (including of fundamental rights and discrimination risks), transparency and human oversight of AI systems used in the area of employment, workers management and access to self-employment.

9. To what extent does this legal framework and its key provisions remain suitable and fit-for-purpose in the face of trends and evolving challenges as well as opportunities posed by AM? In particular:
    a. Does it address the most relevant risks and challenges, posed by AM?
    b. Is this an adequate legal framework to cover the challenges raised by AM? For example, is it sufficient to guarantee workers' health and safety?

Policies and measures put in place

10. To what extent is there a need for new EU level policies/initiatives/strategies/etc. on AM?
    a. If yes, which areas should it specifically target? How should the EU intervene [*if the respondent is not sure, please provide some alternatives e.g., set common minimum standards, facilitate sharing of good practices, etc.]*?
    b. If not, why (not)?

11. What should be the role of the EU social dialogue in the regulation of AM?

12.3. Interviews with businesses (employers, AM tool creators) for case studies on AM tools

Name of interviewee	
Organisation	
Thematic focus of the case study	E.g., recruitment and hiring; employee monitoring and surveillance; employee management
Tool that will be explored in depth	If relevant
Type of interviewee	Technology creator; employer (user) representative; worker or workers representative; etc.
Date of interview	
Name of interviewer	

Introduction: why are we consulting you?

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Main concepts relevant for this interview include:

- **Algorithms:** list of instructions describing how a computer could perform an action, solve a problem, or complete a task in a semi or fully automated manner.
- **Algorithmic Management** (AM): use of advanced digital technologies and algorithms, including artificial intelligence powered ones, to monitor workers and to automate or support managerial decisions.
- **Technologies and apps**: wearables (e.g., wearing a security equipment with a badge/sound/notification), automatic monitoring and surveillance technologies (e.g., cameras with face recognition), chatbots, keystroke trackers, apps and software that interact with workers (e.g., automatically assign work / tasks, track KPIs).
- **Managerial functions** that can be automated through AM: allocation of work shifts, resources, tasks, collection and processing of worker personal data, training workers, providing recommendations to workers, monitoring workers, evaluating workers performance, recruiting new workers, firing and rewarding workers.

The study is performed by Visionary Analytics and is carried out at the request of European Commission, DG Employment, Social Affairs and Inclusion. Please find the support letter here (support letter here).

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Note: questionnaires have to be adapted to the specific elements of the practice in question

Questions on data privacy

Do you agree that this interview will be recorded and its contents used in line with data privacy provisions?

About the company

1. We have collected some background data on your company from publicly available sources. Could you please check, if it is up to date and accurate and fill existing gaps? *[Note: we will collect this information from publicly available sources and Creditreform; this question will be asked only if necessary].*

Company	*Insert official company name*
Year founded	*Insert year founded*
No of employees	*Insert no of employees*
Main characteristics of the workforce	*Insert* information on the workforce broken down by sex, age and level of education
Turnover	*Insert turnover*
Economic activity (NACE code rev. 2)	*Insert economic activity*
Products / services	*Insert types of products produced / services provided*

2. Please, describe main trends in employment in your company over the last two years. Has there been any relevant restructuring process (such as automation, semi-automation) in this period resulting in minimisation of staff needed for performing managerial, HR or other functions?

About managerial practices and industrial relations

3. Is there a company collective agreement and/or is the company covered by a multi-employer collective agreement?
4. Is there any employee representative body? Which type of body (work council, trade unions, shop stewards, etc.)?
5. How is design and implementation of AM regulated the company level (for example, company collective agreement/framework agreement/ company plan based on social dialogue/HRM practices)? If AM is regulated through company collective bargaining, co-determination or social dialogue, please describe the main drivers and motivations that foster a collective bargaining/social dialogue process to deal with AM?

About the AM technology and relevant practices

6. What AM technology do you use?
7. When was the technology introduced?
8. What is the purpose of the technology? What are its main features and functionalities?
9. What managerial/HR/other functions does it automate?
10. Is the technology related to a specific sector?
11. Is the technology designed to manage specific job/functions?
12. What are the main drivers and motivations that led the company to implement the technology and related practices?

13. What legal or regulatory frameworks (e.g., laws, social partners' agreements) have had to be considered when implementing the tool? How do you assess its impact on the practice?
14. How has the technology evolved over time? Why?
15. How is the implementation of the technology monitored?
16. To what extent were employees (either directly or through representatives) involved in designing or implementation of the technology?
17. Do you have carried out or plan to carry out training initiatives on digital literacy?

About challenges and opportunities

18. Have you experienced any difficulties / challenges / obstacles when implementing the technology? What were these?
19. Viewing from the present day, how effective is the technology? What are the benefits for the employer and for workers, in your opinion (e.g. such as: productivity, efficiency, speed of decision making; reduction in production and coordination costs; a more precise, less biased, and accurate decision-making process; higher worker engagement / motivation; diversity and inclusion; higher safety and health at work, such as preventing accidents or other types of health and safety risks; greater information sharing, etc.)? What evidence / data would support these claims?
20. What are the challenges for the employer and for workers, in your opinion (for example, concerning data privacy and data protection, impact on worker autonomy, job control, loss of social support/relationships with peers or managers, not able to take break when needed, impact on ergonomics, safety, stress, mental health, issues etc.)? If so, how? What evidence / data is available?
    a. Have you assessed the impact of AM on workers' main working conditions (working time, pace, OSH, etc.) and performance?
21. In the light of your experience, what would you recommend to other similar companies using a similar technology? What could be considered as key **"success factors"** (see examples below) that could lead to minimisation of challenges or the maximization f identified positive effects? What should be done during the implementation/usage stage of the technology (not only technically but also from a work organisation point of view) in order to reduce the negative effects and maximise the benefits?

- ☐ Ensure worker inclusion in the design and risks assessment of algorithms
- ☐ Ensure periodical and participatory reassessment of risks and impacts of algorithms
- ☐ Provide more autonomy to workers to schedule their tasks and identify methods to achieve goals
- ☐ Ensure transparency of monitoring and surveillance procedures and data use
- ☐ Protect workers from discriminatory treatment of algorithms
- ☐ Clarify accountability when an algorithmic decision leads to negative effects
- ☐ Introduce a reporting mechanism on misuses of algorithms
- ☐ Dedicate additional efforts to understand and protect the health, safety and wellbeing of employees affected by algorithms
- ☐ Involve the worker representatives such as trade unions in the design and improvement of AM technologies

Future outlook

22. Do you plan to introduce any changes and/or further develop the technology? If yes, what and why?

23. What are your future prospects for AM in your company? Do you plan to use more of such technologies in the coming 2, 3, 5 years, and why?
24. To the best of your knowledge, what managerial functions will be most affected (i.e., automated, semi-automated) by algorithmic management in 2/5/10 years?
25. What legal or policy framework (i.e., laws and/or social partners’ agreements, trainings or similar) would be necessary to further support your company in making best use of AM and dealing with the challenges?

12.4. Interview questionnaire for workers (worker representatives) for case studies on AM tools

Name of interviewee	
Organisation	
Thematic focus of the case study	E.g., recruitment and hiring; employee monitoring and surveillance; employee management
Tool that will be explored in depth	If relevant
Type of interviewee	Technology creator; employer (user) representative; worker or workers representative; etc.
Date of interview	
Name of interviewer	

Introduction: why are we consulting you?

The European Commission is conducting a study to better understand the trends and barriers in using algorithmic management (AM) in the workplace, how it can affect workers and employers. The results of this study will help to better understand the potential consequences of AM and identify the main challenges and opportunities for prevention, policy and practice, as well as to identify gaps and needs for EU level intervention.

Main concepts relevant for this interview include:

- **Algorithms:** list of instructions describing how a computer could perform an action, solve a problem, or complete a task in a semi or fully automated manner.
- **Algorithmic Management** (AM): use of advanced digital technologies and algorithms, including artificial intelligence powered ones, to monitor workers and to automate or support managerial decisions.
- **Technologies and apps**: wearables (e.g., wearing a security equipment with a badge/sound/notification), automatic monitoring and surveillance technologies (e.g., cameras with face recognition), chatbots, keystroke trackers, apps and software that interact with workers (e.g., automatically assign work / tasks, track KPIs).
- **Managerial functions** that can be automated through AM: allocation of work shifts, resources, tasks, collection and processing of worker personal data, training workers, providing recommendations to workers, monitoring workers, evaluating workers performance, recruiting new workers, firing and rewarding workers.

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Note: questionnaires have to be adapted to the specific elements of the practice in question

Questions on data privacy

Do you agree that this interview will be recorded and its contents used in line with data privacy provisions? The latter can be found here[288].

About general employment trends, industrial relations' processes and outcomes

1. Please, describe main trends in employment in your company over the last two years. Has there been any relevant restructuring process (such as automation, semi-automation) in this period resulting in minimisation of staff needed for performing managerial, HR or other functions?

2. Is there a company collective agreement and/or is the company covered by a multi-employer collective agreement?
3. Is there any employee representative body? Which type of body (work council, trade unions, shop stewards, etc.)?

About the technology and relevant practices

5. To your best knowledge, what AM technology does your company use?
6. When was the technology introduced?
7. What are its main features and functionalities?
8. What managerial/HR/other functions does it automate?
9. Who uses the technology (what is the workers profile - by occupation, professional category – supervisory vs. not supervisory function, and socio-demographic profile)? Is it related to a specific sector? Is the technology designed to manage a specific skill level?
10. To what extent were employees (either directly or through representatives) involved in designing or implementation of the technology?
11. What legal or regulatory framework (e.g., laws, social partners' agreements) had to be considered when designing the technology? How do you assess its impact on the practice? *[Note: if employees were not involved in the design, this question can be skipped].*
12. How is the implementation of the technology monitored and enforced?

About the challenges and opportunities

14. Looking from employees' perspectives: what are the benefits of this tool/technology (e.g. such as: productivity, efficiency, speed of decision making; higher worker engagement / motivation; diversity and inclusion; higher safety and health at work, such as preventing accidents or other types of health and safety risks; greater information sharing, etc.)? What evidence / data would support these claims?
15. What problems / challenges does it create (for example, concerning data privacy and data protection, impact on worker autonomy, job control, loss of social support/relationships with peers or managers, not able to take break when needed, impact on ergonomics, safety, stress, mental health, issues etc.)? Have you assessed the impact of AM on workers' main working conditions (working time, pace, OSH, etc.) and performance? If so, how? What evidence / data is available?

About regulation/implementation

16. To what extent does the existing regulatory framework protect the rights of workers? In which areas is there sufficient / insufficient protection?

[288] Link to be added to an updated privacy statement

17. In the light of your experience, what would you recommend to employees of other similar companies? What could be considered as key **“success factors”** (see examples below) that could lead to minimisation of challenges or the maximization f identified positive effects? What should be done during the implementation/usage stage of the technology (not only technically but also from a work organisation point of view) in order to reduce the negative effects and maximise the benefits?

- ☐ Ensure worker inclusion in the design and risks assessment of algorithms
- ☐ Ensure periodical and participatory reassessment of risks and impacts of algorithms
- ☐ Provide more autonomy to workers to schedule their tasks and identify methods to achieve goals
- ☐ Ensure transparency of monitoring and surveillance procedures and data use
- ☐ Protect workers from discriminatory treatment of algorithms
- ☐ Clarify accountability when an algorithmic decision leads to negative effects
- ☐ Introduce a reporting mechanism on misuses of algorithms
- ☐ Dedicate additional efforts to understand and protect the health, safety and wellbeing of employees affected by algorithms
- ☐ Involve the worker representatives such as trade unions in the design and improvement of AM technologies

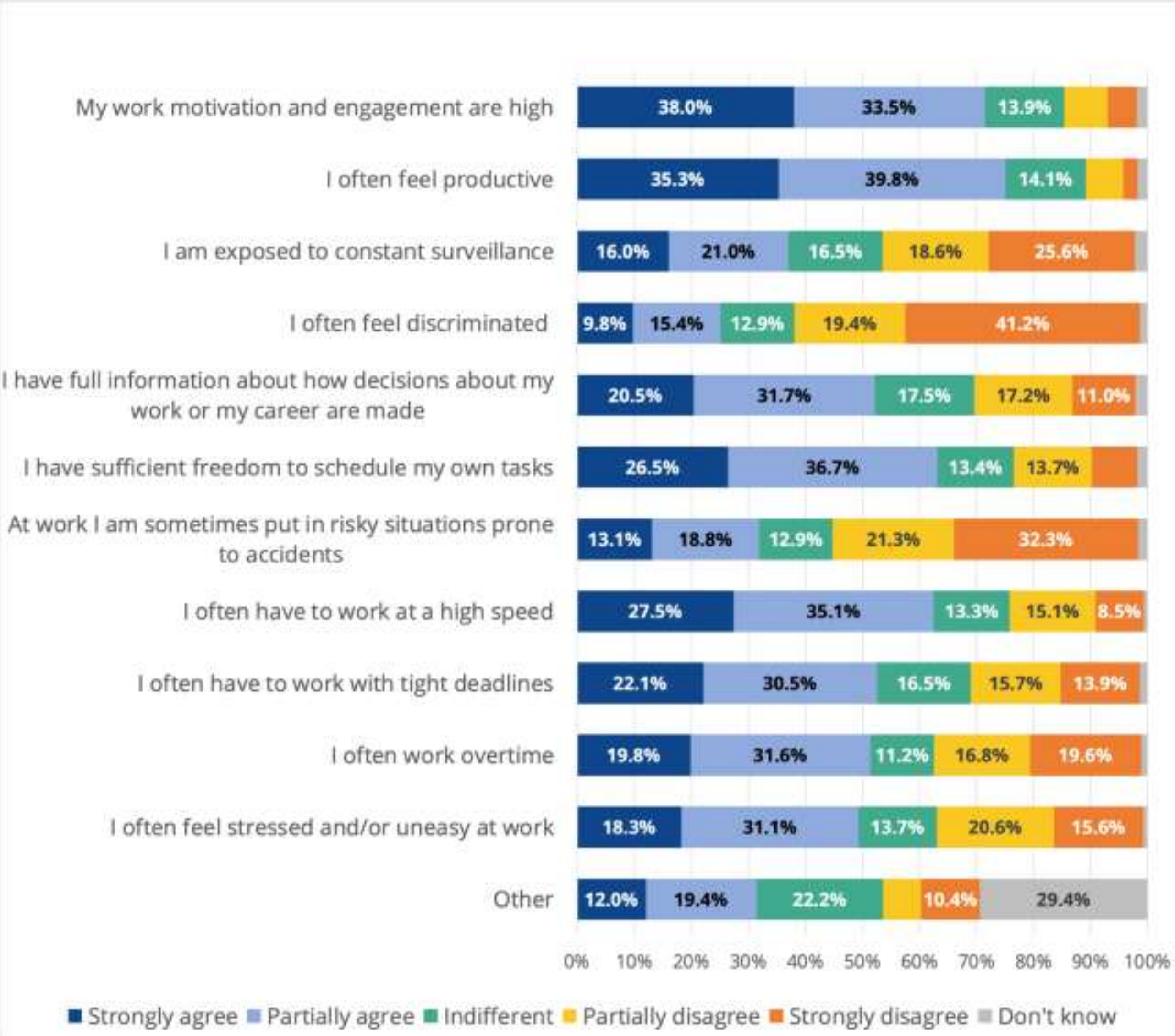
Future outlook

18. Do you plan to propose any changes to the AM technology? If yes, what and why?
19. What legal or policy framework (i.e. laws and/or social partners’ agreements, training and awareness raising, etc.) would be necessary to further support workers in making best use of AM and dealing with the challenges?

Annex 13: Factual summary of the workers' survey

13.1. Part A – Your current work arrangement

Figure 107: Distribution of workers' answers regarding their typical experience at their current workplace

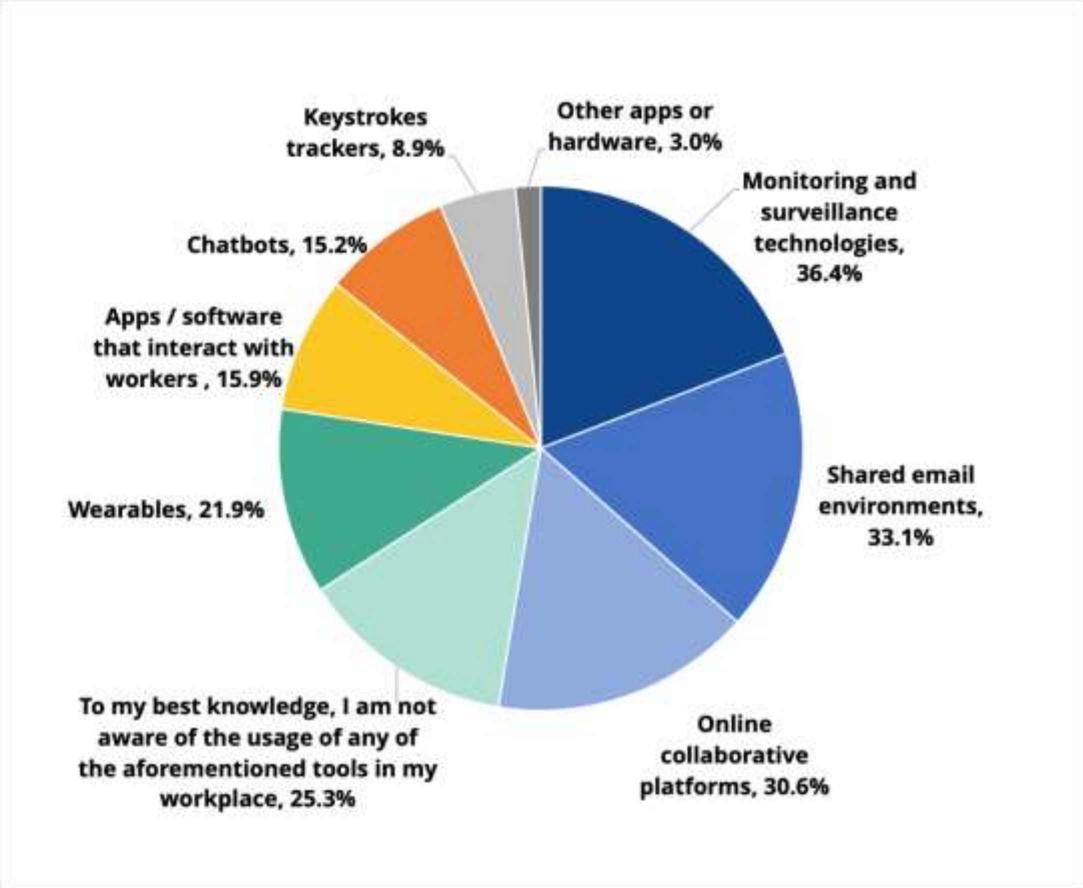


Note: workers N = 1407

Source: Workers' survey (2023)

13.2. Part B – Your experience with algorithms automating managerial tasks

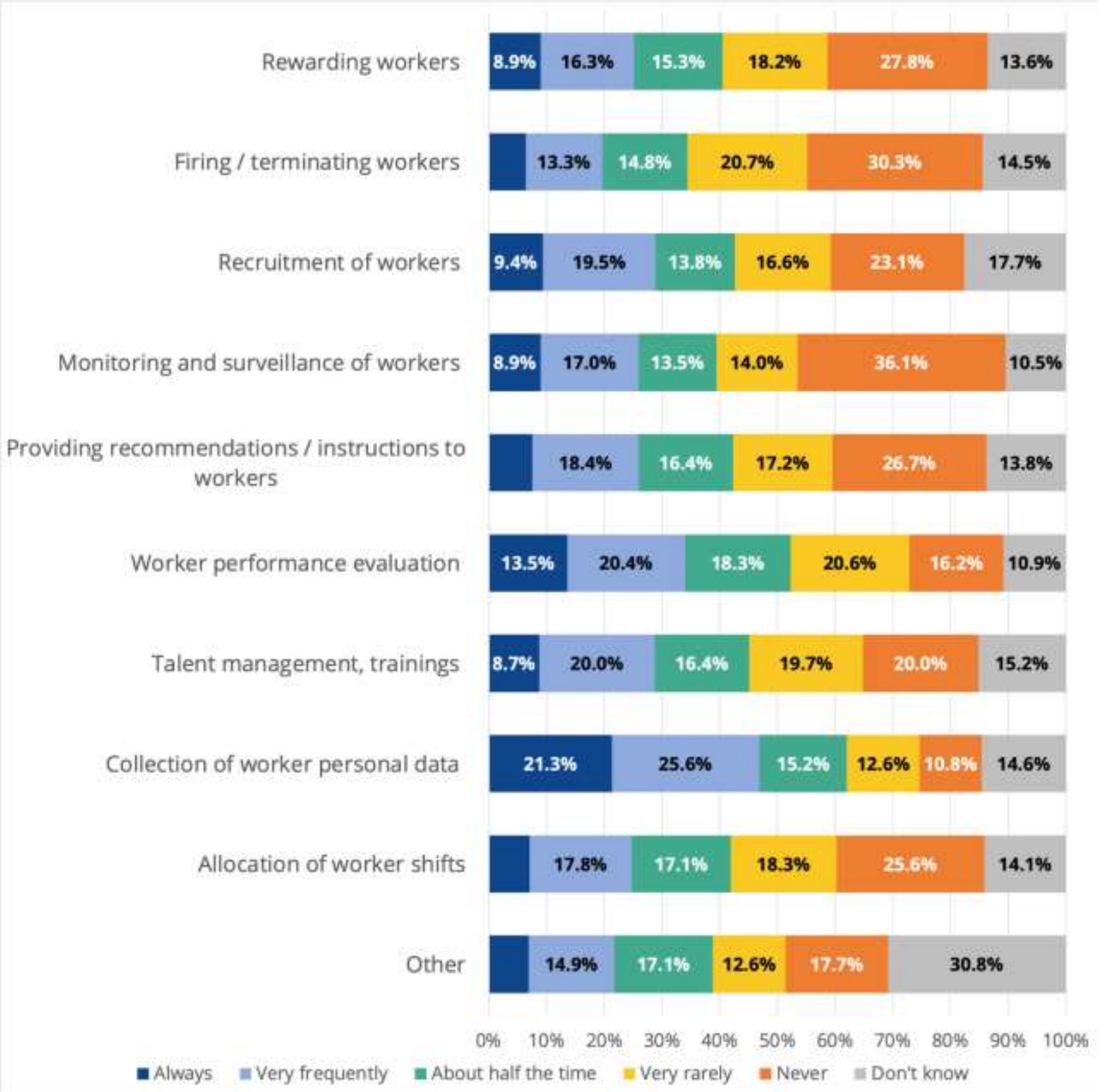
Figure 108: Distribution of workers' answers regarding the use of technologies, computer programmes, and apps in their current workplace (select all options that apply



Note: workers N = 1409

Source: Workers' survey (2023)

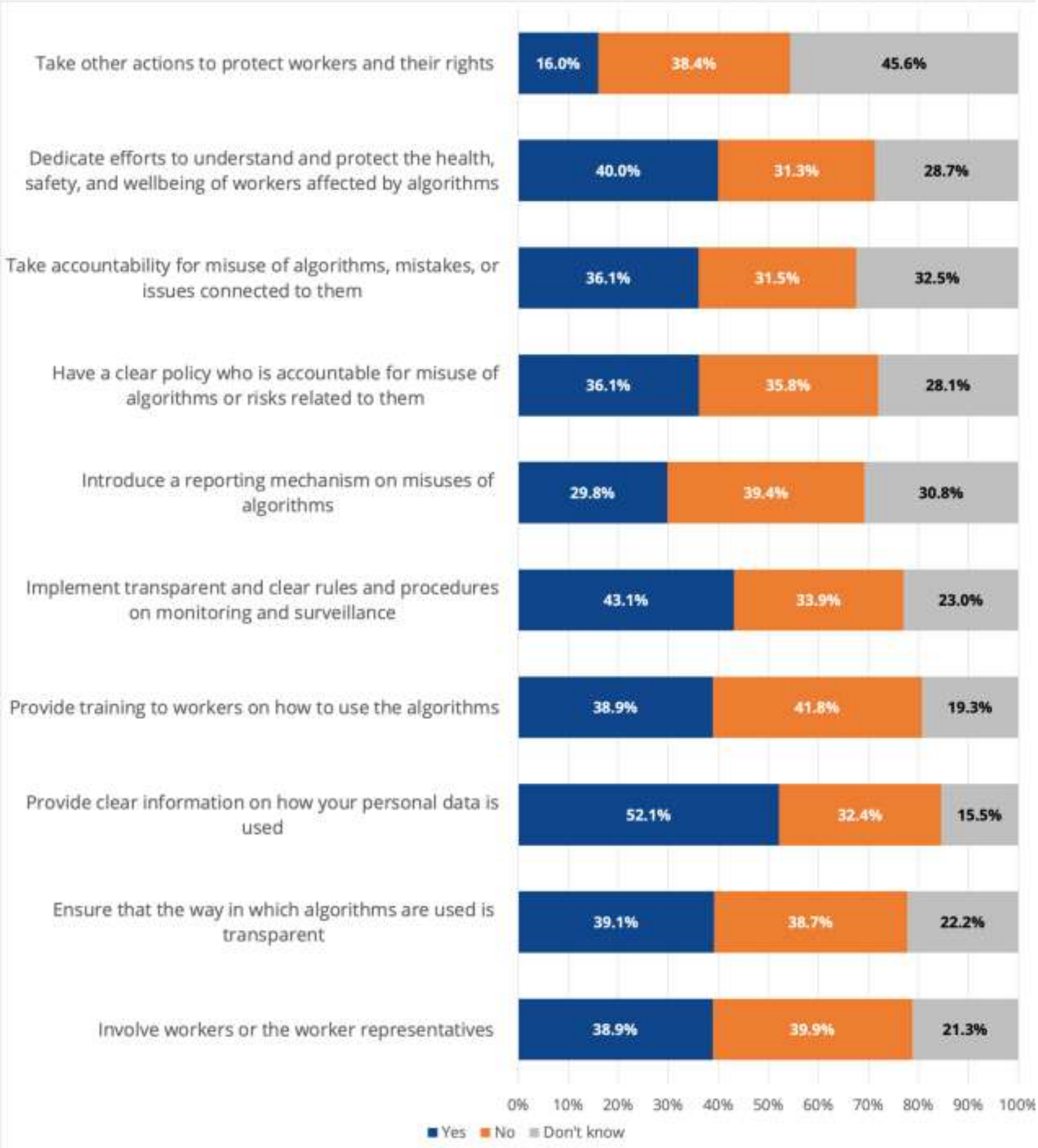
Figure 109: Estimates provided by workers on the extent to which the specific managerial processes are automated through algorithms at their current workplace



Note: workers N = 930

Source: Workers' survey (2023)

Figure 110: Distribution of workers' answers regarding the actions of their employer who is using algorithms at the workplace

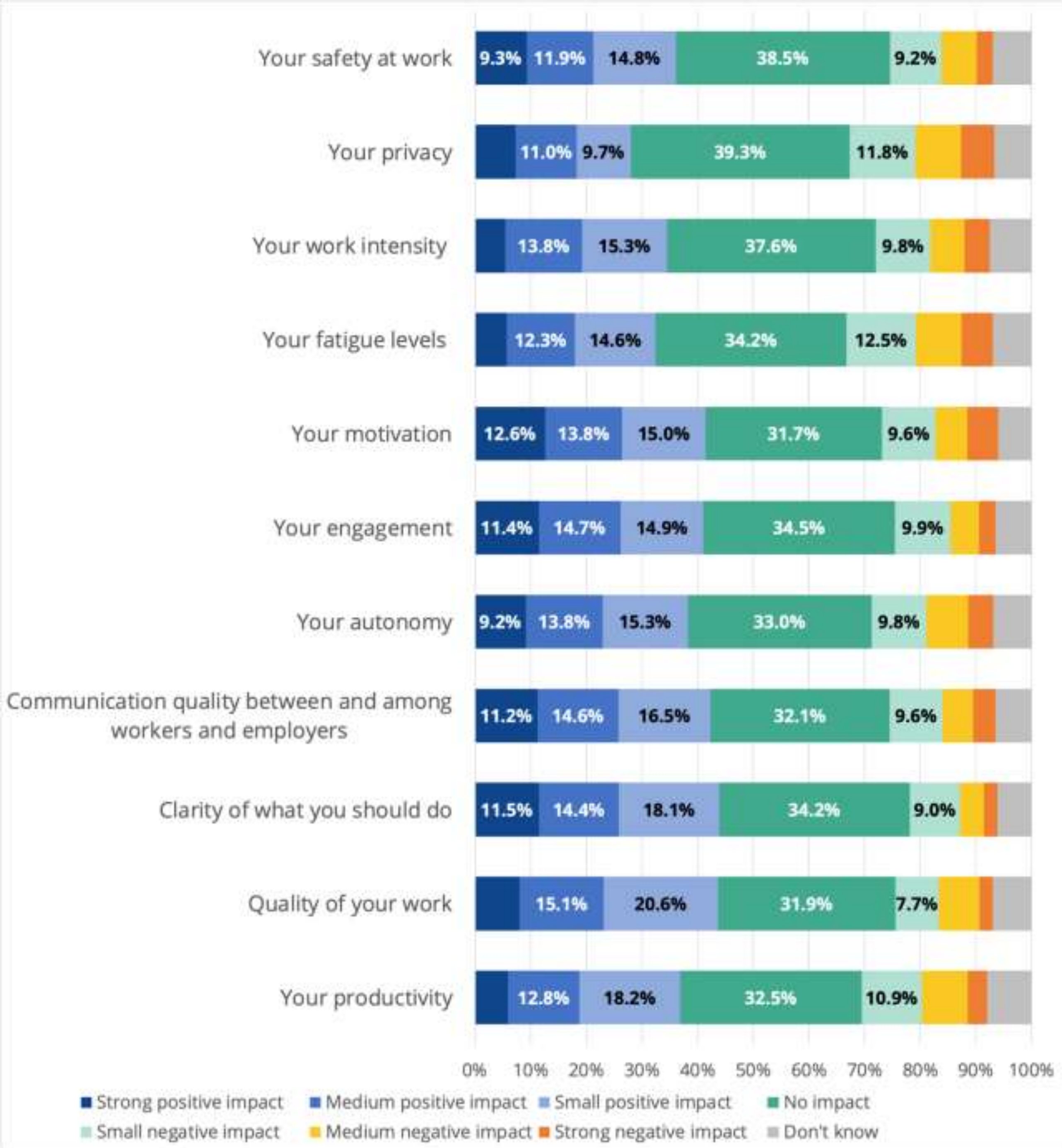


Note: workers N = 14

Source: Workers' survey (2023)

13.3. Part C – Effects of algorithms on workers

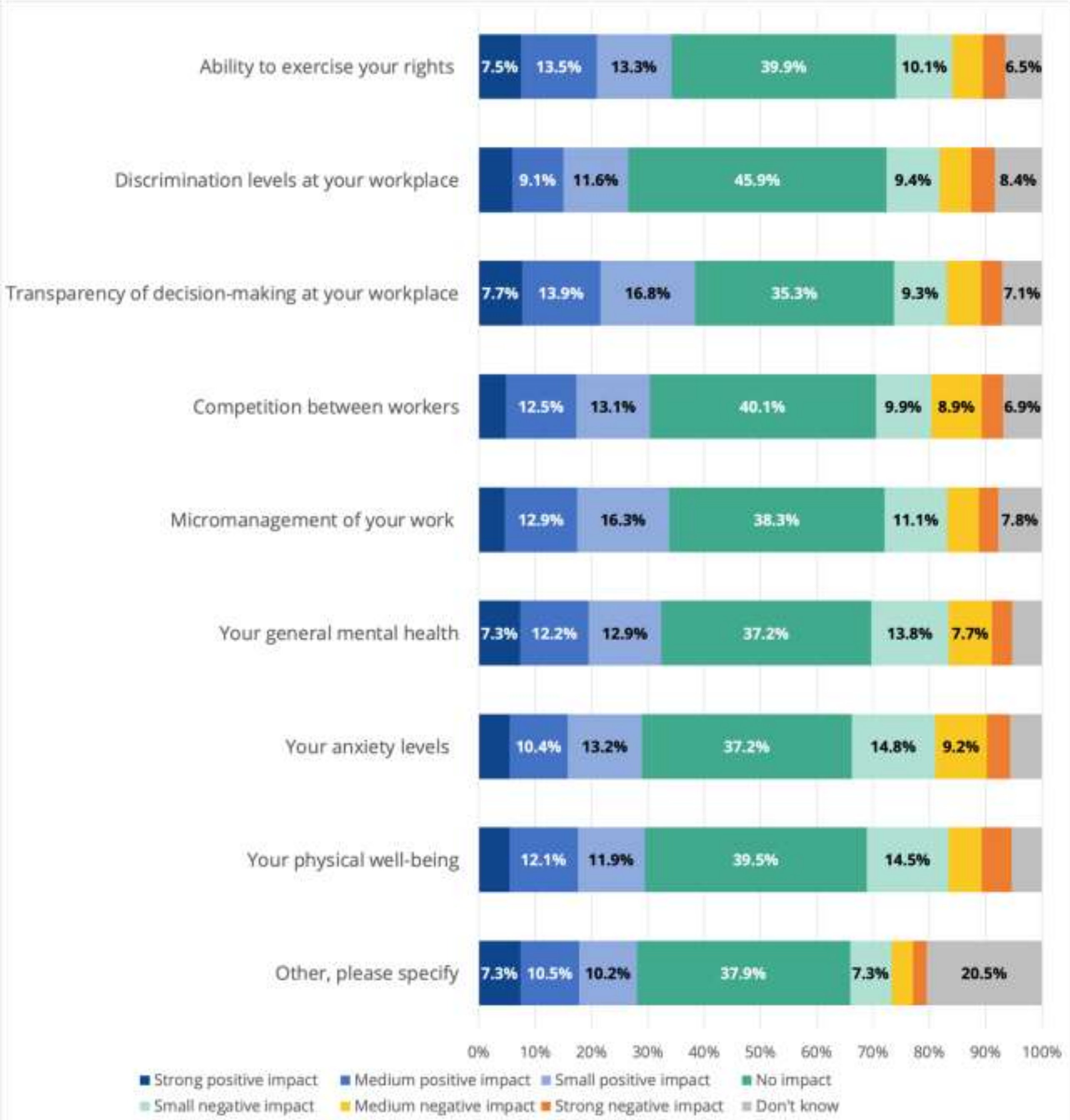
Figure 111: Distribution of workers' answers regarding the impact of prior selected algorithms on them and their workplace (based on their personal experience)



Note: workers N = 866

Source: Workers' survey (2023)

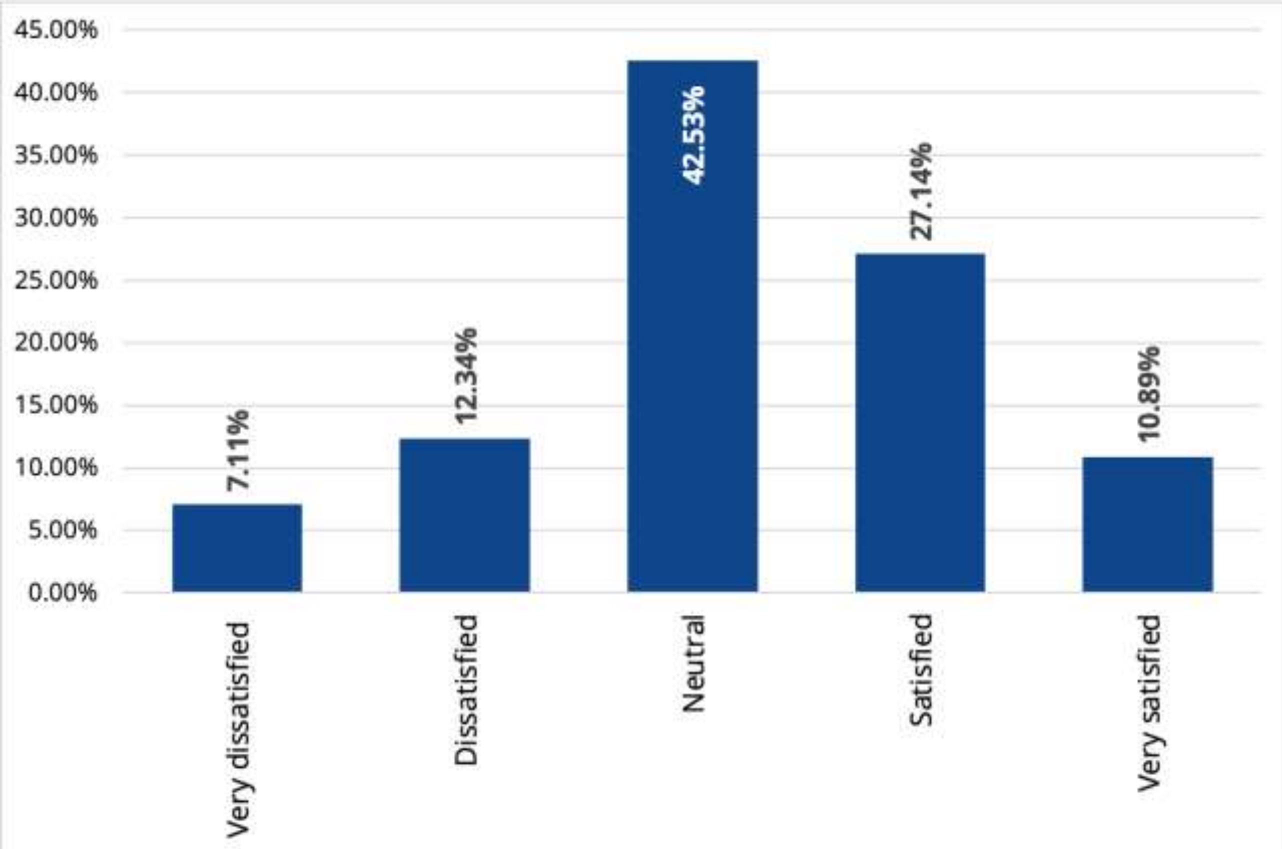
Figure 112: Distribution of workers' answers regarding the impact of prior selected algorithms on them and their workplace (based on their personal experience)



Note: workers N = 859

Source: Workers' survey (2023)

Figure 113: Distribution of workers' answers regarding the extent of satisfaction with the way in which algorithms automating managerial functions are used at their workplace

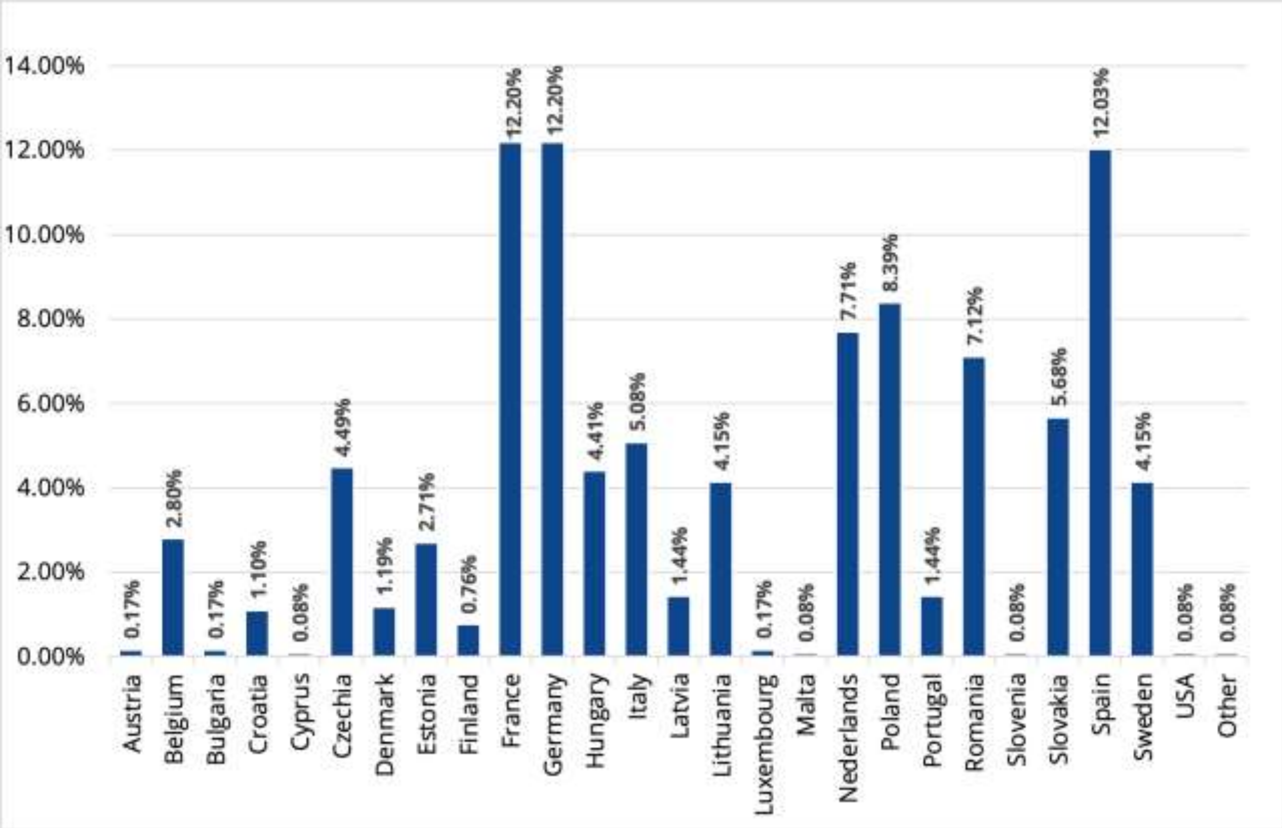


Note: workers N = 689

Source: Workers' survey (2023)

13.4. Part D – About you

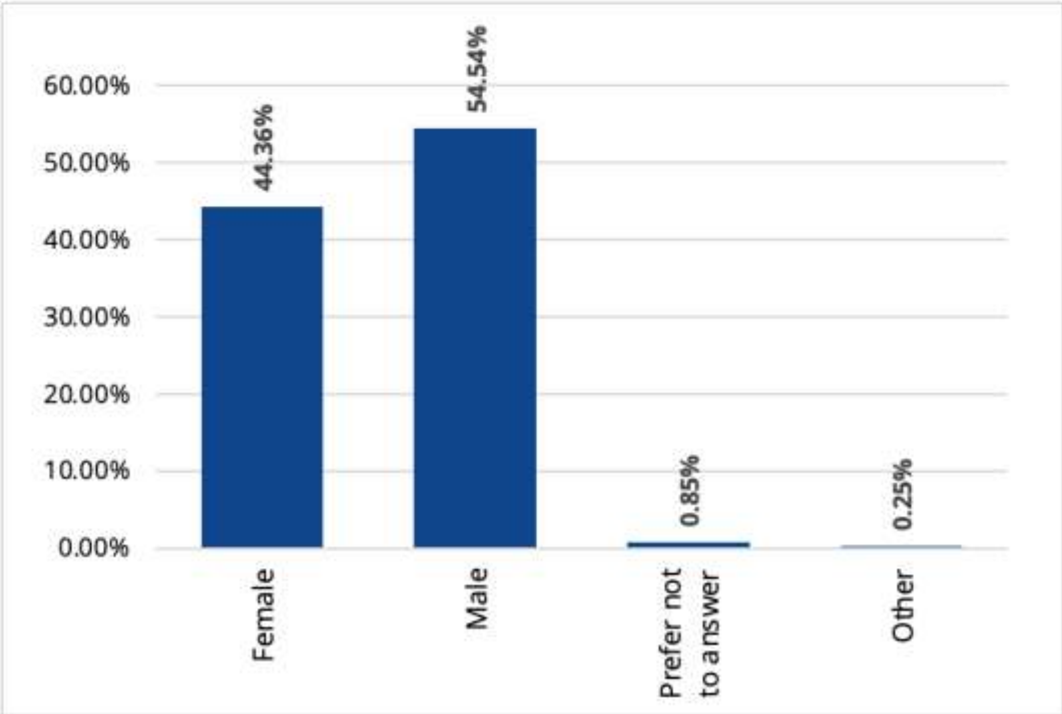
Figure 114: Distribution of workers' answers based on the country of their residence



Note: workers N = 1180

Source: Workers' survey (2023)

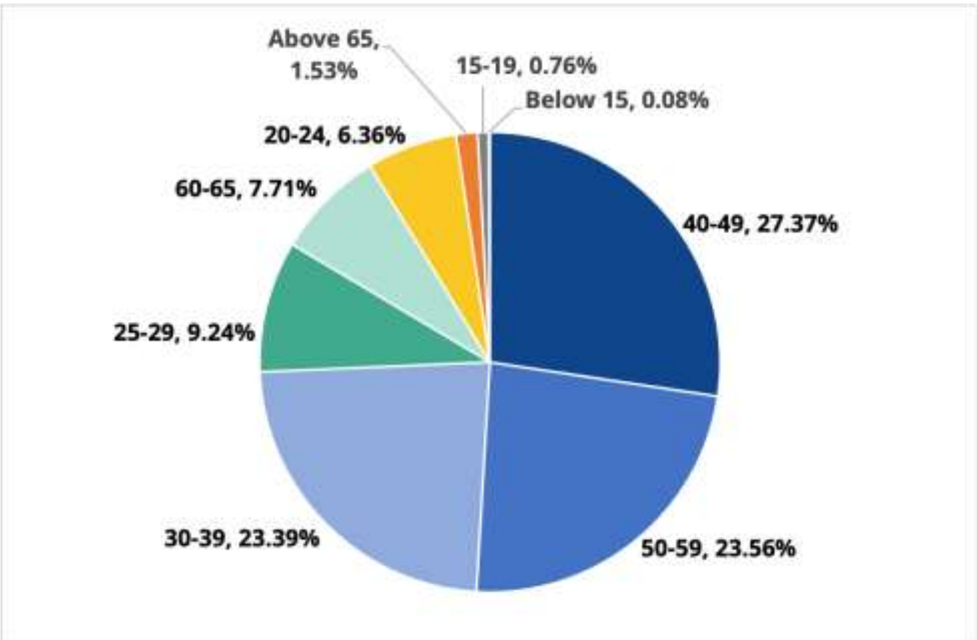
Figure 115: Distribution of workers' answers based on gender



Note: workers N = 1179

Source: Workers' survey (2023)

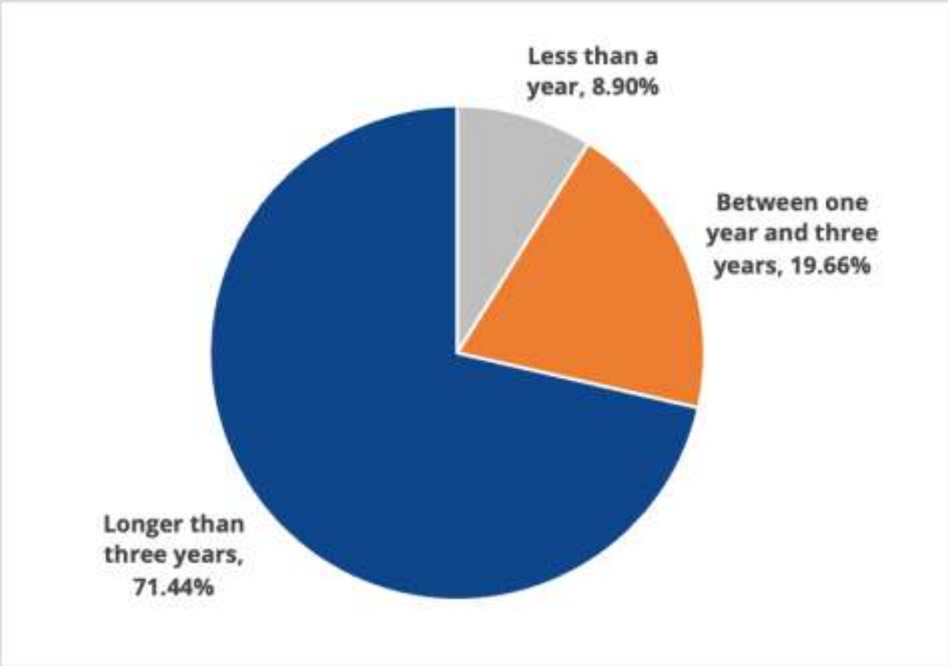
Figure 116: Distribution of workers' answers based on age



Source: workers surveys (2023)

Notes: workers N = 1180

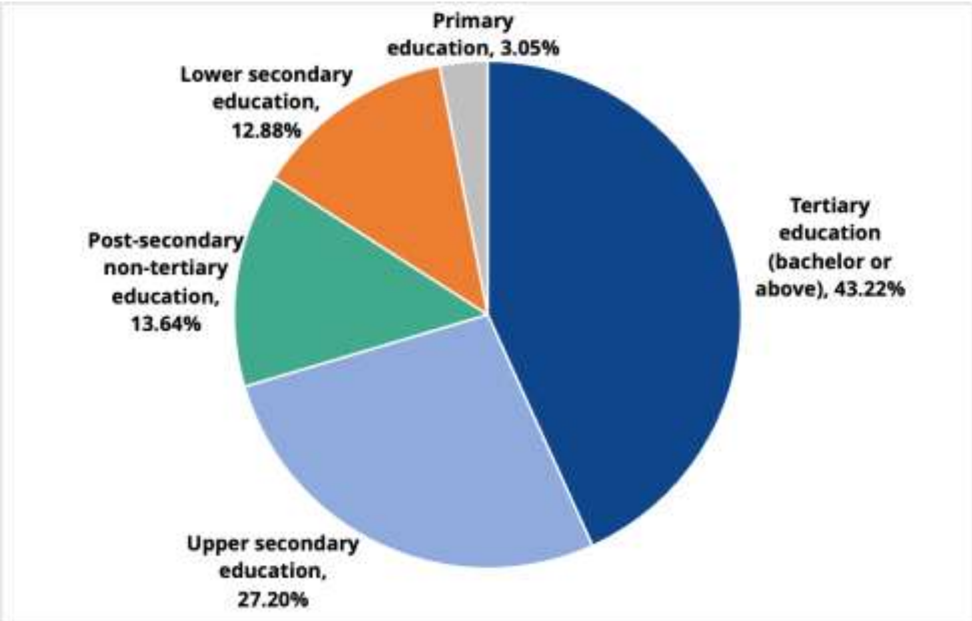
Figure 117: Distribution of workers' answers regarding how long they have been working for their current employer



Note: workers N = 1180

Source: Workers' survey (2023)

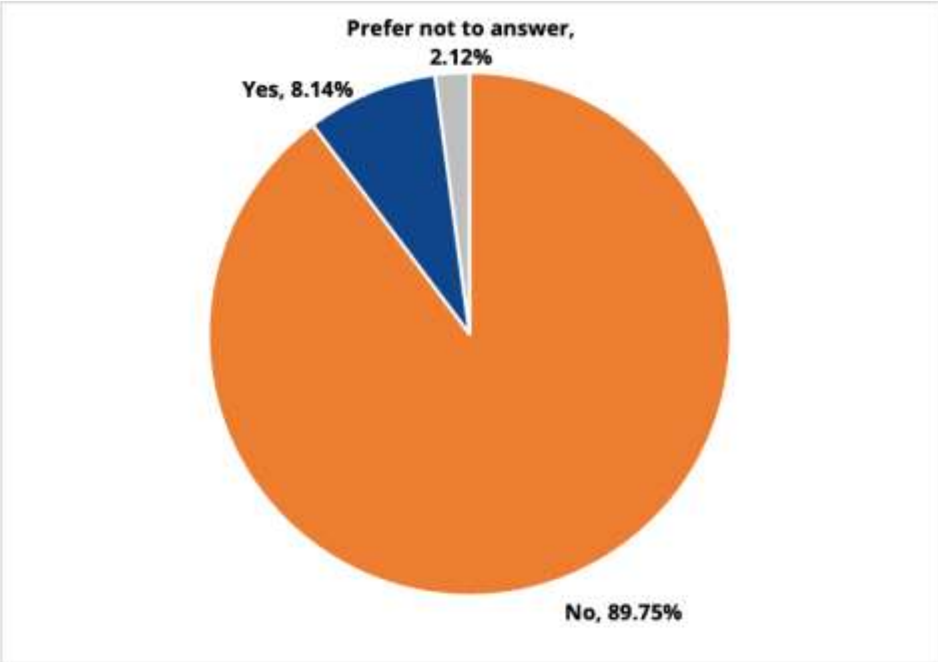
Figure 118: Distribution of workers' answers regarding their educational level



Note: workers N = 1180

Source: Workers' survey (2023)

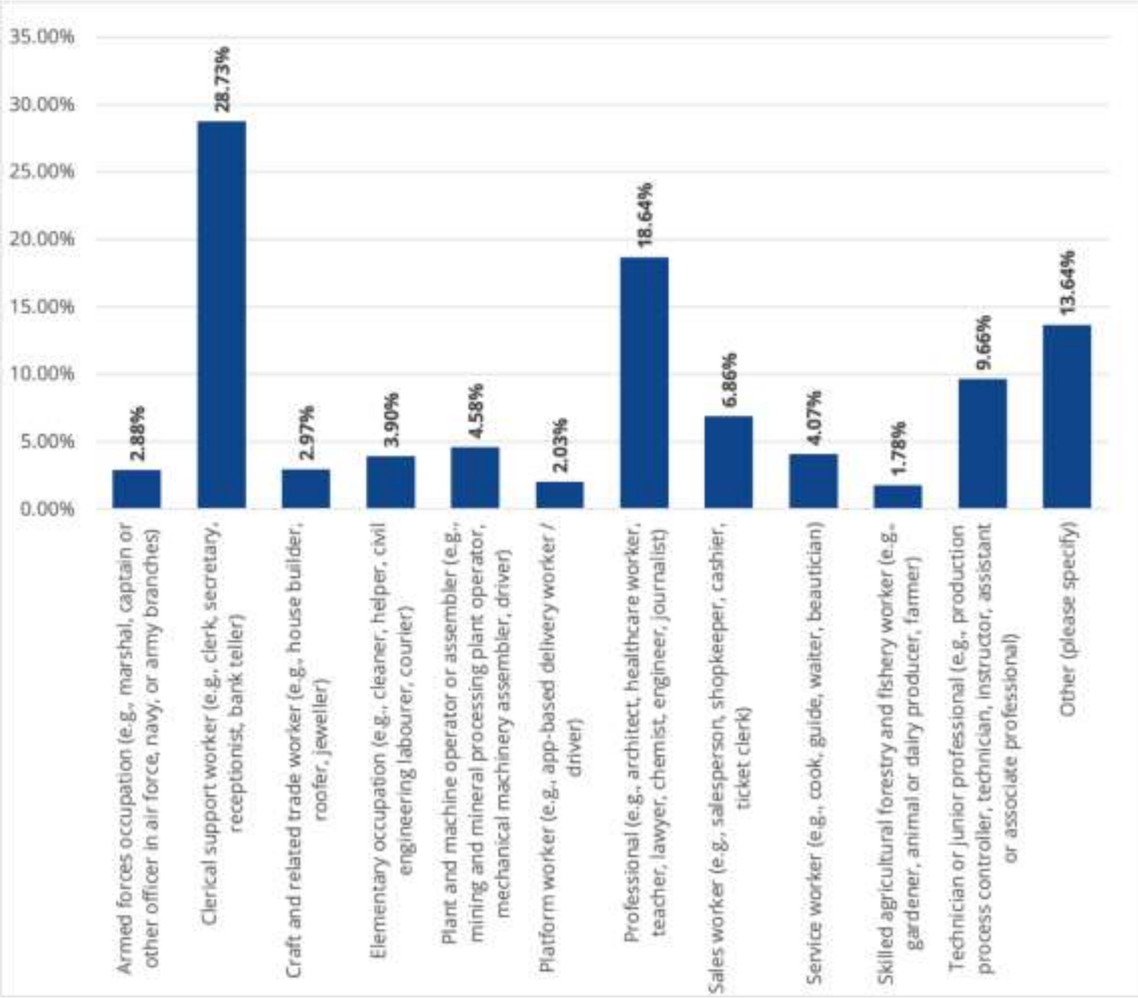
Figure 119: Distribution of workers' answers based on having a disability



Note: workers N = 1180

Source: Workers' survey (2023)

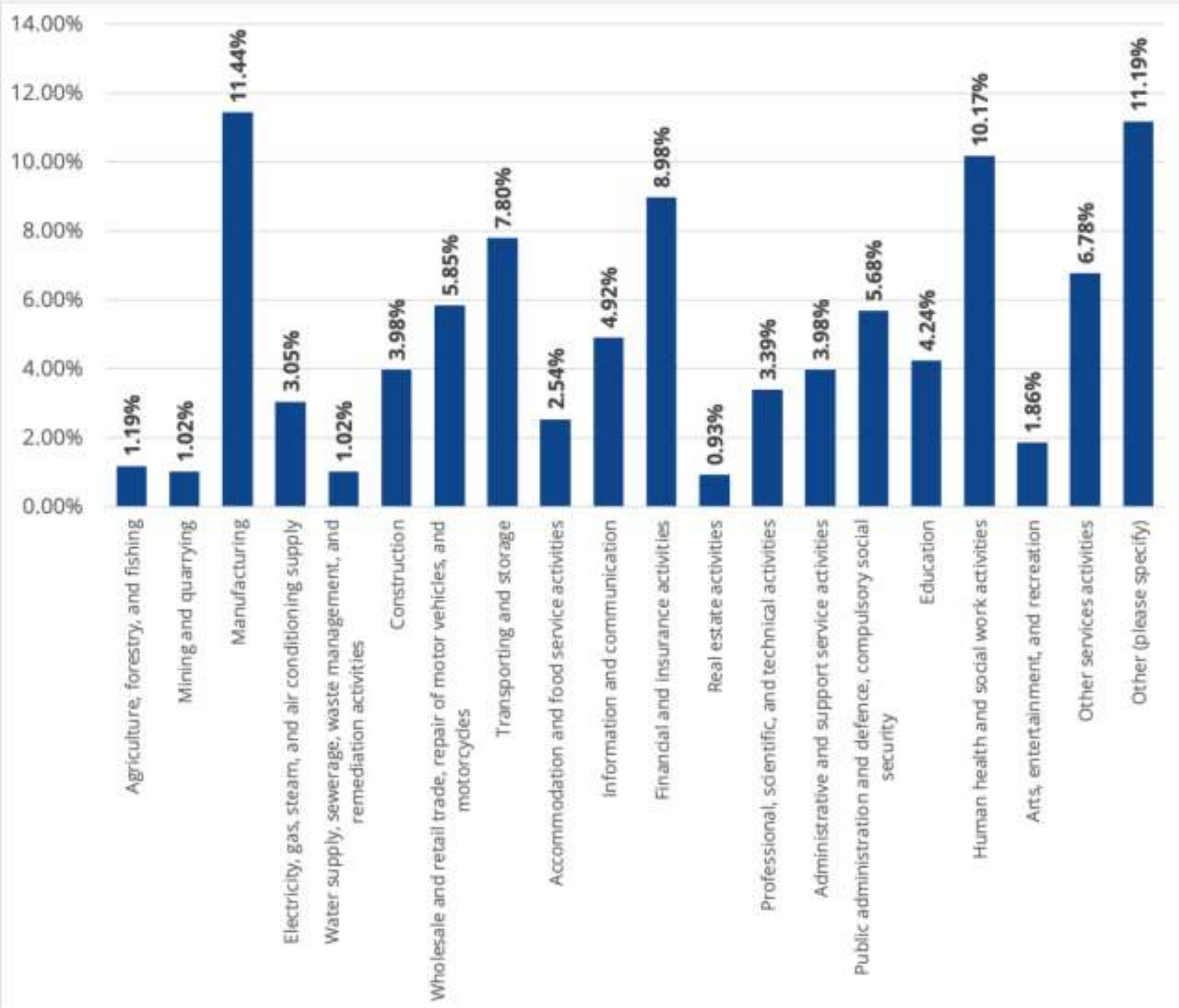
Figure 120: Distribution of workers' answers regarding what their role or activity is



Note: workers N = 1180

Source: Workers' survey (2023)

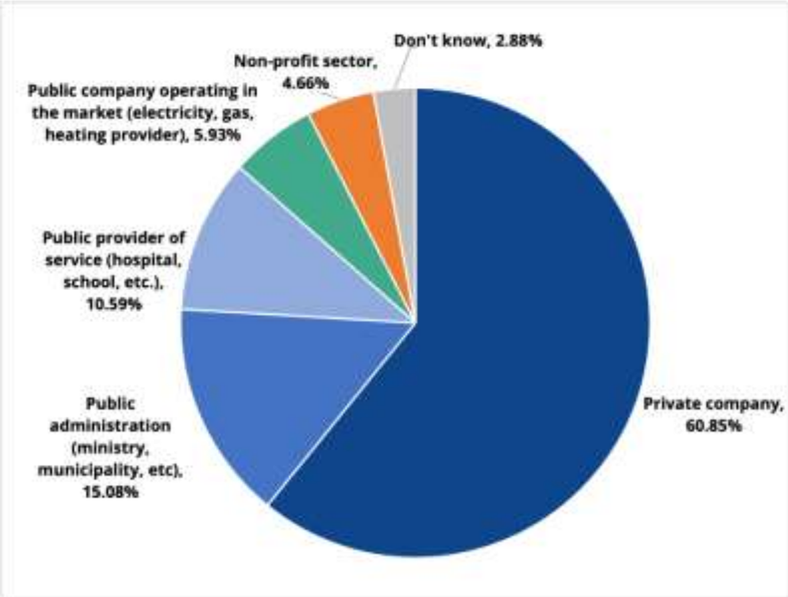
Figure 121: Distribution of workers' answers regarding the main activity of their workplace



Note: workers N = 1180

Source: Workers' survey (2023)

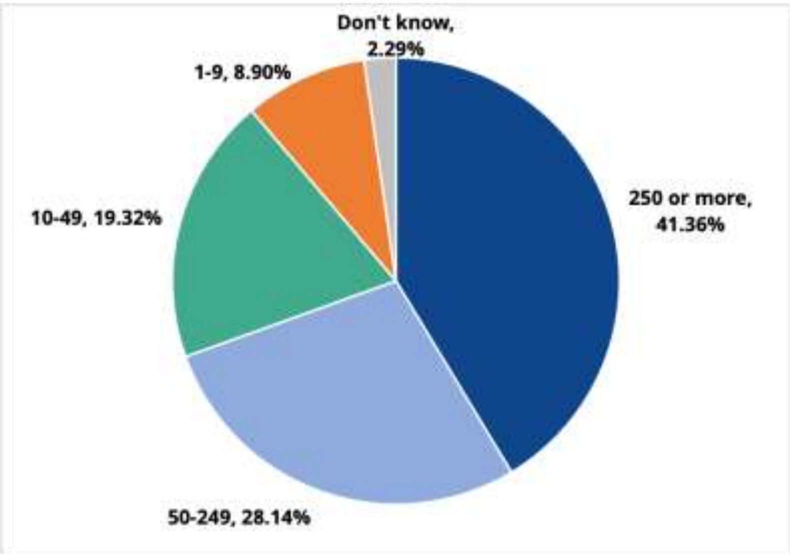
Figure 122: Distribution of workers' answers regarding the type of organisation they work for



Note: workers N = 1180

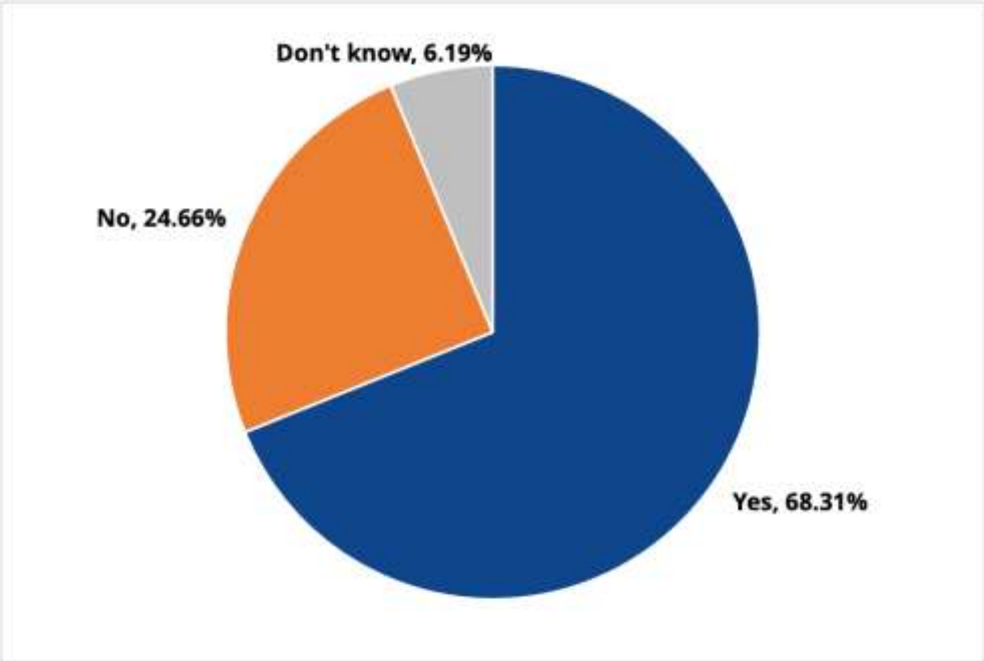
Source: Workers' survey (2023)

Figure 123: Distribution of workers' answers regarding the number of employees/workers in their workplace (based on their estimate)



Note: workers N = 1180. *Source:* Workers' survey (2023)

Figure 124: Distribution of workers' answers regarding the presence of employee representatives in their workplace



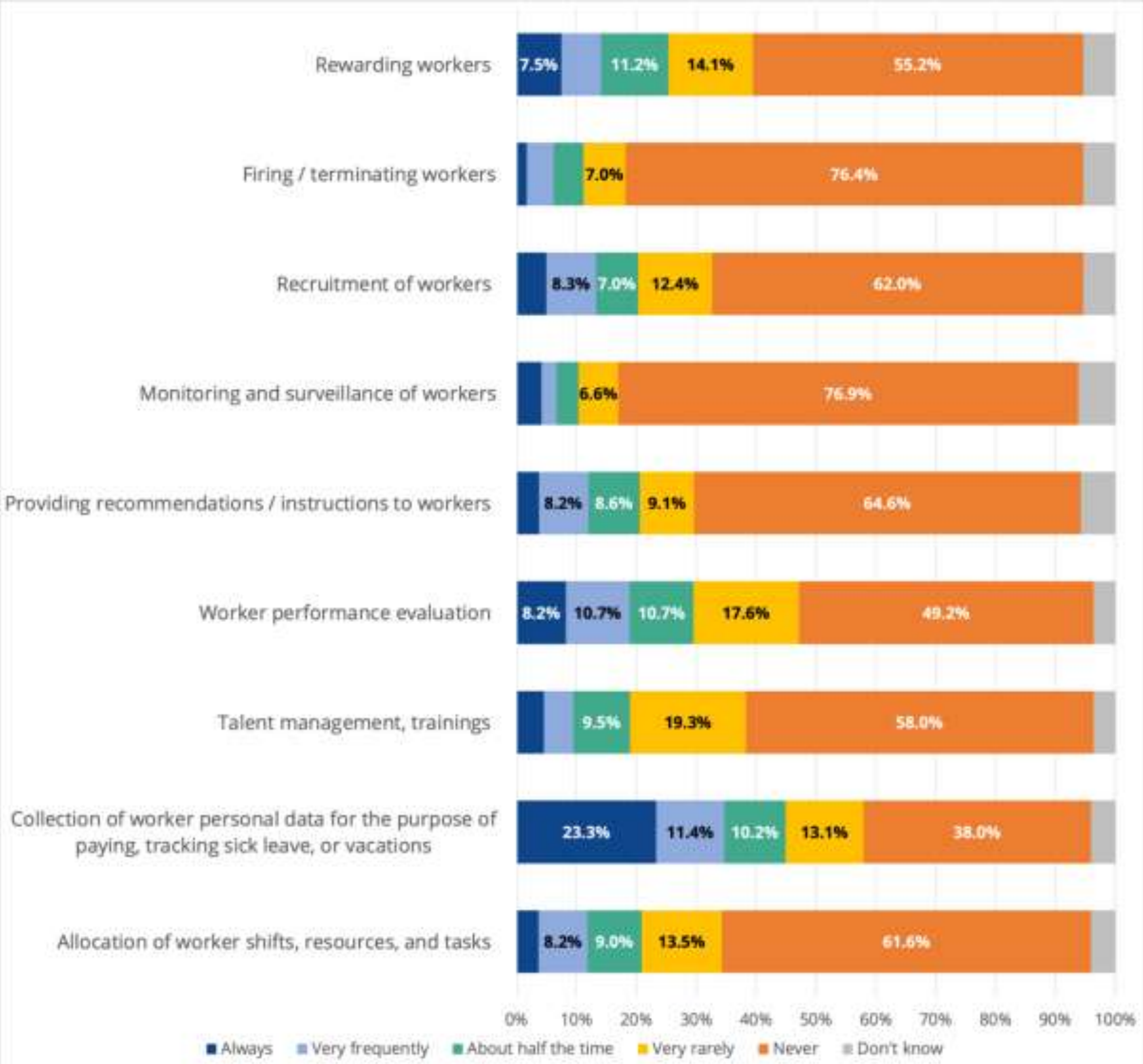
Note: workers N = 1180

Source: Workers' survey (2023)

Annex 14: Factual summary of the employers' survey

14.1. Part A – Your experience with algorithms automating managerial tasks

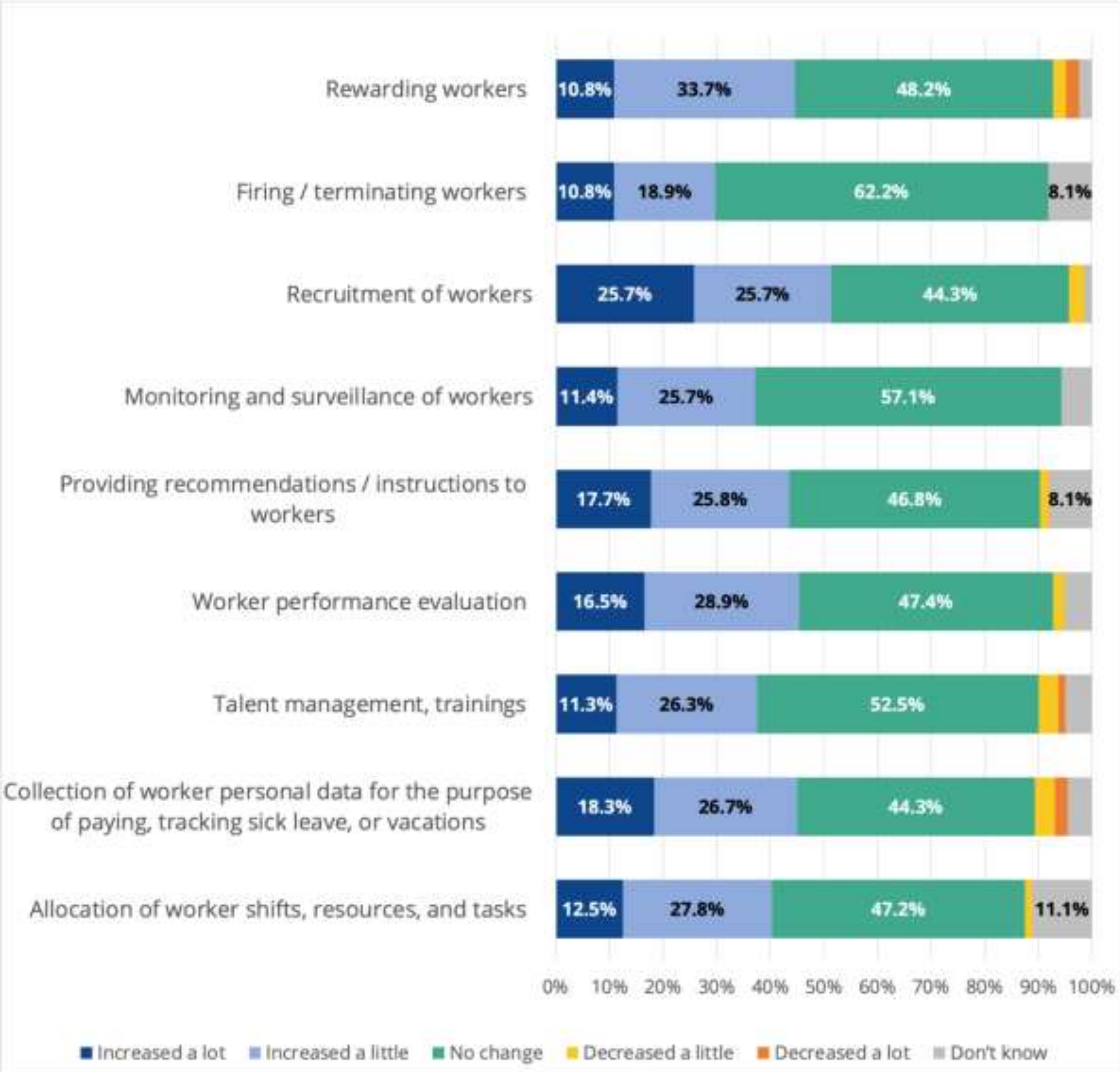
Figure 125: Distribution of employers' answers regarding the estimate on the extent to which the specific managerial processes are automated through algorithms at their current workplace



Note: Employers N = 245

Source: Employers; survey (2023)

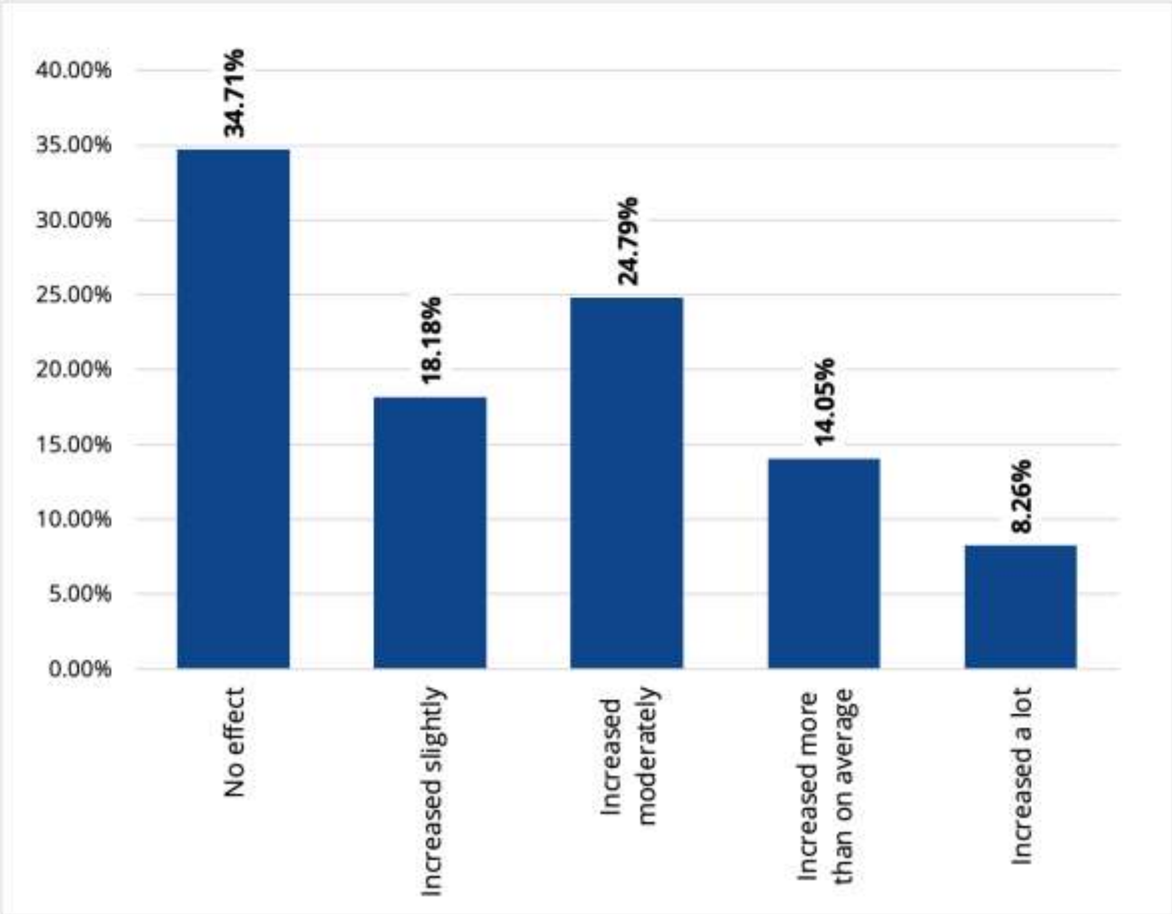
Figure 126: Distribution of employers' answers regarding the estimate on how the use of algorithms to automate the managerial functions have evolved in their organisations over the last two years



Note: Employers N = 131

Source: Employers' survey (2023)

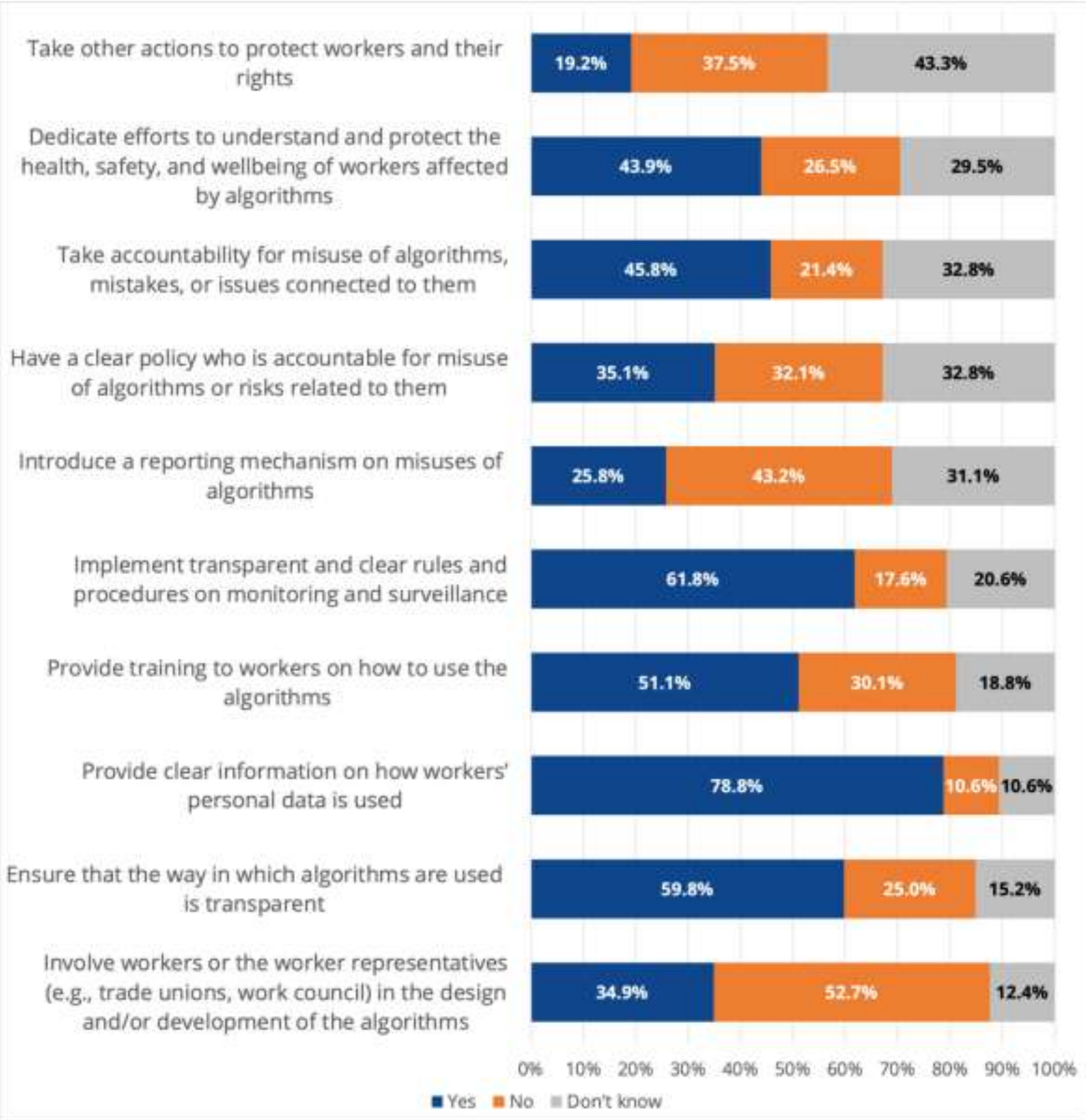
Figure 127: Distribution of employers' answers regarding the extent to which the COVID-19 pandemic fostered a more wide-spread use of algorithms in their companies



Note: Employers N = 121

Source: Employers' survey (2023)

Figure 128: Distribution of employers' responses about their companies' actions regarding the use of algorithms at the workplace

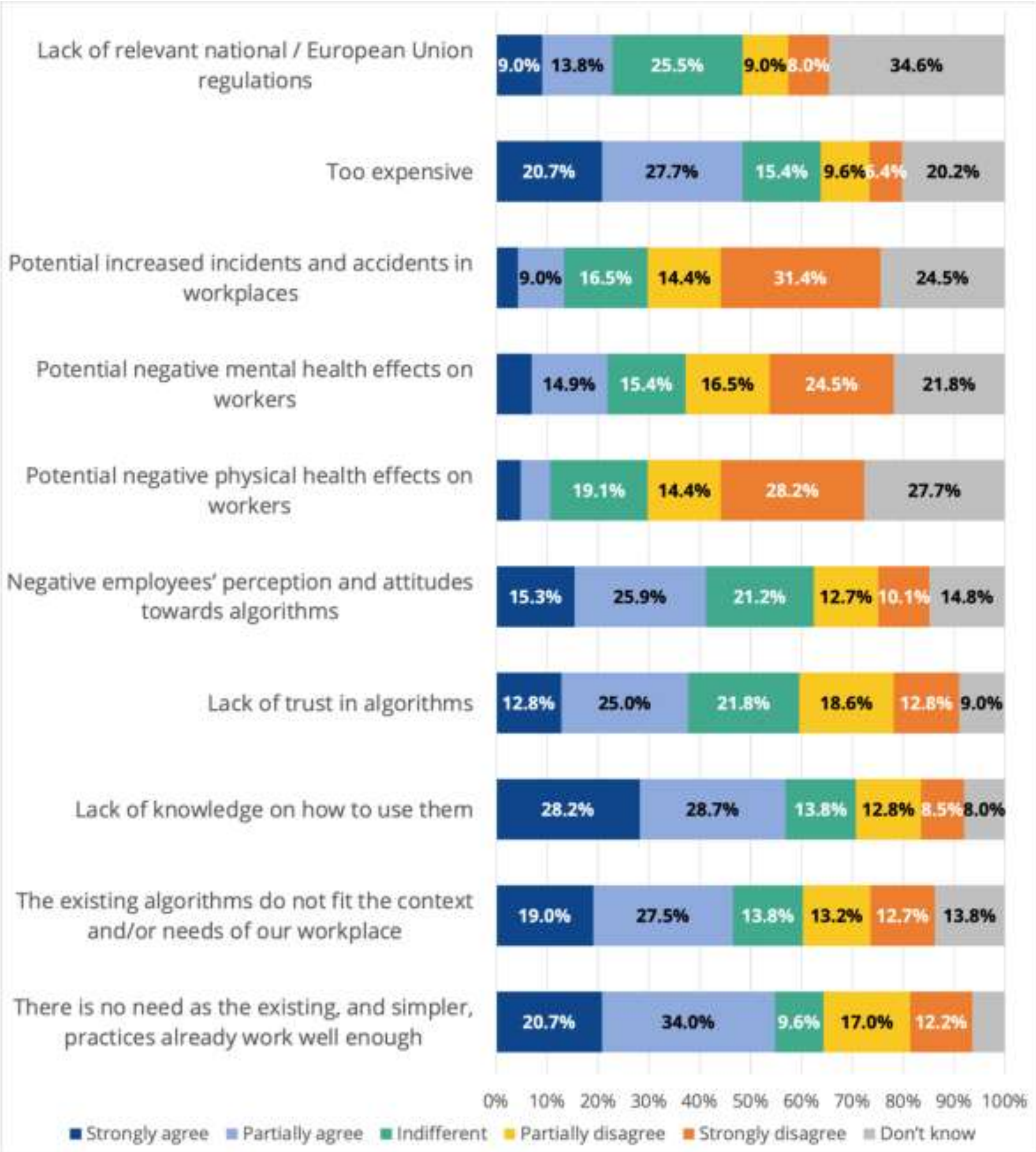


Note: Employers N = 133

Source: Employers' survey (2023)

14.2. Part B – Barriers

Figure 129: Distribution of employers' responses regarding the main barriers for their companies (or other companies) in implementing the aforementioned algorithms

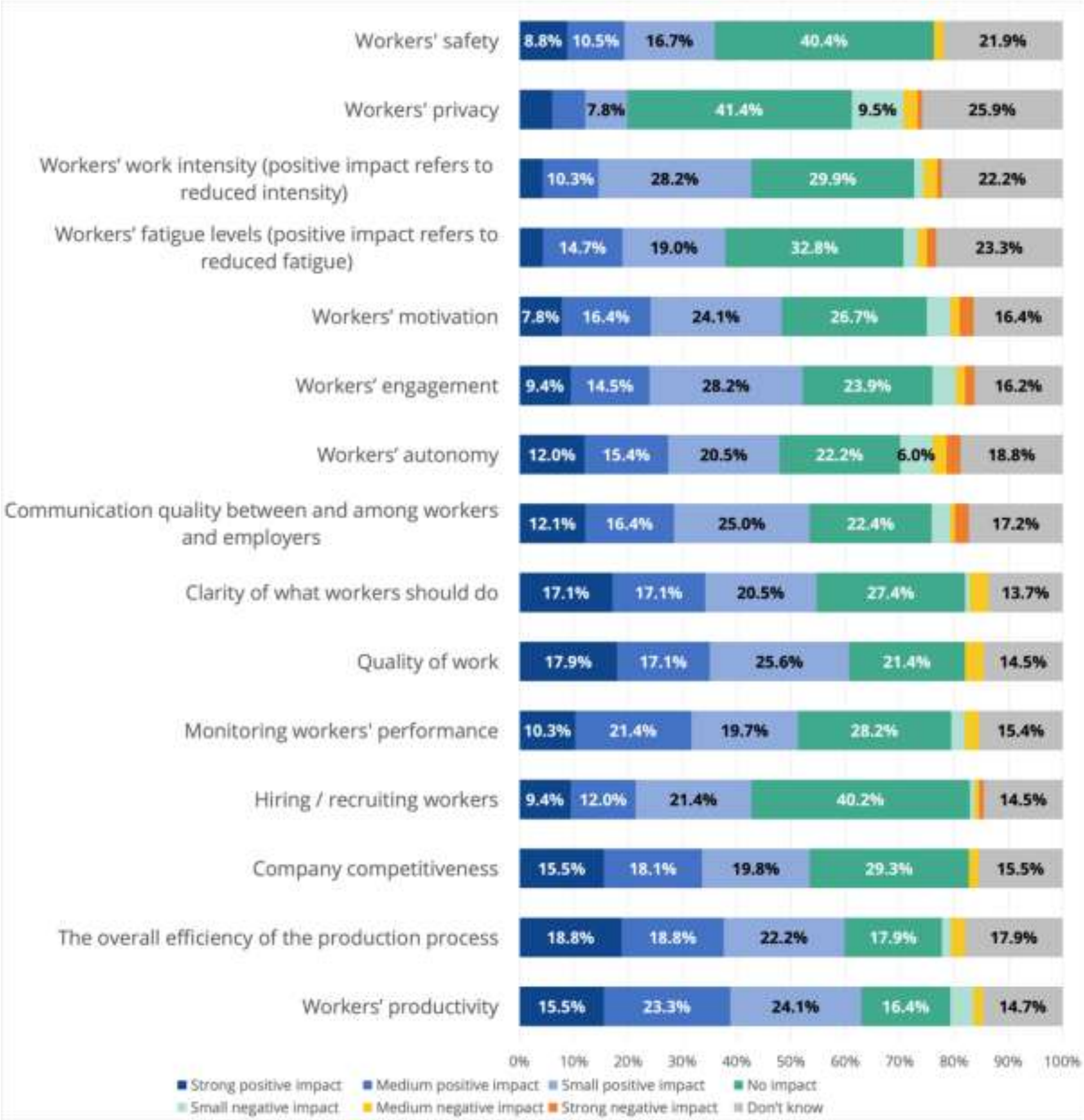


Note: Employers N = 189

Source: Employers' survey (2023)

14.3. Part C – Effects of algorithms on employers and workers

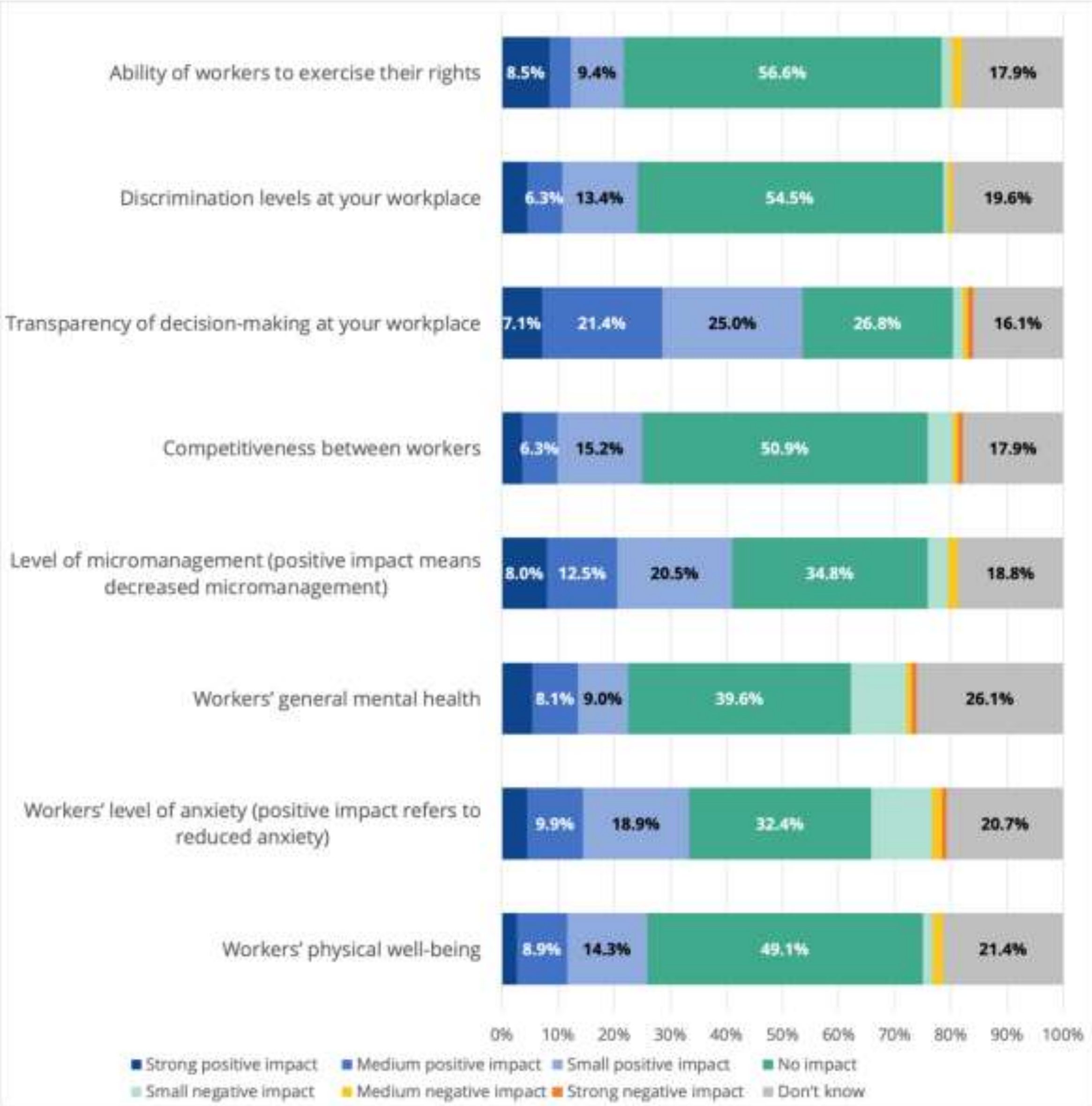
Figure 130: Distribution of employers' responses regarding the effects that the use of algorithms had on various aspects



Note: Employers N = 117

Source: Employers' survey (2023)

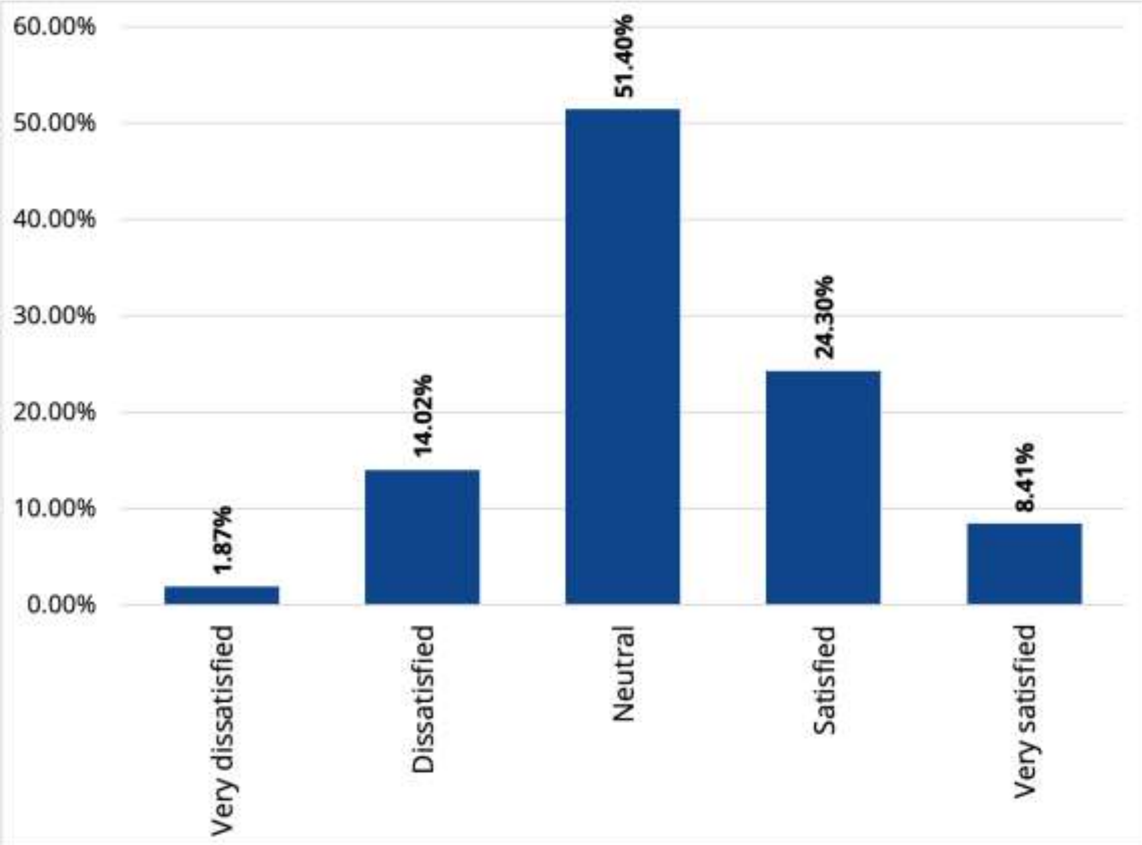
Figure 131: Distribution of employers' responses regarding the effects that the use of algorithms had on various aspects



Note: Employers N = 112

Source: Employers' survey (2023)

Figure 132: Distribution of employers' responses regarding the extent to which they are satisfied with how algorithms that automate managerial functions are used at their workplaces

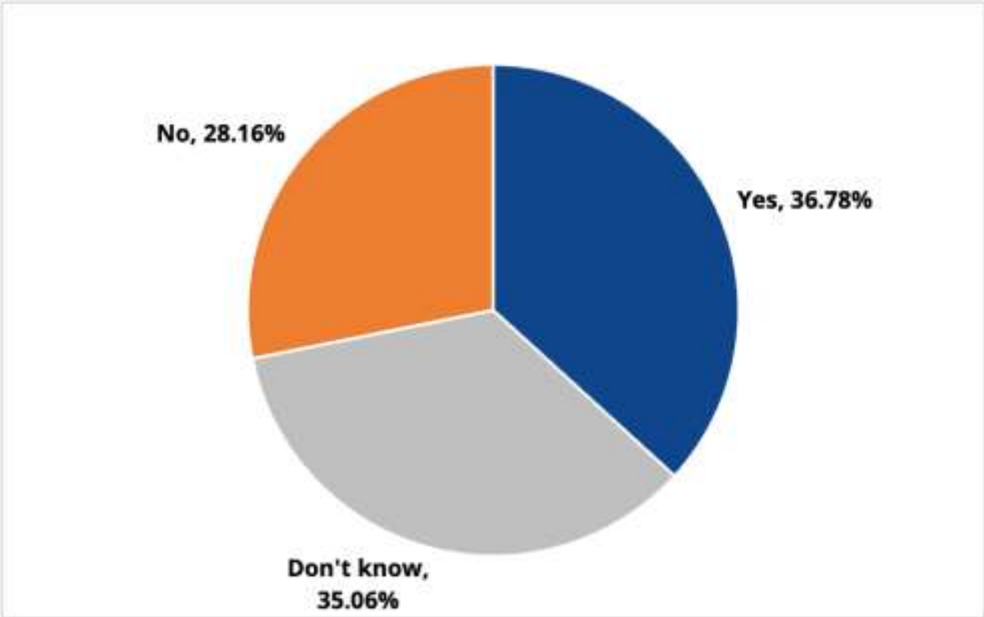


Note: Employers N = 107

Source: Employers' survey (2023)

14.4. Part D – Future of algorithms at work

Figure 133: Distribution of employers' responses regarding whether their companies are planning to introduce (more) algorithms to automate managerial functions in the next two years

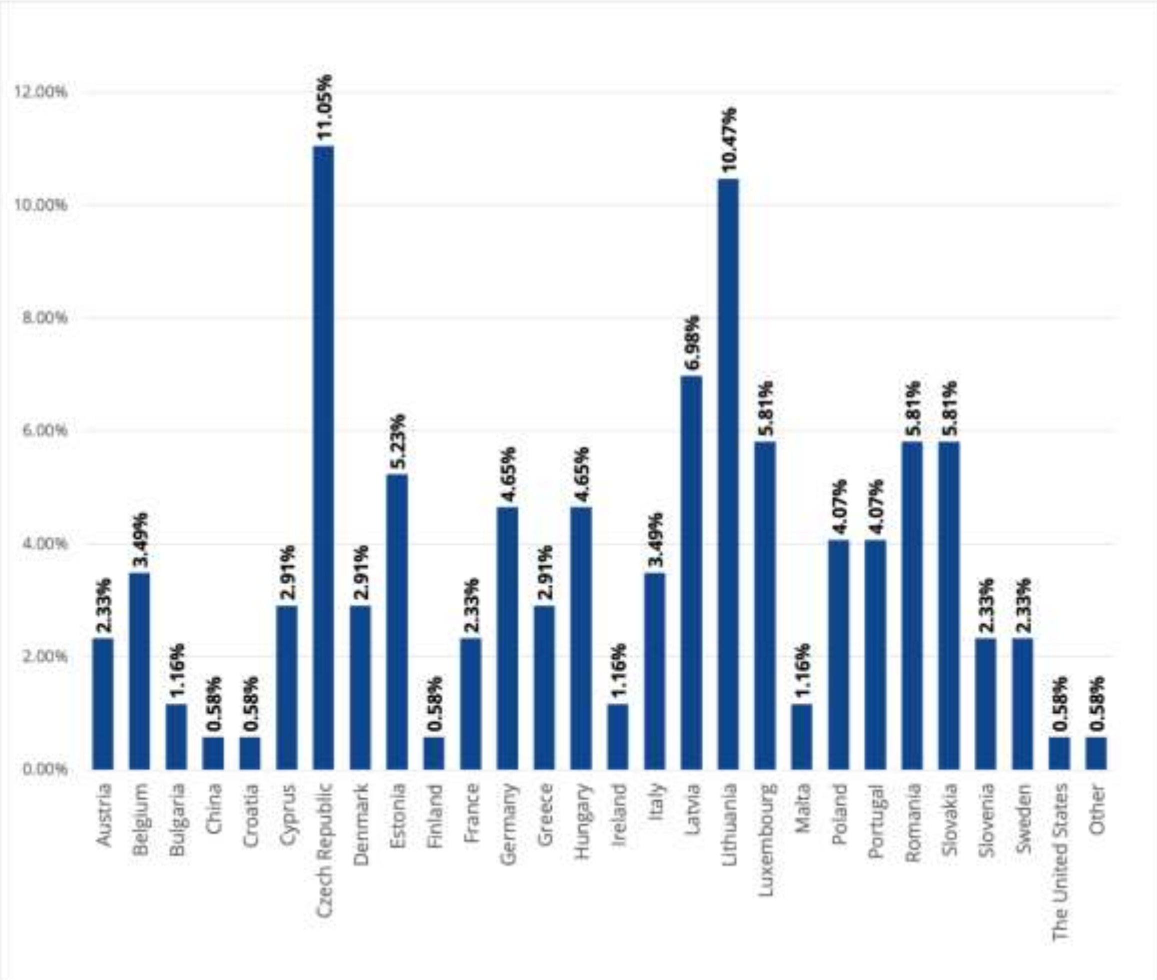


Note: Employers N = 174

Source: Employers' survey (2023)

14.5. Part E – About your company

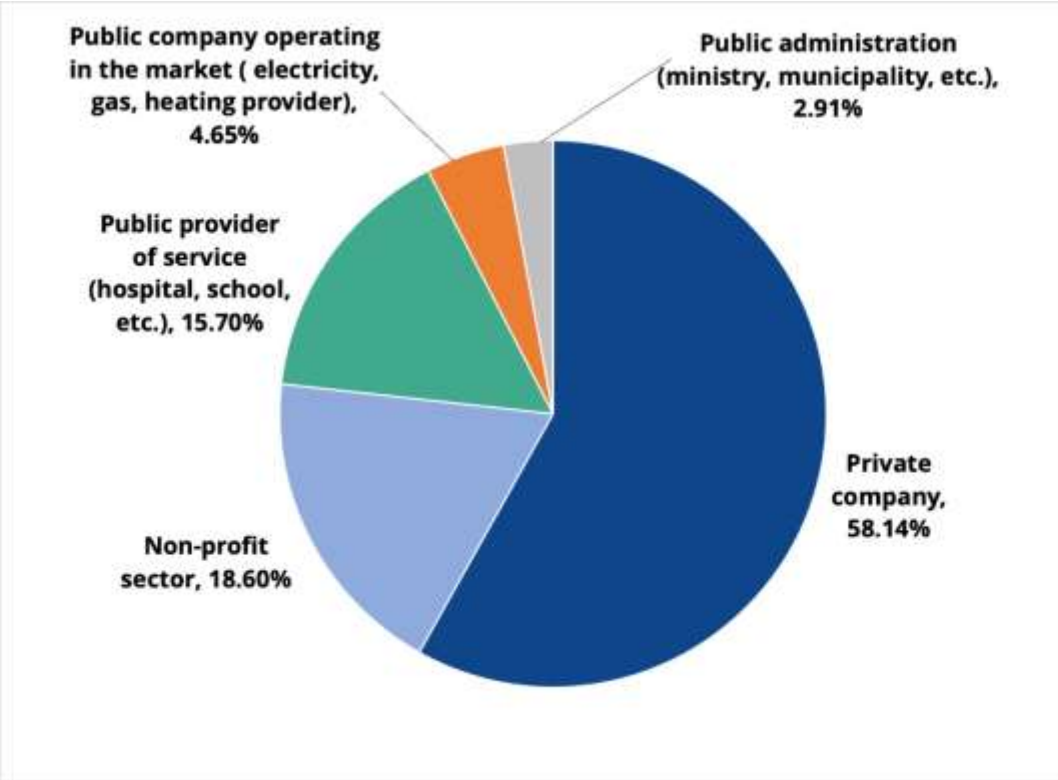
Figure 134: Distribution of employers' responses based on the country where their companies' head-offices are registered



Note: Employers N = 172

Source: Employers' survey (2023)

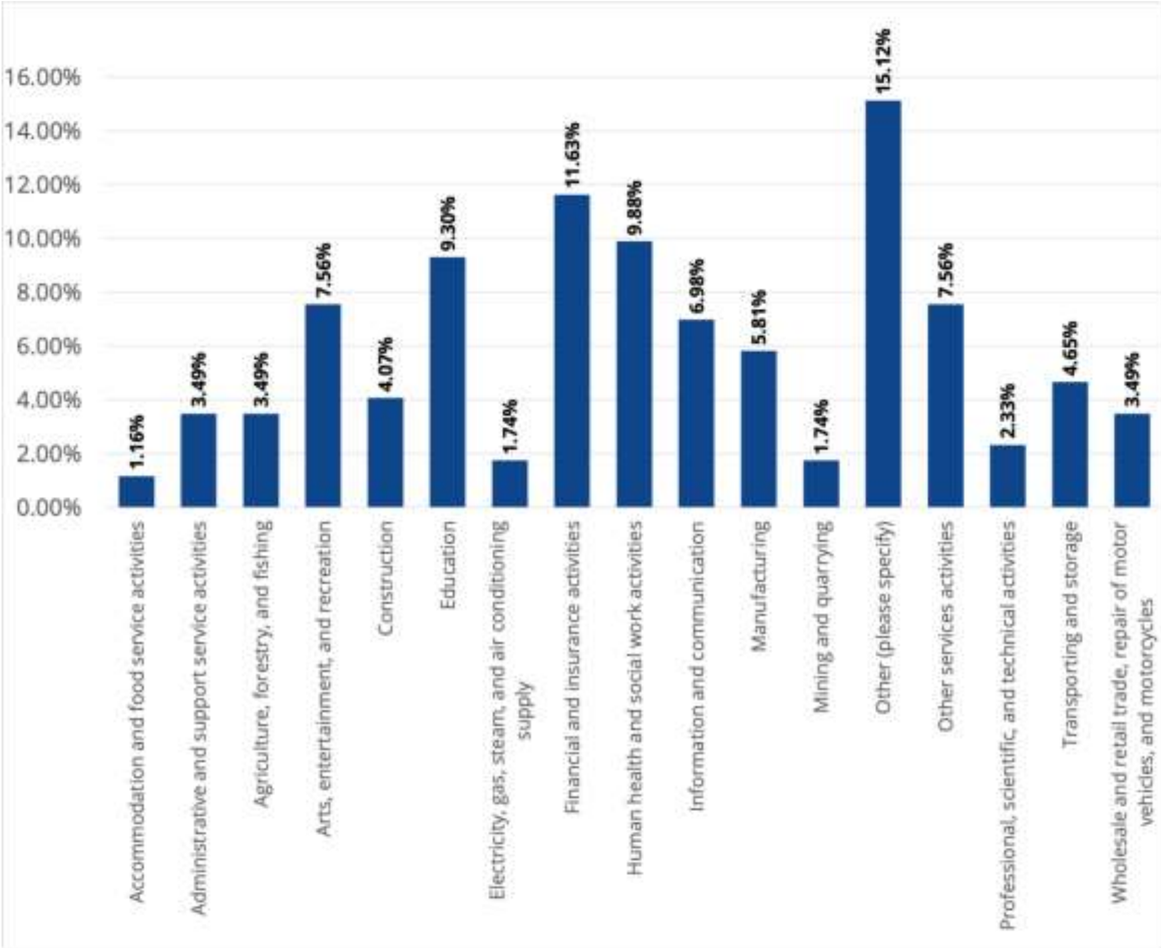
Figure 135: Distribution of employers' responses regarding the type of organisation they work for



Note: Employers N = 172

Source: Employers' survey (2023)

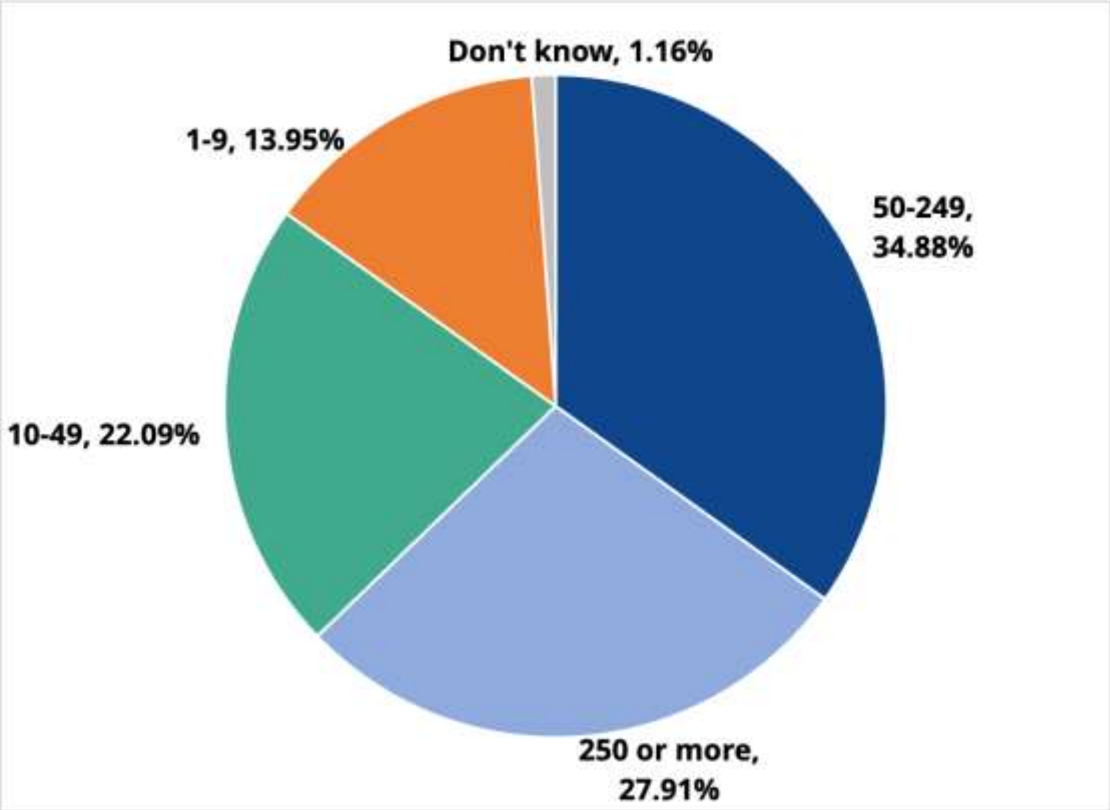
Figure 136: Distribution of employers' responses regarding the main activity of their workplace



Note: Employers N = 172

Source: Employers' survey (2023)

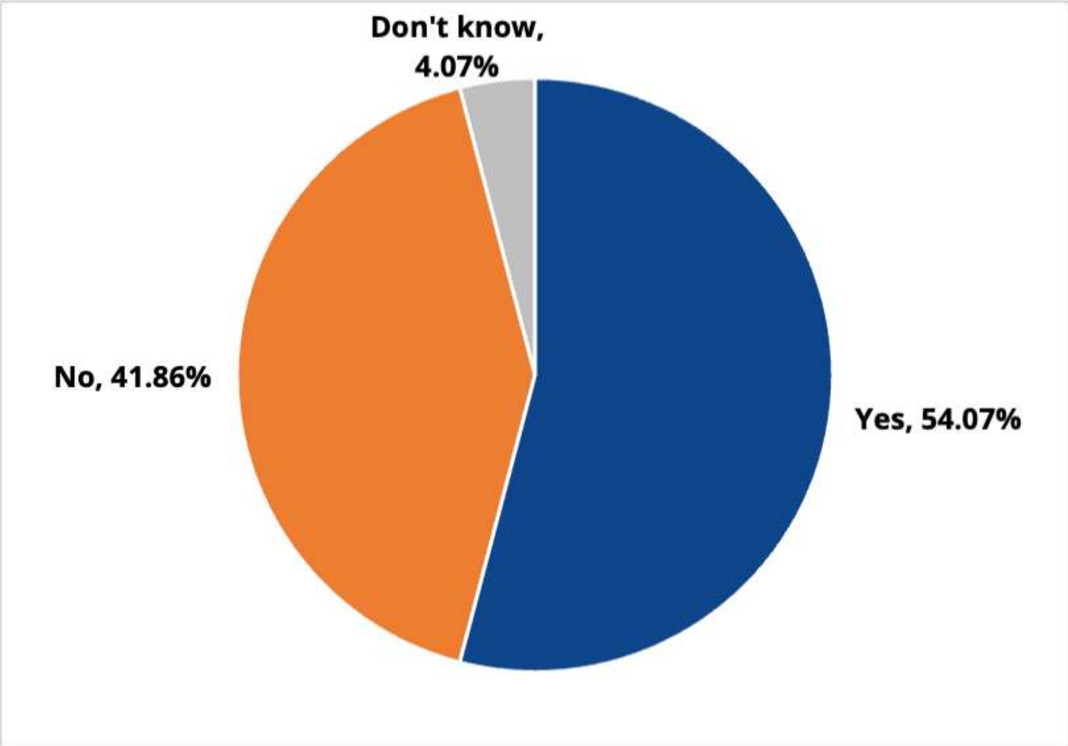
Figure 137: Distribution of employers' responses regarding the number of employees in their workplace



Note: Employers N = 172

Source: Employers' survey (2023)

Figure 138: Distribution of employers' responses regarding the presence of employees' representatives in their workplace

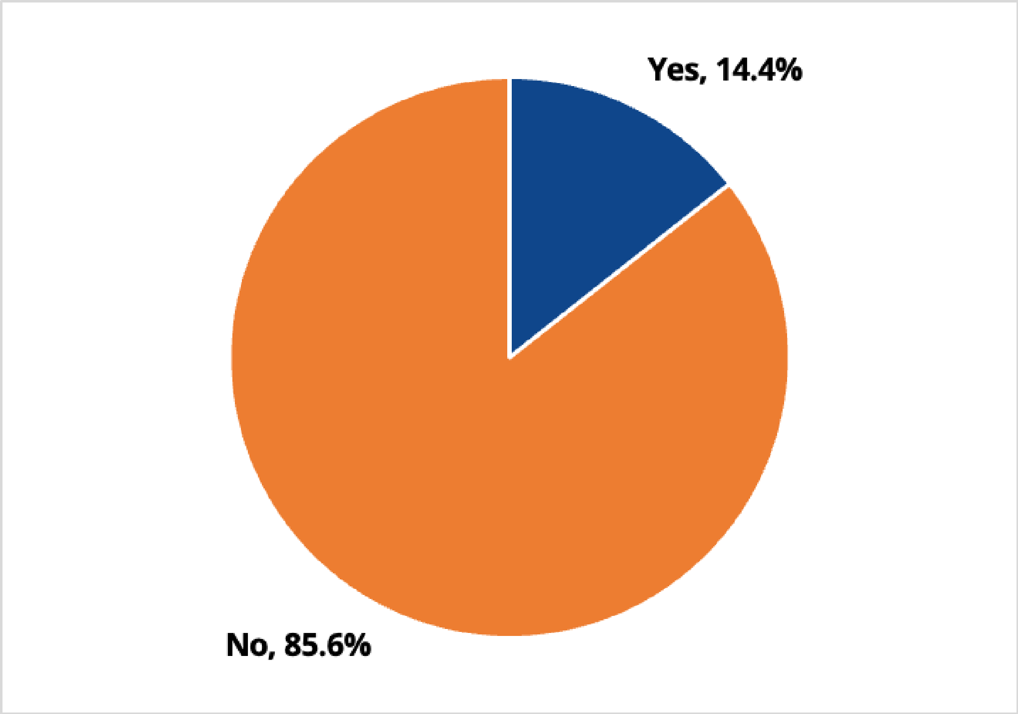


Note: Employers N = 172

Source: Employers' survey (2023)

14.6. Part F – Closing questions

Figure 139: Distribution of employers' responses regarding whether they would be willing to provide additional insights on the future of algorithms and their potential effects through an additional survey or an interview



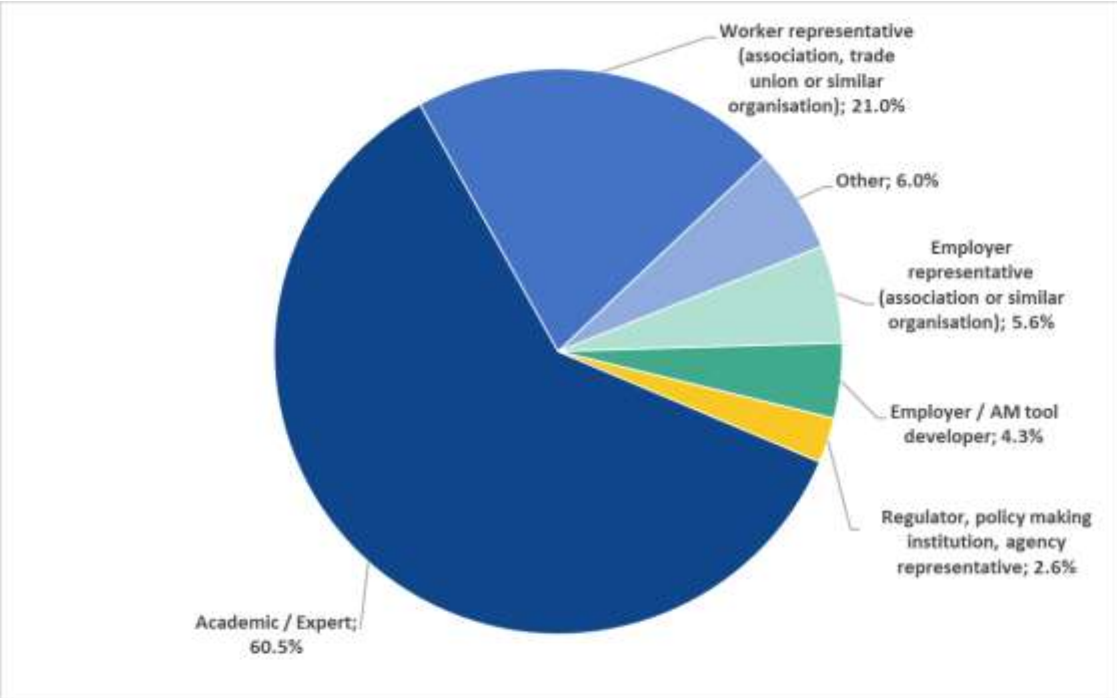
Note: Employers N = 160

Source: Employers' survey (2023)

Annex 15: Factual summary of the Delphi survey

15.1. Introduction

Figure 140: Distribution of respondents by their type

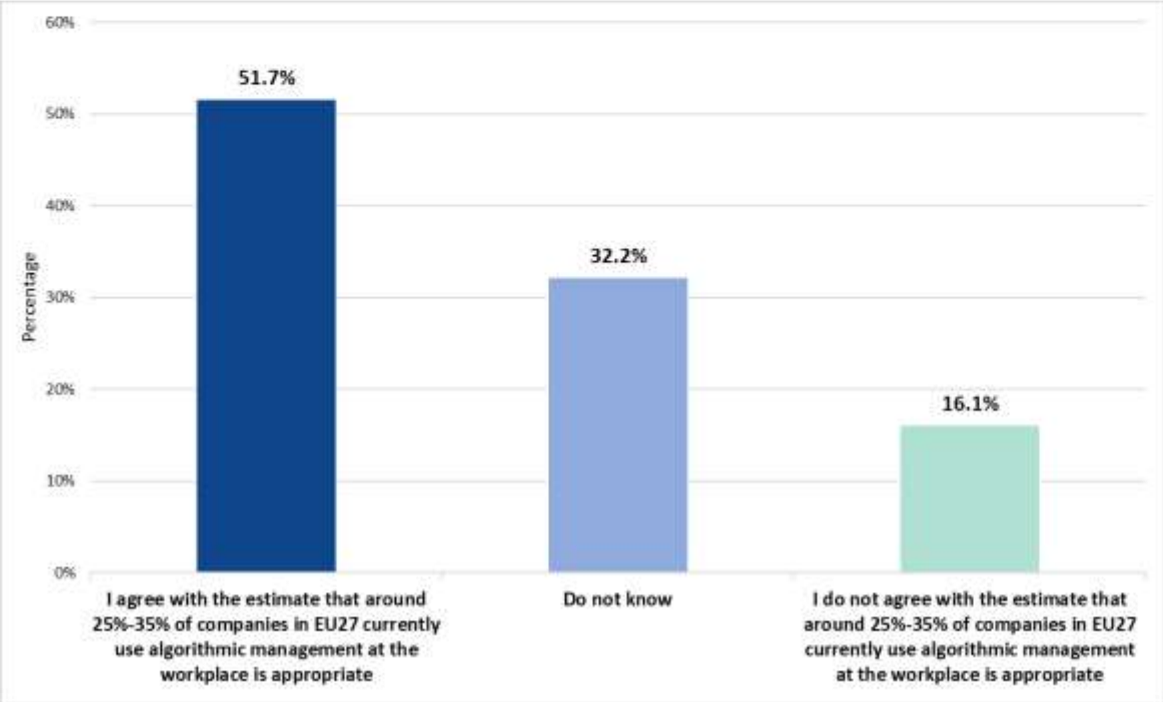


Note: N = 233

Source: Delph*i* survey (2023)

15.2. Part A - Current AM Usage (2023)

Figure 141: Share of respondents who (dis)agree that the estimate of 25%-35% of companies in the EU27 using AM is plausible

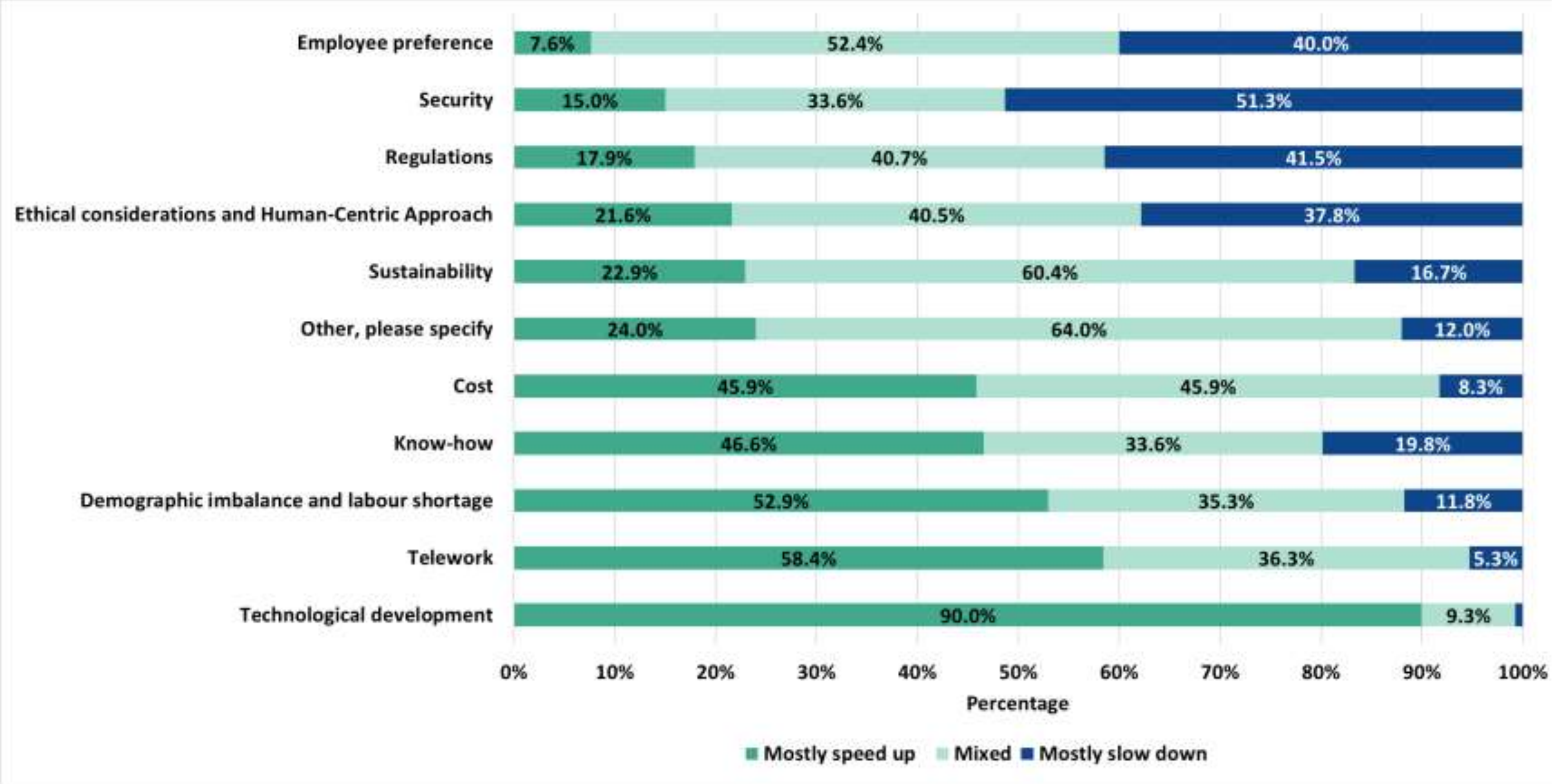


Note: N = 211

Source: Delph*i* survey (2023)

15.3. Part B - Drivers and barriers of change

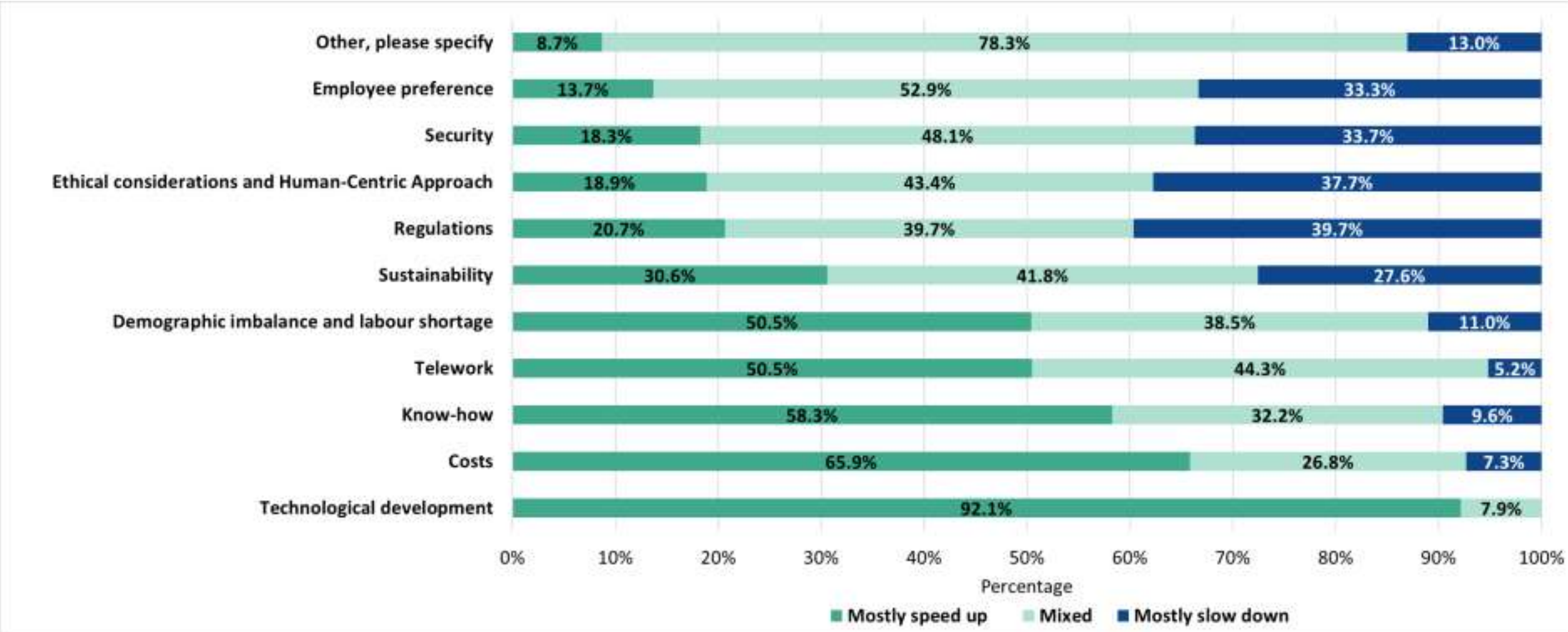
Figure 142: Distribution of respondents' answers regarding the factors that will speed up or slow down AM adoption in the next two years



N around = 115 (N for other = 23)

Source: Delph*i* survey (2023)

Figure 143: States Distribution of respondents' answers regarding the factors that will speed up or slow down AM adoption in the next 10 years

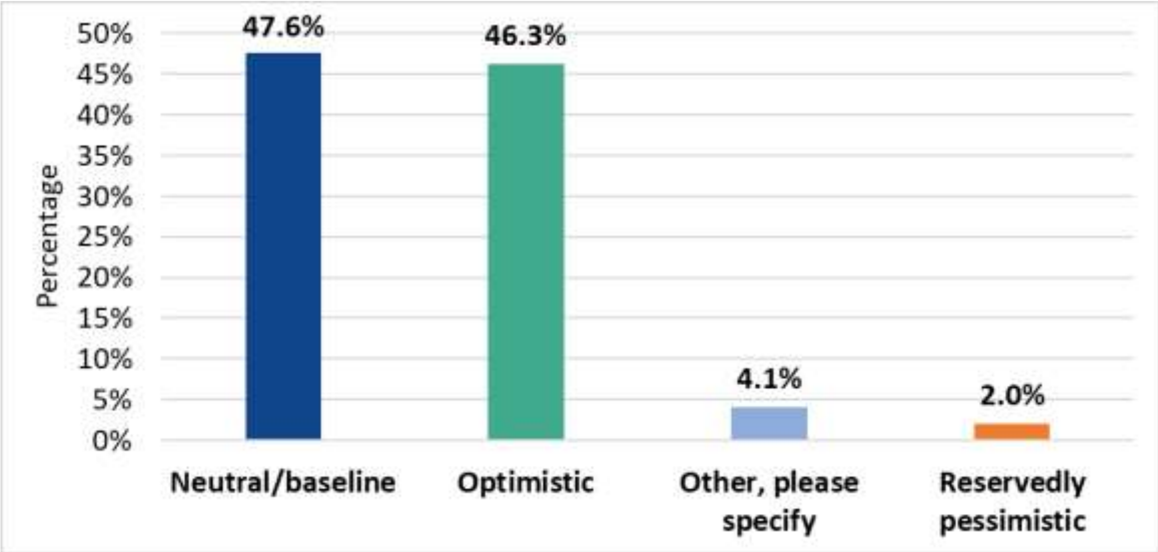


N around = 111 (N for other = 23)

Source: Delph*i* survey (2023))

15.4. Part C - Future evolution of AM

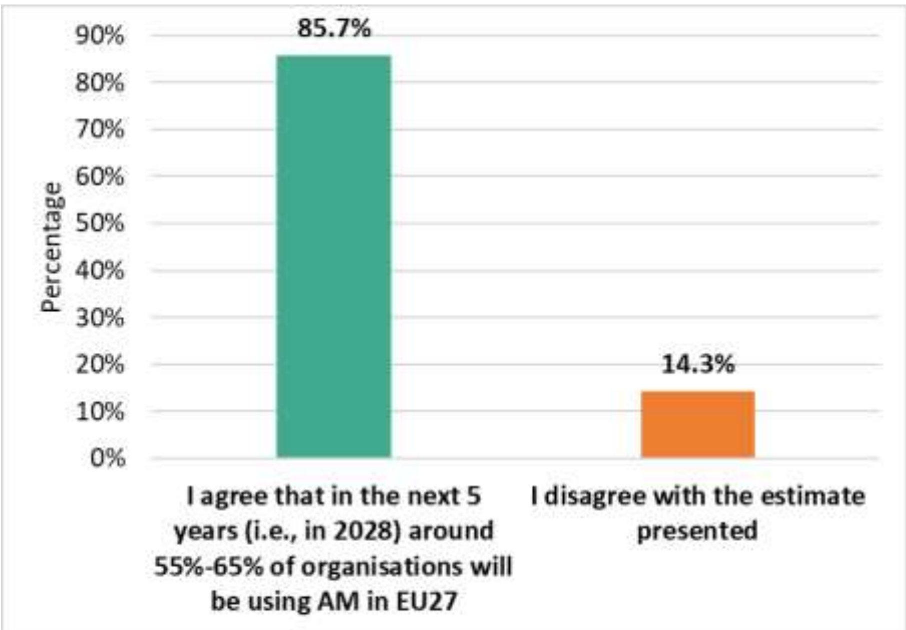
Figure 144: Distribution of respondents' answers regarding which one of the three scenarios on the future of AM (optimistic, neutral, pessimistic) will most likely become a reality



N = 147

Source: Delph*i* survey (2023)

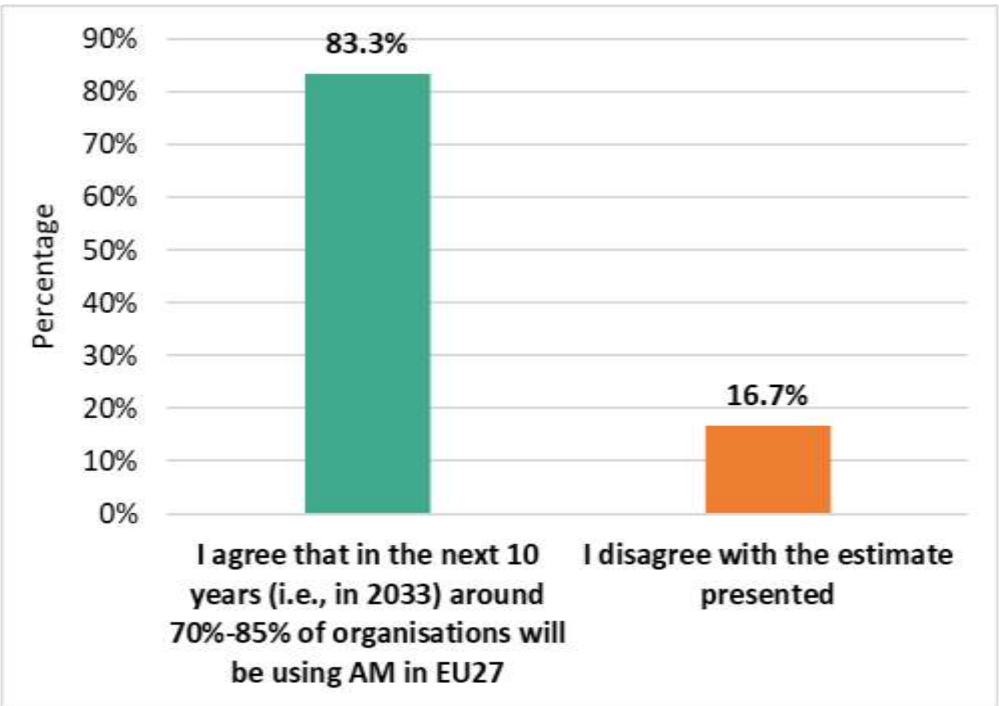
Figure 145: Share of respondents who (dis)agree that (considering the <u>optimistic</u> scenario) in the <u>next 5 years</u> (i.e., in 2028) around 55%-65% of organisations will be using AM in EU27



N = 42

Source: Delph*i* survey (2023)

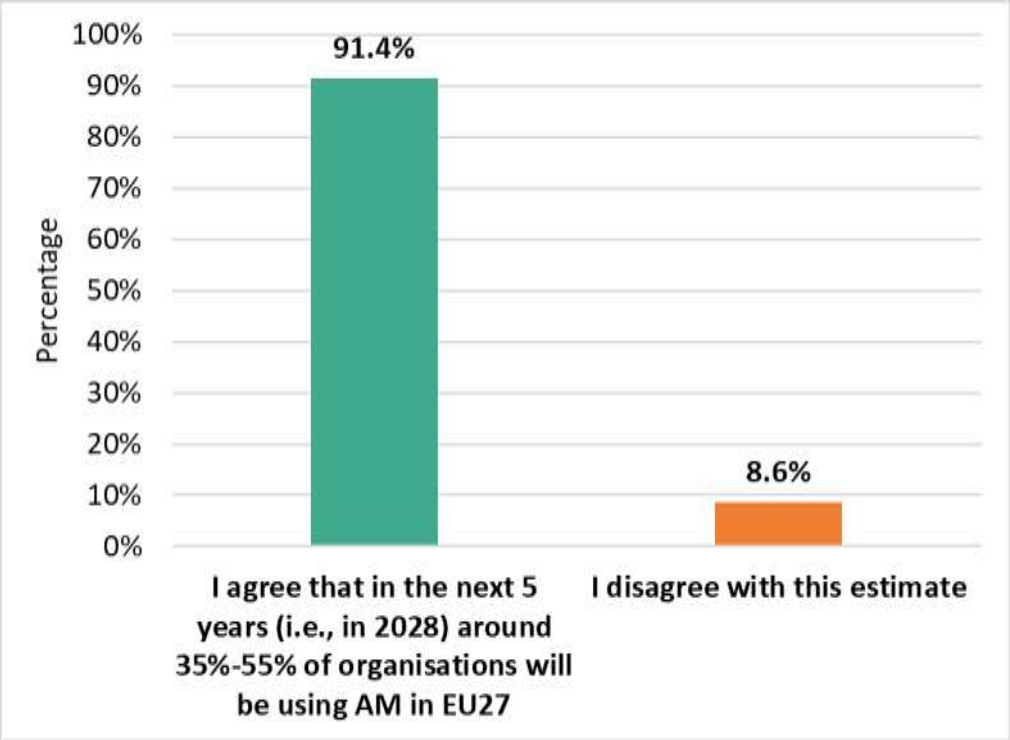
Figure 146: Share of respondents who (dis)agree that (considering the <u>optimistic</u> scenario) in the <u>next 10 years</u> (i.e., 2033) around 70%-85% of organisations will be using AM in EU27



N = 42

Source: Delph*i* survey (2023)

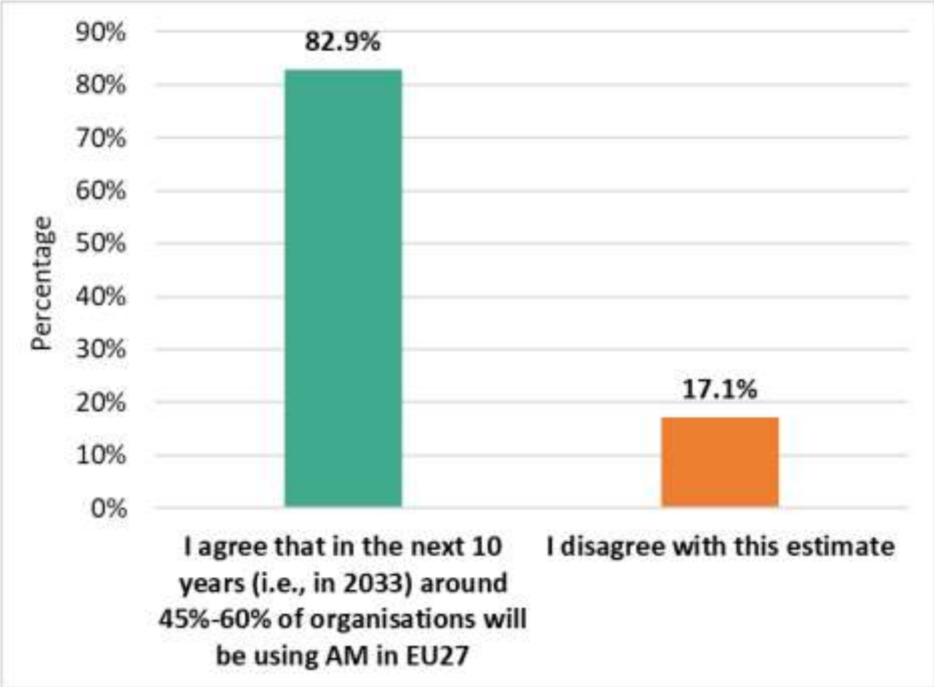
Figure 147: Share of respondents who (dis)agree that (considering the <u>neutral/ baseline</u> scenario) in the <u>next 5 years</u> (i.e., in 2028) around 35%-55% of organisations will be using AM in EU27



N =35

Source: Delph*i* survey (2023)

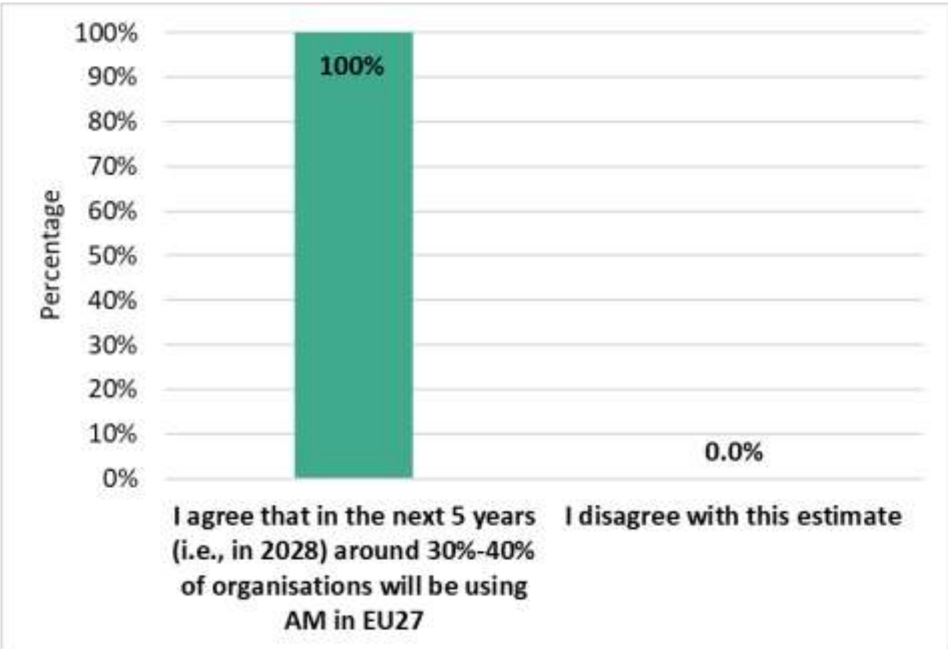
Figure 148: Share of respondents who (dis)agree that (considering the neutral/ baseline scenario) in the next 10 years (i.e., in 2033) around 45%-60% of organisations will be using AM in EU27



Source: Delphi survey (2023)

N=35

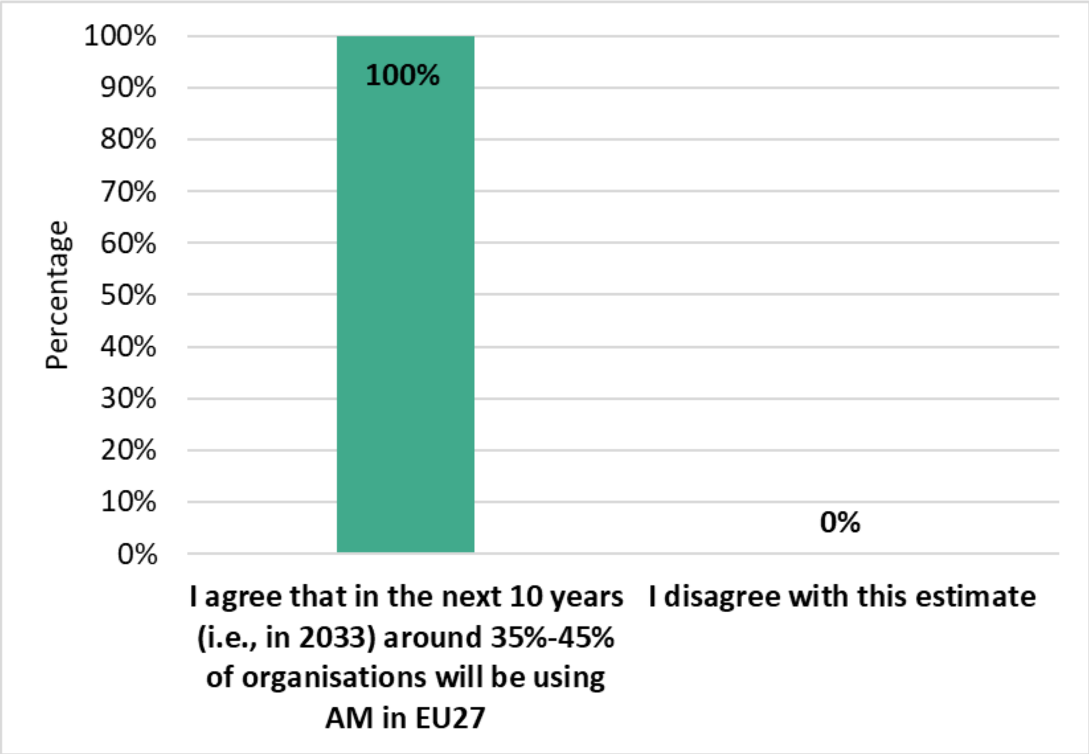
Figure 149: Share of respondents who (dis)agree that (considering the pessimistic scenario) in the next 5 years (i.e., in 2028) around 30%-40% of organisations will be using AM in EU27



N = 1

Source: Delph*i* survey (2023)

Figure 150: Share of respondents who (dis)agree that (considering the pessimistic scenario) in the next 10 years (i.e., in 2033) around 35%-45% of organisations will be using AM in EU27

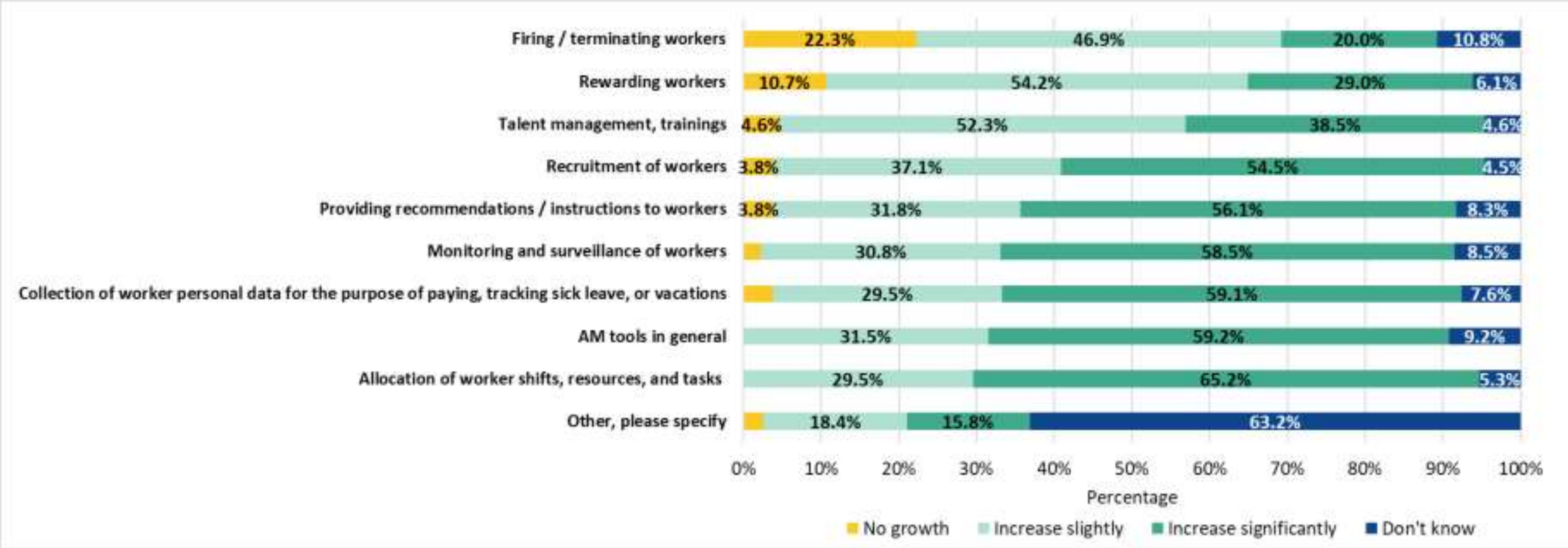


N = 1

Source: Delph*i* survey (2023

15.5. Part D - Managerial functions that can be automated through algorithms

Figure 151: Estimates provided by respondents on how the use of algorithms for each of the managerial functions below will evolve in the next 5-10 years

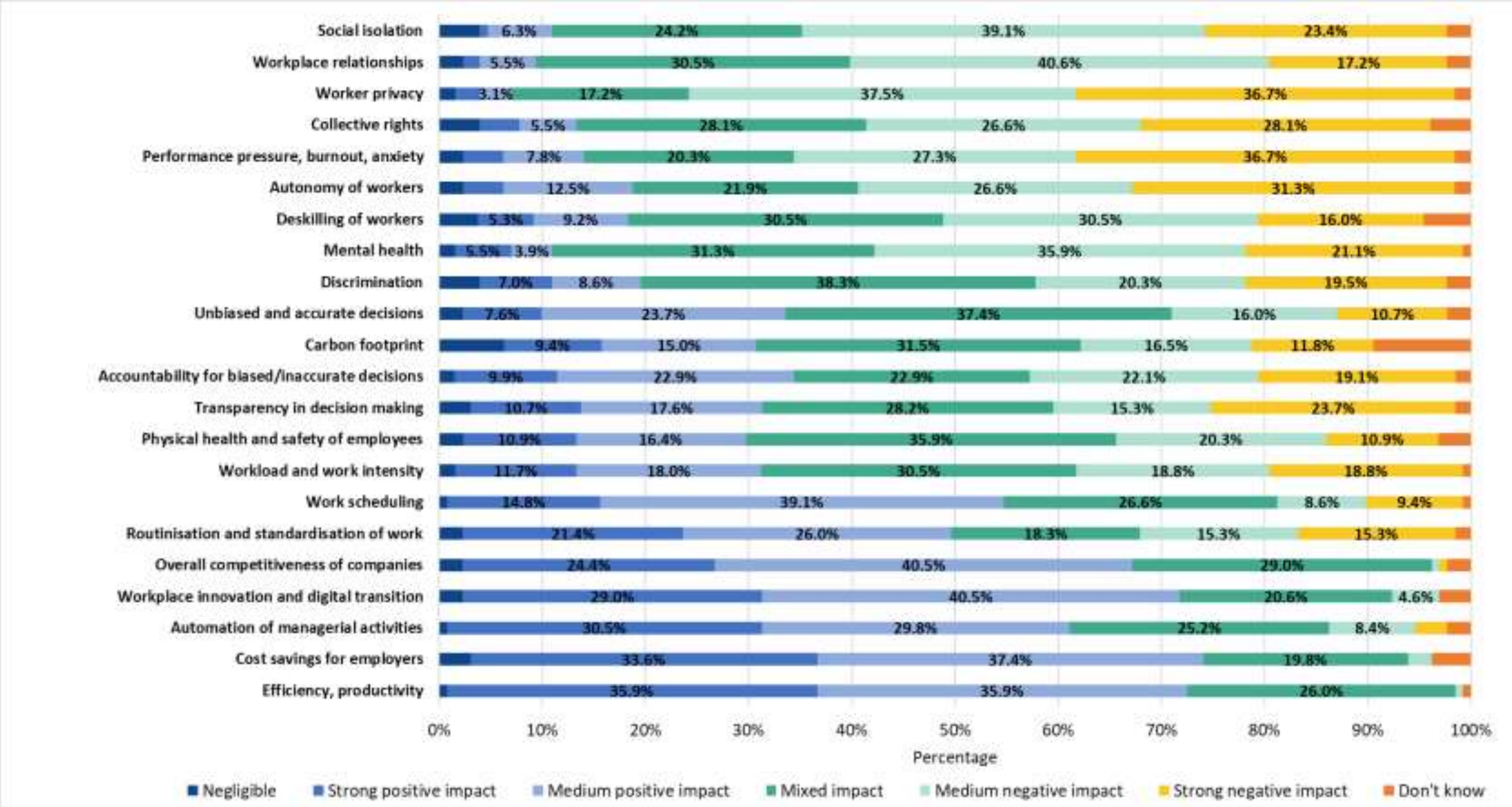


N around = 130

Source: Delph*i* survey (2023

15.6. Part E - Likely impacts of future evolution of algorithmic management

Figure 152: Assessments provided by respondents on the impacts that the selected future AM adoption scenario (optimistic, neutral/ baseline, or pessimistic) is likely to have on the following aspects



N around = 128

Source: Delph*i* survey (2023)

Annex 16: Factual summaries of the workshops

16.1. Data protection and the exercise of collective rights: challenges arising from monitoring and surveillance tools, and the role of trade unions and workers' representatives

July 19, 2023, 10.00- 13.30 CET

Workshop summary

Context

Visionary Analytics, on behalf of the European Commission's Directorate - General for Employment, Social Affairs, and Inclusion, is conducting a study to better understand the trends and barriers in using algorithms that automate managerial functions in the workplace, their effects on workers and employers, including what challenges and opportunities these can create. For more information on the study please click here.

Workshop Objectives

The main objectives of the workshop were to:

a) deepen the understanding of how monitoring and surveillance tools used by employers can challenge the principles of data protection outlined in the GDPR and/or collective rights of workers

b) better understand how employers, trade unions and workers' representatives can effectively navigate the complexities of monitoring and surveillance technologies in AM-driven workplaces.

Agenda

10:00 – 10:10 **Introduction**

10:10 – 12:00 **SESSION I: CHALLENGES AND GAPS**

Presentation of interim study findings:

Antonio Aloisi, IE University Law School, Madrid

Invited speakers:

Philipp Hacker, Chair for Law and Ethics of the Digital Society at European University Viadrina. Presentation: algorithmic management and data protection. The German case.

Halefom Abraha, University of Oxford.

Presentation: The notions of transparency and access in the GDPR, Art. 88 GDPR (law or collective agreements providing for more specific rules), the implementation by EU Member States.

Rüdiger Krause, Georg-August-University, Göttingen

Presentation: increasing use of automated decision-making and AI systems in workplaces and the challenges to collective rights

Aída Ponce Del Castillo, European Trade Union Institute

Presentation: The role of worker representatives and trade unions.

Gregory Gillet, ETNO, Chair of Social Dialogue and Community working group

Preliminary focus of the presentation: Algorithmic Management from the telecom Employer's Perspective

12:00 – 12:15 **Break**

12:15 – 13:30 **SESSION II: LOOKING FORWARD**

12:15 – 13:20 **Facilitated discussion**

13:20 – 13:30 **Summing up** and Closing of the workshop

Summary of the discussion take-aways

What are the key factors for ensuring transparency and accountability in automated decision-making processes that involve workers' personal data?

- The focus on individual rights is only half of the answer because employees would be often reluctant to enforce their rights during the employment relationship. Collective rights might be a more effective way to achieve transparency because worker representatives in the broad sense could function as information intermediaries and could explain to the workforce what is going on in the systems.

- A comprehensive explanation for why and how all the data are aggregated and processed, as well as how they are used should be provided.

- The kind of information provided could be different for different actors, but transparency should be ensured. The information that would enable the workers to exercise their rights is needed at the individual level without an overload of irrelevant information.

How can organisations and regulators address the "black box" problem and provide individuals with meaningful explanations for automated decisions?

- The legal framework should require that the automated decision-making would be traceable. Also, there should be legal presumptions about employer's responsibility if something goes wrong in the decision-making process. The issue of "black box" should not be an excuse or grounds for avoiding accountability.

- The idea of transparency and traceability is an incentive for employers to design and deploy AM tools in a way that they could understand and explain their functioning to the employees and their representatives.

What are the policy gaps to be addressed?

- Provisions of the GDPR that are specifically tailored to the workplace context have been very little used in the European and national framework.

- Collective dimension of the GDPR is a single aspect of a larger problem which is the non-specific, non-tailored nature of the instrument.

- Data subjects' and large corporations' customers' data are often processed in a way that is not in the accordance with the GDPR, making the power to enforce their rights under the GDPR low.

- The existence of the legal grounds such as contractual necessity and legitimate interest is not robust in a sense that there is always room for a proportionality test. There could be less privacy-intrusive methods striving for the same goals that the privacy-interfering tools are pursuing.

- According to the GDPR, Member States could clarify to what extent consent could be applicable in the workplace. However, no such explanation is currently available. There are guidelines provided by the data protection authorities in Europe stating that consent cannot be a legal ground but there is no clear legal framework for how it could be applied in the GDPR.

- One of the problems of the GDPR regarding AM is the legitimate interest. Monitoring of the workplace is an inherent feature of the employment relationship, but the issue lies in specifying to what extent and what kind of monitoring is justified. The problem arises when the processing of personal data goes beyond what is required for the performance of the contract.

- Fundamental rights on the side of the employee and business interests on the side of the employer do not have equal weight on the scale of justice. Business interest is a legitimate interest, but it does not weight as heavily as any fundamental human right such as privacy or the right to data protection. The notion of proportionality is crucial for ensuring the enforceability of those rights.

- The GDPR has moved forward in comparison to the past. However, in terms of its enforceability, it has gone back a few steps in many Member States. There are more rights, but their enforceability has diminished, contrary to the intention of enhancing it.

- The GDPR allows a lot of processing and gives some guarantees. However, it should also ensure that the provided guarantees are enforceable.

- The importance of the collective action is a much more urgent matter than devising exceptional rules for workers because many of the exceptions that are made for workplaces are actually a way of consenting to something that should not be consented to. Some of the collective labour agreements are a form of collective consent, whereas everybody agrees that consent cannot be a legitimate ground for the processing of employees' data in the workplace. It is emphasized how supposedly it is to the benefit of the employee, whose fundamental rights are in fact infringed upon.

- The GDPR is not workplace specific, and another instrument could be negotiated but there is no guarantee that this instrument would be more protective in terms of reducing the most pervasive and detrimental usages of technology.

- It is difficult to come up with a new AM directive and these kinds of instruments because there are many different aspects that need to be covered within supposedly one piece of legislation.

- A model of risk-based certification is included in the AI Act but is merely left to the providers, so there is little margin of manoeuvre for the users (adopters).

- Given the complexity, new potential tools for regulation and governance could be effective. However, they are quite difficult to negotiate because of the existing agreements.

- There has been a lot of interest in the framework agreement on digitalisation. It was adopted, agreed upon and signed by social partners. However, the attention that it got in the public sphere so far has been limited. Some frameworks and tools that could enable the exercise of collective rights at the decentralised level are needed.

In what ways can trade unions and workers' representatives participate in the design, deployment, and governance of AI systems? What role should they play in promoting trustworthy AM practices within organizations?

- Ideally the collective bargaining agreements should include the rationales for AI or AM tools' implementation, employers' objectives that could be achieved by using those tools, and the provisions on review of whether and to what extent those objectives were met. If the objectives are not met, then the tools and the data processing associated with them could be banned, since it would mean that those tools do not necessarily help to achieve the efficiency benefits perceived by the employer.

- Trade unions are confronted with an avalanche of new technologies which are very difficult to comprehend in both legal and technical ways. Therefore, to the extent possible, trade unions should allocate their resources to this field, since not all of them are aware of the upcoming risks.

- Regarding the case law, very different interpretations can be seen. Trade unions could demand more insight if they do not have it themselves, but there should be awareness of the whole "black box" discourse and what the technology behind it actually is.

- Workers' representatives should assume a new role in designing and enforcing data protection law in the workplace because currently the enforcement is left to data protection authorities that are not labour experts. Strategic enforcement and strategic plans of data protection authorities in Europe do not include employment in their priorities, meaning that the workplace is left behind by supervisory authorities. Therefore, workers' representatives should have a legal basis and step in to enforce as well as oversight the protection of employees.

- Workers' representatives should be involved in the design process of algorithmic systems and should not be misled by the argument that the algorithms are "black box". AI systems should be made explainable because having inscrutable AM systems is a design choice and not just the nature of technology. The design requires identifying the key parameters of the system and trade unions should be involved in defining those parameters.

- The fallacy of the "black box" should be avoided because it does not make any sense to introduce technology that is not even known to those who are adopting it. It is not only about information and transparency, but also about deciding the purpose of those technologies together. Both parties in the employment relationship should be interested in understanding these important elements.

- Some extremely intrusive products could be used in the European market only if they are certified. Employees' representatives could step in during the certification process like data protection authorities. Different modes of governance should be considered.

Oher take-aways:

- Results of the online survey (see 'AM workshop presentation 19072023' slides in a separate document) showed that the workshop participants identified the non-specificity of the GDPR when it comes to work relationships and legal complexity and practical feasibility of explanation as the key obstacles that could undermine the relevance and effectiveness of data protection and collective rights to address AM-related challenges and opportunities at the workplace.

- Lack of direct reference to AM tools in the information and consultation legal instruments was the least common option chosen by the workshop's participants in the online survey regarding the question of the key obstacles undermining the relevance and effectiveness of data protection and collective rights to address AM-related challenges and opportunities at the workplace.

- Consent is most problematic for 'lawfulness' for data collection, processing, or usage of workers, because the risks that workers face are material rather than the types of risks faced by other data subjects, e.g. consumers. Data law does not have the capacity to accommodate workers' privacy and data harms preventions rights as they are too homogenous.

- Using the algorithms produced by IT companies within the AM without the actual knowledge about how they work can be problematic from the employers' perspective because employers have to be in line with legal regulations even if they do not exactly know how the "black box" operates.

- The reception of the technology can be partially influenced by means of transparency, meaning that workers would not be prone to feel surveilled if they can exercise the collective rights.

- There is a lack of literacy in a sense that few legal experts actually know what AI does on the IT programming level and that few IT programmers working with AI know the legal implications of what they are doing.

- There are some tensions in terms of what consent means and whether or not workers have the actual choice to opt out given that the decision-making processes can have a material effect on their life.

Table 26: List of participants

No.	Participant	Affiliation
1.	Halefom Abraha	University of Oxford
2.	Antonio Aloisi	IE University Law School
3.	Łukasz Arendt	University of Lodz
4.	Predrag Bejaković	Institute of Public Finance
5.	Suncica Brnardic	Union of Autonomous Trade Unions of Croatia
6.	Jasmin Gegenwart	European Commission
7.	Gregory Gillet	ETNO
8.	Dirk Gillis	Katholieke Universiteit Leuven
9.	Blaz Goyha	Austrian Trade-Union Federation
10.	Phillip Hacker	European University Viadrina Frankfurt (Oder)
11.	Christina Hiessl	KU Leuven
12.	Rüdiger Krause	Goethe-Universität Frankfurt
13.	Jaan Masso	University of Tartu
14.	Laura Mažeikaitė	Visionary Analytics
15.	Marcel Mlinarić	Ministry of Foreign and European Affairs of the Republic of Croatia
16.	Chiara Monti	European Commission
17.	Phoebe Moore	Essex University
18.	Agnė Paliokaitė	Visionary Analytics
19.	Aída Ponce Del Castillo	ETUI
20.	Nastazja Potocka-Sionek	Ca' Foscari University of Venice
21.	Aistė Ragaliauskaitė	Visionary Analytics
22.	Marta Subataitė	Visionary Analytics
23.	Ivana Šepak-Robić	MATICA HRVATSKIH SINDIKATA

No.	Participant	Affiliation
24.	Johan Verbrugghe	ACV-CSC METEA
25.	Luciana Zorzoli	Cardiff University

16.2. Occupational safety and health implications of using AM tools in the workplace

July 27, 2023, 10.00- 13.00 CET

Workshop summary

Context

Visionary Analytics, on behalf of the European Commission's Directorate - General for Employment, Social Affairs, and Inclusion, is conducting a study to better understand the trends and barriers in using algorithms that automate managerial functions in the workplace, their effects on workers and employers, including what challenges and opportunities these can create. For more information on the study please click here.

Workshop Objectives

The main objectives of the workshop were to:

a) obtain feedback and comments on the preliminary results of the study

b) obtain fresh insights from experts and stakeholders concerning the key opportunities and challenges to occupational safety and health (OSH) that the introduction of algorithmic management (AM) technologies at the workplace presents for workers, and the potential ways forward.

Agenda

10:00 – 10:10 Introduction

SESSION I: CHALLENGES AND GAPS

10:10 – 11:30 Presentations by invited speakers

Presentation of interim study findings:

Phoebe Moore, University of Essex, Essex Business School.

Invited speakers:

Sascha Wischniewski and Patricia Rosen, German Federal Institute for Occupational Safety and Health (BAuA) Presentation: Criteria and Guidelines for Human-Centered Work Design in a Digitally Transformed World of Work

Dr Francisco Santos O'Connor, International Labour Organisation.

Presentation: Occupational safety and health implications of using algorithmic management: How can data protect workers health and lives?

Isaline Ossieur, Business Europe.

Presentation: Occupational safety and health implications of using AM tools in the workplace

Prof. Dr Adrian Todoli-Signes, University of Valencia.

Presentation: Making algorithms safe for workers

11:30 – 11:45 Break

SESSION II: LOOKING FORWARD

11:45 – 12:45 Facilitated discussion

12:45 – 13:00 Closing remarks

Summary of the discussion

Below we present a summary of the key points raised and the suggestions provided by the workshop participants.

What are the remaining gaps for properly addressing challenges and opportunities for OSH that the introduction of AM technologies creates for workers and employers?

- Psychosocial risks for workers are often overlooked when introducing AM tools and applications.
- A serious challenge is that there are still many companies without works councils or other types of worker representative bodies.
- The issue of data aggregation for future projections/predictions tends to be overlooked. Many advanced tools aggregate data, and subsequently, projections for the future are made based on statistics and probability calculations. Depending on them, decisions about the employees' future roles/activities in companies are taken. This already ongoing practice is problematic because it is often not possible to accurately calculate and predict the individual development of humans, as circumstances are not always dependent on likelihood.

- Data used for AM may not be ‘clean’ due to disruptions in collection or other problems in collection and aggregation. Data may further be utilised in such processes which are not high quality.

- AM can lead to work intensification, which encompasses not only increasing the pace of work, but also narrowing the frame down to a specific way that the work has to be done, based on statistics and data aggregation.

- Problems of deskilling, diminishing autonomy and lack of holistic approach to work can arise. This is a serious issue since workers’ mental health and psychosocial pressures are influenced by characteristics of workplace design in AM. Therefore, precise requirements for workplace design need to be developed.

- Prevention of OSH risks is often used as a motivation to introduce AM tools (e.g. wearables) in the workplace. However, the usage of such tools can also have detrimental effects on OSH.

- Worker monitoring helps to ensure that employees are wearing personal protective equipment in such industries as construction and oil and gas. However, this can present a challenge as well, since technologies may include surveillance dimensions, which may have a negative impact on workers’ behaviour and an increase in psychosocial pressures such as anxiety, if they know, or suspect, that they are being constantly monitored.

- There is a lot of knowledge regarding both the positive and negative aspects of AM from an OSH perspective. However, not enough actions are taken to address the concerns effectively. It is not completely feasible to counterbalance risks and challenges with opportunities. In some cases, opportunities do not outweigh the risks in AM. At times, opportunities favour employers, leaving employees burdened with challenges. Therefore, new interventions and/or rules are needed to take this into account.

- The field of AM is to some extent covered within the AI Act. Some interest groups have attempted to exclude it from the legislation or at least to narrow down the scope, meaning that many products would fall out of the scope and that the requirements for them would no longer be applicable in the workplace.

- Based on research, worker participation, effective provision of information to workers and transparency (referring both to system operation and data treatment) are some of the key factors for the successful implementation of AM systems.

How can we measure successes or challenges in AM?

- To measure successes or challenges in AM, it is important to ensure worker participation at a high level.

- Employees’ and employers’ interests should be balanced to a certain extent. Competitiveness should remain at safe and healthy levels without leading to a harmful work environment. That could be measured by communication with employees.

- The idea of *auditability* could be a good way to deal with the issues regarding AM, however, there is no guarantee that the conclusions coming from the audits would be enforceable.

To what extent is there a need for new tools/policies/initiatives/strategies? If yes, which areas should they specifically target? What are some best practices (at the national, workplace level) that can be shared?

- The regulatory solution should be not to forbid technology, but rather to regulate the workplace, since the introduction of the technology could lead to increased productivity and benefit a lot of people. Regulations should not only focus on the technology itself, but rather on the effects that it causes.

- While researchers are aware of the problems related to AM, many union members in small and medium sized companies, and even OSH experts, do not have sufficient knowledge about the specific risks of AM and do not perform AM-specific assessments. Hence, having institutions responsible for algorithm auditing could be beneficial.

- Although co-determination is important, not all EU countries' labour law includes this right. In Germany, 'Mitbestimmung' is applied regularly for decisions in AM. However, it cannot be a substitute for adequate regulation. Around 19 European countries have the right to hold worker representation on company boards, but this is not often recognised nor applied

- In addition to co-determination and social dialogue, it is crucial to have good legislation and there is a need to update the specifications of OSH regulation as well. Besides that, proper enforcement is important, although lately, it has been diminishing. Therefore, public institutions should focus on improving the enforceability of regulation.

- According to the framework directive, the employer bears responsibility for all aspects of work. This could cover all the areas that are currently lacking special tools to effectively apply regulation to workplaces.

- In many cases, OSH regulations are not complied with because OSH is very costly. Companies might try to lower their costs by saving on OSH regulations, since in many cases they are expensive in terms of equipment and productivity. That is the reason why proper enforcement remains an issue. However, this is relevant not only to the field of OSH.

- Expectations for the AI Act are high, but it faces some challenges. The AI Act sets criteria for bringing different products (also AI) into the internal market, including requirements for OSH (often also referred to as EHSR). However, that is only the side of the product criteria. Art 114/115 is about product requirements and it can have a strong influence on OSH but that is not sufficient. It must be combined with specifications in the area of OSH Legislation under Art 153 that go far beyond the product requirements but work itself. Only on such a solid legal basis companies' risk management, market surveillance, supervision, and enforcement can be reliably connected.

- The introduction of legislation is important, but there is not much that it can do if there are no means to enforce it.

- Although having appropriate regulations and strong enforcement is important, it is not possible to regulate completely everything in detail. In addition to strong regulation and good enforcement, worker participation is needed.

- From the field of research, there is a lot of knowledge that could aid in specifying appropriate workplace design criteria. However, for these criteria to be effectively implemented, they need to be made mandatory.

Other take-aways:

- Risk is not the same in all sectors and does not apply identically to all types of 'data subjects' (e.g. workers, consumers and citizens). Many workers do not know the risks of AI or working with AM, but this statement is not exclusive to AI nor AM systems. Workers in many other sectors also do not know the risks, e.g., related to chemicals or nanomaterials. The same situation applies to labour inspectors, since not all of them know about the risk of chemicals. So, generally, workers are not well-informed, they do not receive enough risk communication, and do not know the risks overall.

- There is not enough worker participation in risk assessment and management. This has been a systematic situation in implementing all legislations and it has not changed. Workers do not know the risk of AI and AM, but the same can be said about the rest of the risks, including psychosocial risks.

- If the problem of risk communication, risk assessment and risk participation could be tackled, maybe there would not be any necessity to legislate more or to enforce laws because then everything would be done in the workplace with good co-determination when possible.

- The number of FTEs allocated to inspection services specialised in OSH matters is very low. There is a preventative aspect of OSH regulations but without a proper enforcement, these regulations lose their value.

- Companies should have a clear objective for introducing AI systems or AM tools in the workplace. Introducing such technologies should not be done merely for the sake of doing so, but with a clear understanding of the specific targets that they aim to achieve.

Table 27: List of participants

No.	Participant	Affiliation
1.	Antonio Aloisi	IE University Law School
2.	Ioannis Anyfantis	European Agency for Safety and Health at Work (EU-OSHA)
3.	Predrag Bejaković	Institute of Public Finance
4.	Lucia Barrera Castillo	University of Valencia
5.	Michael Bretschneider-Hagemes	Commission for Occupational Safety and Standardization
6.	Emmanuelle Brun	European Agency for Safety and Health at Work (EU-OSHA)
7.	Maurizio Curtarelli	European Agency for Safety and Health at Work (EU-OSHA)
8.	Raluca Dimitriu	Bucharest University

No.	Participant	Affiliation
9.	Robert Donoghue	Essex University
10.	Solveiga Eidukynaitė-Gerard	European Commission
11.	Jasmin Gegenwart	European Commission
12.	Dirk Gillis	Katholieke Universiteit Leuven
13.	Blaz Goyha	Austrian Trade-Union Federation
14.	Julio Losada Carreño	Ministry of Labour and Social Economy in Spain
15.	Ángela Martín-Pozuelo López	Universitat de València
16.	Laura Mažeikaitė	Visionary Analytics
17.	Chiara Monti	European Commission
18.	Phoebe Moore	University of Essex, Essex Business School
19.	Isaline Ossieur	Business Europe
20.	Agnė Paliokaitė	Visionary Analytics
21.	Petra Pirklova	European Commission
22.	Aída Ponce Del Castillo	European Trade Union Institute
23.	Nastazja Potocka-Sionek	Ca' Foscari University of Venice
24.	Aistė Ragaliauskaitė	Visionary Analytics
25.	Patricia Rosen	German Federal Institute for Occupational Safety and Health (BAuA)
26.	Dr Francisco Santos-O'Connor	International Labour Organisation
27.	Marta Subataitė	Visionary Analytics
28.	Ivana Šepak-Robić	MATICA HRVATSKIH SINDIKATA
29.	Adrian Todoli	University of Valencia
30.	Manon Van Thorre	Confederation of Christian Trade Unions
31.	Sascha Wischniewski	German Federal Institute for Occupational Safety and Health (BAuA)
32.	Luciana Zorzoli	Cardiff University

16.3. HR and people analytics: fairness and discrimination

August 3, 2023, 10.00-13.00 CET

Workshop summary

Context

Visionary Analytics, on behalf of the European Commission's Directorate - General for Employment, Social Affairs, and Inclusion, is conducting a study to better understand the trends and barriers in using algorithms that automate managerial functions in the workplace, their effects on workers and employers, including what challenges and opportunities these can create. For more information on the study please click here.

Workshop Objectives

The main objectives of the workshop were to:

a) obtain feedback and comments on the preliminary results of the study

b) obtain fresh insights from experts and stakeholders concerning the key opportunities and challenges to fairness and non-discrimination in HR and hiring that the introduction of algorithmic management (AM) technologies at the workplace present for workers, and the potential ways forward.

Agenda

10:00 – 10:10 Introduction

SESSION I: CHALLENGES AND GAPS

10:10 – 10:30 Presentation of interim study findings

Presentation of interim study findings:

Prof Phoebe V Moore (University of Essex, Essex Business School) and Dr Antonio Aloisi (IE University Law School, Madrid).

10:30 – 11:30 Presentations by invited speakers

Invited speakers:

Dr Abigail Gilbert, Institute for the Future of Work.

Presentation: AI and the concept of fairness: beyond equality and non-discrimination

Dr Ekkehard Ernst, International Labour Organization.

Presentation: AI regulation + HRM. A gap analysis

Prof. dr. Linda Senden, Utrecht University.

Presentation: EU equality law framework and algorithmic discrimination: gaps and ways forward

Mr Dovydas Čeilutka, AI Association Lithuania.

Presentation: Algorithmic management. Employer's perspective

11:30 – 11:45 Break

SESSION II: LOOKING FORWARD

11:45 – 12:45 Facilitated discussion

12:45 – 13:00 Closing remarks

Summary of the discussion

Below we present a summary of the key points raised and the suggestions provided by the workshop participants.

What are the key factors for properly addressing the challenges and opportunities in the area of fairness and discrimination that the introduction of AM technologies at the workplace presents for employers and workers?

- The usage of algorithms can have many advantages, but they must be somewhat balanced with the drawbacks. It is necessary to ensure that the system is flexible and efficient without harming specific vulnerable groups.

- Discrimination is a result of limited human perception. There is an opportunity that systems of automatic analysis could help to assess whether people are unwillingly excluding certain candidates due to their limited views and understanding of the world.

- Discrimination is the most concrete notion currently available in the law for tackling the inequalities and biases in the employment context because there is a specific definition for it from a legal perspective. However, there is no legal definition for biases.

- Expanding the discrimination perspective by taking the notion of vulnerability into account allows to have more focus on the structures and elements in the system that recognise the vulnerability of specific groups rather than focusing on the discrimination assessment on itself.

- Fairness is a concept that goes beyond discrimination. It is difficult to define fairness because it can have many different meanings and manifestations in legal principles depending on the type of data subject and the object itself.

- The definition of the ex-ante mechanism is very broad and includes systems such as the impact assessment tool and the risk-based approach. But these procedures must be informed and guided by some overarching principles, definitions, and notions. Hence, developing a more specific notion of fairness could be beneficial.

- It is important to take different stakeholders into consideration. The system of stakeholders in AM is broader and goes beyond the classical dichotomy between employers and workers because there are third-party providers of the technology.

- Social dialogue is a very effective and flexible model that could be used as a participatory method to get the views of those who are adopting the technology or being subject to it.

- It is important to understand what AI and AM tools are doing at scale in order to ensure their beneficial effects on society. Although these tools can be productivity-enhancing and increase compliance with safety regulations, individual companies will not be able to assess the negative side of these tools and how they are automatically developing themselves into implicit discrimination. That is where the governance needs to be strengthened.

- The proposed platform work directive includes important aspects aimed at transparency enhancement. The information right, the metrics, the logic, and the weighting of the factors that are included in automated monitoring and decision-making must be disclosed to both platform workers that are employed by the platform and those that are generally self-employed workers.

What are the remaining gaps?

- There are many small and medium-sized enterprises that are willing to adopt technological solutions to streamline some processes, but they are also considering the risk of doing so. Vulnerability and exposure to legal uncertainty could result in limitations regarding the adoption of technology.

- Due to the unfairness in social reality, highly accurate systems could also reproject and reproduce highly uneven outcomes. Hence, there are trade-offs between the accuracy and fairness of the system.

- In some cases, there are promises regarding AI which cannot be completely fulfilled.

- Career consistency, professional background and family status might not always be the best features for making inferences based on data during the search for potential employees. Plus, these factors are not straightforwardly captured under the current set of protected grounds.

- There are strong divergences regarding the views on technology. Therefore, in some cases, social dialogue could be associated with a lower adoption of the technology.

- Not many people question AM procedures and their effectiveness in the workplace.

- There is a possibility that increasingly cheaper technologies could induce people to question the usefulness of AM procedures even less frequently, because the use of technologies seems to make the procedures faster. However, there may be a higher risk of reducing the accuracy and effectiveness of the AI and AM systems, as well as introducing bias and possible discrimination.

- When it comes to technologies, 'intended function' is a very important aspect and one that the AI Act has emphasised in its classification scheme for whether a tool or application is considered a ‘general purpose’ AI or not (general purpose AI have a range of uses). Many AM technologies are developed for specific reasons and intended purposes, and developers are expected to produce manuals that should be given to the companies to which those technologies are sold. Companies are therefore expected to state the purpose intended for the technology and to stick to that, to stay within the AI Act regulation. However, AM HR tools can usually be **used** for many reasons, including making subjective management decisions, which cannot be predicted (e.g., when it comes to 'inferences'). This can make it problematic to protect against discrimination and unfair practice.

- It is very difficult to regulate ‘inferences’ and to capture them by using the elements of the current equality law *acquis* due to their subjective nature and due to a lack of mechanisms to depict when it occurs.

- Algorithms may circumvent and counteract affirmative policies.

- Algorithms should not make any decisions on people that automatically fall under protected groups, e.g. people with disabilities. However, the notion of disability in the context of discrimination has been evolving throughout the years. Nowadays it is more dynamic and not attached to the specific criteria that have been used in the past. Thus, only a certain percentage of all people with health issues are recognised as having a disability, leaving others unprotected. The variables and criteria based on which the scores (e.g., a job seeker score) are generated for such workers are not clear, hence causing uncertainty about whether to apply these affirmative policies for them.

- Some notions (e.g., the contractual necessity, the legitimate interest) can be amply used to justify the adoption of the technology that could result in some negative effects.

- There is a technical challenge in striking a balance between discretion and objectivity. Discretion is acknowledged as one of the perks of human intelligence, whereas objectivity (which is quite difficult to achieve in the real world) could help to avoid favouritism.

- Labour, equalities, privacy and data protection law are the best to source for protection of workers’ rights when discrimination and fairness are on the table. Competition and anti-trust law is not appropriate. Algorithmic collusion relates to surge pricing, which has to do with demand for services and market capture, rather than what occurs in the employment lifecycle, where demand and ‘what is at stake’ questions relating to workers and employers, is quite different to the relationships between ‘consumers’ and business owners and the broader company approach to use of data.

What are some best practices (at the national, workplace level) that can be shared?

- There is a quite comprehensive set of directives, but the Member States have been strengthening the model.

- Some responses are coming from the AI Act which adopts a risk-based approach. Although it has some limitations, the relevance of discrimination and the need to pursue a discrimination-free working environment is acknowledged in the preamble and the text of the proposed AI Act, meaning that the identification and classification of the systems, which are considered to be high-risk, are based on their potential to impinge upon equality rights.

- There are some attempts to blend data protection rights, equality, and discrimination. When it comes, e.g., to notification, information and access, some rights dealing with privacy in the workplace that are enshrined in the GDPR and other pieces of legislation can be mobilised to lower the obstacles and facilitate a better understanding.

- Several cases of non-discrimination have ended up as data protection cases. Some of the examples include the Siri case about social fraud in the Netherlands or the case of the Austrian profiling system in public employment. Due to the lack of expertise in the analysis of the discriminatory effects of algorithms, the cases were only looked at from the data protection perspective.

- The notion of the proportionality test is an attempt to strike a balance between the functionalities of AM tools and the consequences in terms of equality and non-discrimination.

- Proportionality could be seen as an important element of fairness, non-discrimination, and equality assessment. However, there are some tensions between the need to carry out a proportionality test for verification (e.g., whether there are fewer discrimination-infringing technologies available) and the functionality, efficiency, productivity-enhancing role, and accuracy of the technology.

To what extent is there a need for new tools/policies/initiatives/strategies? If yes, which areas should they specifically target?

- In the context of anti-discrimination law, there might be a need for more rather than fewer procedures in order to ensure that no mistakes are made.

- The fragmented approach of EU law faces some issues when it comes to ensuring fairness and legal certainty. Having different rules in different files or legislative acts does not always ensure a coherent and consistent system.

- Besides having coherent legislation, it is crucial to understand how legislation can be enforced at the national and workplace levels.

- When it comes to the EU equality law (and many other domains in general), a better enforcement mechanism is needed. More public enforcement, monitoring and compliance systems need to be put into place.

- The weighing of different interests, values and rights should be much more integrated at the ex-ante level.

- There should be more discussions about a ‘balancing act’ between company and worker interests, and identify practical methods for how to have all views properly represented, since in practice companies face some issues regarding the protection of those who are suffering from discrimination.

- There is a need to focus more on participation in various phases of the deployment and the use of technologies at both the regulation and workplace levels.

- An impact assessment tool could fit well into the EU regulation approach.

- When it comes to challenges and opportunities, the need to raise the standard of transparency and mitigation strategies is shared between employers and workers.

- There is a need to strengthen ex-post governance and involve social partners, while also placing a stronger emphasis on education and training concerning the implications of AI and AM tools.

- When it comes to the new challenges posed by technology, many experts and scholars spend a lot of time measuring and assessing the flexibility of the existing legal instruments which is very important because the law is designed to be sufficiently comprehensive and generic to include as many situations as possible. However, in the workplace context, there are some distinctive aspects related to AM that call for a more context-specific intervention. This is mostly related to the specificity of some challenges and first must be coupled with a very broad understanding of the existing legislation and a strengthened approach, when it comes to enforcement.

Other take-aways:

- There are many tools that could potentially be used to improve the imperfections of existing reality. If looking at a very broad definition of technology, the purpose of its invention has been to close the gaps in human fallacies.

- While limited in resolving the problem of real, historical inequality which becomes encoded in any system, auditing algorithms can reveal former human biases, as they are encoded in the system and reflected back, inviting genuine critical engagement with human systems or previous hiring practices. Until this point, historic practices may have never been quantified.

- There is a difference between human-based discrimination and algorithmic discrimination.

- There are slight differences in terms of duties and responsibilities between public and private employment, but the challenges and opportunities associated with the adoption of AM tools are rather homogenous because some of those tools can be adopted in both the public and private sectors.

- The introduction of technology tends to reduce accountability for people who are responsible for decision-making.

- Digital companies have a strong interest in placing themselves in the *ex-ante* discussions because they want to control the impact assessment.

- When it comes to AI and AM tools in the hiring process, there is a combination of marketing proposals and attempts to address problems evident in the real world.

- A healthy dose of scepticism regarding any promises in AM is always needed.

- Employers want to play it safe. When it comes to AM, buying resources via procurement still puts the burden on the employer and, in the context of equality and non-discrimination, many procedural rules associate the responsibility and the liability mostly with the employer (even in cases of those solutions that are from third-party providers).

- Technologies can be very helpful (e.g., in automating tedious processes such as going through a large stack of CVs) but sometimes there is no actual need to implement them. In some cases, it might be even questioned if certain procedures linked to AM technologies are needed at all.

- There is a lack of consensus on whether the existing legal framework is suitable.

- There has been an emerging consensus of some specific elements of the legal framework that can be flexible enough to accommodate some of the new issues emerging in the field of AI and AM. Nevertheless, some specific gaps still exist. Some of the gaps are structural, some architectural, and some of them are more context-specific, i.e. strictly related to the way in which AM systems are designed, developed and deployed.

Table 28: List of participants

No.	Participant	Affiliation
1.	Doris Allhutter	The Institute of Technology Assessment
2.	Antonio Aloisi	IE University Law School
3.	Predrag Bejaković	Institute of Public Finance
4.	Nuno Boavida	NOVA University of Lisbon
5.	Dovydas Čeilutka	AI Association Lithuania
6.	Robert Donoghue	University of Essex, Essex School of Business
7.	Ekkehard Ernst	International Labour Organization
8.	Jasmin Gegenwart	European Commission
9.	Abigail Gilbert	Praxis
10.	Dirk Gillis	Katholieke Universiteit Leuven
11.	Andrea Glorioso	European Commission
12.	Blaz Goyha	Austrian Trade-Union Federation
13.	Laura Mažeikaitė	Visionary Analytics
14.	Phoebe Moore	University of Essex, Essex School of Business
15.	Agnė Paliokaitė	Visionary Analytics

No.	Participant	Affiliation
16.	Petra Pirklova	European Commission
17.	Nastazja Potocka-Sionek	Ca' Foscari University of Venice
18.	Aistė Ragaliauskaitė	Visionary Analytics
19.	Tjaša Redek	University of Ljubljana
20.	Linda Senden	Utrecht University
21.	Marta Subataitė	Visionary Analytics
22.	Sonja van Lieshout	WEC Europe/ Randstad n.v.
23.	Alexander von Janowski	TÜV Verband
24	Horen Voskeritsian	University of the West of England

16.4. Algorithmic management in the workplace study findings

October 17, 2023, 14.30- 17.30 CET

Workshop summary

16.4.1. Agenda

14:30 – 14:40 **Introduction**

SESSION I: PREVALENCE AND THE FUTURE OF AM

14:40 – 15:05 Presentation of study findings: AM prevalence, future scenarios and likely impacts

- **Aleksandr Christenko**, Visionary Analytics

15:05 – 15:45 **Q/A and discussion**

15:45 – 16:00 **Break**

SESSION II: EU LABOUR ACQUIS AND REGULATORY GAPS

16:00 – 16:30 Presentation of study findings: EU labour acquis and regulatory gaps

Antonio Aloisi, IE University Law School, Madrid

Nastazja Potocka-Sionek, Ca' Foscari University in Venice

16:30 – 17:25 **Q/A and discussion**

17:30 Closing of the workshop

16.4.2. Summary of the discussion

AM prevalence and the future of AM

What are some of the perceived gaps in the quantitative analysis, or suggestions for future research?

- A Delphi survey carried out as part of the Horizon project "Pillars", with several thousand users based on technological exposure and the evaluation of its impact on different actors could be used to synergistically compare with the survey data collected in the Algorithmic Management (AM) study. This could potentially help to supplement some of the current limitations within the data.

- AM has an impact on the working relationship that can be separated, at least for descriptive purposes, into three phases of the working relationship. That is, separating: 1) the phase in which the relationship is not yet in place - the hiring process; 2) when the relationship is in place and managed by algorithms; and 3) when the relationship is about to end or is already over. Understanding the extent of AM use at different stages of the working relationship can illuminate the type of cost that the employer is trying to reduce with the use of AM.

- An in-depth consideration of the hiring practices of AM involves highlighting not only the use of AM to hire workers but also the qualitative effects on workers of the practice. E.g., Fumagalli et al. 2022, emphasize that the use of algorithms for hiring is prone to be more gender biased and more biased towards vulnerable workers than human hiring.

- The exploration of potential scenarios and simulations in which labour markets or platform workers are managed by algorithms, with and without a regulatory framework would help to create an argument for a regulatory framework.

How does AM impact various facets of the labour market?

- The existence of online job vacancies (ads) might provide a proxy evidence for the existence or presence of some kind of AM tools. Listing a job ad on an online platform also means that recruiters will use the same platform for at least one part of the screening process. Online job vacancies provide an idea of company recruitment practices and what kind of workers they tend to recruit. This can shed light on the use of AM with respect to the type of skills that are currently sought after and provide an alternative way of looking at the data collected so far. However, this has the potential to lead to inaccurate estimations and has been previously considered but disregarded based on the severe limitations.

- Art. 40 Data access and scrutiny – the Digital Services Act (DSA) grants some privileges to vetted researchers (Digital Services Coordinator of the establishment or the Commission) to use data from very large online platforms or search engines. This is a recommendation for future study.

- One of the types of typologies within the study concerns managerial functions. It is used to limit the broadness of the concept of AM in order to avoid ambiguity, constraining what could be encapsulated within the definition but allowing the characteristics that help to steer. Following the Kellogg typology, for evaluation direction discipline in recruitment. As such, there is a typology that leads logically to the taxonomy.

What are some of the challenges in gathering AM data?

- AM is not yet an established concept and it is not static. Therefore, the development of a systematic way of conducting surveys related to AM is needed in the future. Systematic tracking not only of the current state of AM but, given the progressing nature of the phenomenon, also of its evolution over time.

- There is difficulty in obtaining data from employers and an understanding that it would be useful to provide companies with incentives to share data about their AM processes. However, currently, it is challenging to gather quantitative data on AM in a systematic way precisely because of the reluctance of employers and workers to respond.

- In collecting data some companies and sectors are more represented than others, thus the survey provides initial insights on how future surveys can be built for understanding AM rather than using the data from the same survey for future iterations.

How likely are the different scenarios and what are the key drivers of growth and higher adoption?

- The scenario of maximum growth on AM is most likely considering its current upward trajectory. This is the case with many technologies, e.g., ChatGPT, which is a relatively new but already largely utilized tool in various sectors including the educational sector. The same can be said about AM tools, which are fast evolving, their uptake is increasing and will likely continue to.

- The main driver for companies to invest in AM is the potential to reduce costs and increase profits. The profits that are already being generated by the use of AM act as a stimulus for further uptake, this is why the use is expected to grow further.

EU labour acquis and regulatory gaps

What are some of the global legal considerations relevant to the future of AM?

- Technology is biased because humans that create it are biased. This is a structural issue related to fairness and discrimination. Even when it comes to human-based discrimination, the topic is complex. Algorithms that are designed in a discrete way could potentially offer an opportunity to flag and detect these problems.

- There are companies that operate on a global level and there are many gaps in terms of compliance with international regulation, not only EU regulation. EU will, in the future, have to consider how to facilitate regulation at the global level.

- Competition is becoming global, such that workers compete from very different geographical areas, for example, the trend in platform work is having the employers based in the EU or USA and most of the workers located in India or Pakistan where wage levels vary considerably and generate competition for the EU.

To what extent has the study captured the relevance and effectiveness of existing law tools in the context of AM systems?

- The issue of performance is demonstrated by cases such as the Amazon case, VIII Pa 135/19, District Court in Poznań. From a legal standpoint, arguments around fair working conditions are not always enough to justify that a dismissal is unfair, unjust, or unlawful. It should be linked to, for example, negligence of some kind according to the employment contract. It is not always possible to use a legal source in order to ask the employer to justify their processes with or without algorithms.

- Difference across platforms is a potential regulatory gap because the working conditions, requirements and expectations vary substantially for workers that work, say, in Uber, Amazon, and Apple.

- The heterogeneity of performance across workers exists not only online but also offline, therefore this is not an algorithmic issue but rather a social issue. It is not clear how to deal with differential performance when there‘s a set threshold at which a worker should perform, however, if they don‘t pass the threshold they are considered underperforming. This is an issue because performance is heterogeneous by nature.

- While there should be a baseline or ceiling on what can be reasonably expected from workers in terms of performance, this exists in tension with companies‘ incentives to make a profit and obligations to shareholders. When it comes to AM, it is unacceptable when the tool is used without transparency, which notably also exists outside of the AM context.

- Is it possible that AM systems could provide transparency and protect workers while at the same time allowing managers to fulfil their roles and obligations? When thinking about the initiatives of AM, it is important to take into account both perspectives because they are legitimate on both sides.

- In reality, AM is untested and has the potential to offer a more transparent way of tackling problems of unfair competition and the existent nudges that push workers to compete against each other.

- AM technologies cannot be assessed in a vacuum, but rather in the context in which they are adopted and implemented. As such, making a generalistic assessment would be problematic because the concrete ways in which the technologies operate are a fundamental variable of the assessment.

- According to European case law, managerial prerogatives belong exclusively to the employer and the employer alone can interfere with the exercise of such prerogatives. As such, the employer is usually not required to justify the exercise of managerial prerogatives, unless the law specifies otherwise under specific circumstances.

- The Amazon case, VIII Pa 135/19, District Court in Poznań and the Hannover Administrative Court Amazon case, both covered in the analysis, provide the opposite outcomes and both highlight the tension between the exercise of managerial prerogatives and the attempt to constrain the managerial prerogatives. The hyper-nature of the two could be stressed even more in the study.

- Regulation is focused on safeguarding the workers, however, companies also face difficulties, which pertain to the ability to comply with regulations that are new and changing often. Employers also require support in the transition and should be considered.

- A multidimensional flexibility perspective should be adopted when trying to understand the needs of companies in terms of clarity, legal certainty and such.

To what extent has the study captured the most relevant regulatory gaps? Which ones are the most important?

- A way to think about legal gaps is not only as a topic that is not being regulated but also one that is not sufficiently regulated. For example, there exist various regulations on discrimination based on different categories, however, while these regulations exist they are not sufficiently effective in the new context. Similarly, the regulation on co-determination and collective agreements is also neither effective nor sufficient in the context of AM.

- Most legislation has not been designed with AM in mind, therefore the issue is not that there are gaps to be filled but rather a structural issue.

- The way technologies are introduced into the labour market is more concerning in the AM context. Traditionally, companies make the decision to adopt the technology and subsequently inform their social partners or the work council, at which point there is less room for negotiation. This reduces bargaining power.

- One of the important issues is that there are established rules without sanctions. One way to make regulations and the existing legal framework more effective is to supplement these rights with effective sanctions and subsequently enforce sanctions when rights are breached.

- The fundamental issue behind AM is that it can be challenging to detect and therefore transparency is necessary. However, there needs to be someone to observe what is behind the transparency. If there is no one looking, then action cannot be taken where action is due. Worker representatives are best placed for this.

Table 29: List of participants

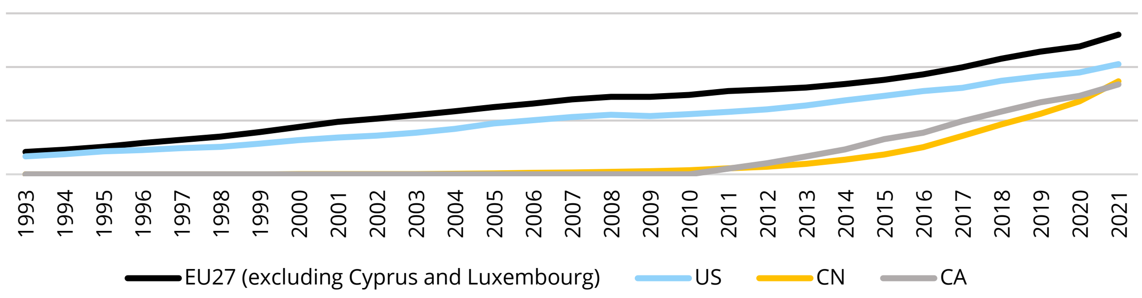
No.	Participant	Affiliation
1.	Antonio Aloisi	IE University Law School
2.	Aleksandr Christenko	Visionary Analytics
3.	Maria Estrella Gómez-Herrera	University of Balearic Islands
4.	Andrea Glorioso	European Commission DG EMPL

No.	Participant	Affiliation
5.	Elena Gramano	Bocconi University
6.	Phoebe Moore	Essex University
7.	Aleksandra Morozovaitė	Visionary Analytics
8.	Agnė Paliokaitė	Visionary Analytics
9.	Nastazja Potocka-Sionek	Ca' Foscari University of Venice
10.	Maria Savona	University of Sussex
11.	Marta Subataitė	Visionary Analytics
12.	Adrian Todoli Signes	University of Valencia
13.	Elia Tusell	European Commission DG EMPL

Annex 17: Trends in AI, robot, and digital technology usage

Exploring the usage of robots across the EU27 a strong upward trend can be observed**.** According to the International Federation of Robotics data[289], we can see that the number of robots installed in EU27 companies[290] is steadily growing (see **Figure 153** below). The trend observed in the EU is similar to the one observed in the USA, though usage of robots in recent years started to accelerate a bit more in the EU than in the USA. In addition, though late to robot usage, in China and Canada starting from around 2010 usage of robots grew rapidly. On average the number of robots installed in the EU grew by 6.8% annually, with a short stagnation during the 2008 financial crisis. Though this does not directly indicate the trajectory of change related to AM usage, it provides contextualised information on how quickly new technologies, specifically robots in this case, are being implemented throughout the EU.

Figure 153: Number of robots installed in companies per 1 million population



Source: Author's own elaboration, based on the International Federation of Robotics data.

In addition, using this data we can estimate how the usage of robots will evolve, which might provide some indication of how AM usage will also change. Important to mention that only data on robots can be used for forecasting here as it spans a time period from 2000 until 2021, which is one of the few data sets that is somewhat related to AM and provides a long enough time frame for forecasting. However, 20 years is still a relatively short time frame for accurate forecasting as, according to Box and Tiao (1975)[291], where Box is one of the authors of the ARIMA model we are using in the study, for accurate forecasting at least 50 observations, and preferably 100, are needed. In addition, the growth rate of robots used per capita can be influenced by many factors, including the declining population in the EU. Hence, the discussed forecast only provides very flawed insights.

[289] For more information see: https://ifr.org/

[290] Cyprus and Luxembourg were excluded due to lack of data on number or robots they have in operation.

[291] Box, G. E., & Tiao, G. C. (1975). Intervention analysis with applications to economic and environmental problems. Journal of the American Statistical Association, 70(349), 70–79. https://doi.org/10.1080/01621459.1975.10480264

The forecasting was carried out using an ARIMA[292] model. It was selected instead of another frequently used approach called the Theta[293] model, through the standard forecasting model accuracy estimation approach. Namely, we built several models using ARIMA and Theta forecasting models and different parameters using the 2000-2019 data on robots. Then we forecasted how this data will change in 2020 and 2021 in each Member State. Then the forecasts were compared to the true values of how the robotics sector evolved in these years. In this test, ARIMA had a mean absolute error rate (i.e., the percentage difference between the forecasted and real values) of 4.5%, while the Theta model had an error rate of 10.9%. Hence, ARIMA was picked for further forecasting.

Using the ARIMA model and the optimal parameters for it (i.e., the parameters that gave the lowest mean absolute error rate), we forecasted the usage of robots per capita in 2022, 2023, 2024, and 2025. To summarise the results of the forecast, which are provided in the Table below, robotics usage is growing, but there is some variation between Member States[294]. More specifically, the table below provides insights on the percentage of robots installed in most Member States, where 2021 data is used as a baseline (i.e., values in each year were divided by the value presented in 2021). On average, in the EU27, usage of robots grew at around 6.3% annually. On the one hand, from the base of 2021, **usage should increase by around 10%-20% by 2025 in countries such as Belgium, Sweden, and Slovakia, Denmark, Finland, Spain**. On the other hand, **in many Central and Eastern European countries, such as Lithuania, Latvia, Estonia, Poland, etc. this trend will be much stronger.** An especially interesting case is Bulgaria which, according to the forecast, should see an around 300% increase in usage of robots by 2024. This difference can be explained by the fact that the initial usage of robots in these countries was much lower than, for example, in Western or Northern Europe. Hence, this also implies that these countries are likely to catch up to other country levels.

Table 30: Forecast of how the usage of robots will change in the upcoming three years*

Country	2019	2020	2021	2022f**	2023f**	2024f**	2025f**
EU27	**87.80%**	**91.70%**	**100.00%**	**107.06%**	**112.94%**	**118.81%**	**124.49%**
AT	86.34%	90.59%	100.00%	109.41%	118.83%	128.24%	137.65%
BE	92.17%	94.68%	100.00%	104.00%	106.77%	109.53%	112.30%
DK	90.96%	93.67%	100.00%	106.33%	112.66%	118.99%	125.33%
DE	90.84%	93.79%	100.00%	104.78%	107.80%	110.82%	113.84%
CZ	86.09%	91.33%	100.00%	107.88%	115.76%	123.64%	131.53%
ES	92.10%	94.82%	100.00%	104.49%	108.53%	112.29%	115.86%
FI	93.02%	94.96%	100.00%	104.13%	107.73%	111.02%	114.13%
FR	85.28%	90.88%	100.00%	108.29%	115.88%	122.87%	129.35%

292 ARIMA, standing for AutoRegressive, Iterative, Moving Averages, is a widely used econometric forecasting model that predicts future trends from past data.

293 A forecasting method that involves fitting two lines. Currently it is considered to be one of the most accurate forecasting models as in a recent "M3 Competition" forecasting competition it managed to beat many other forecasting approaches, including those employing machine learning and AI.

294 Luxembourg and Cyprus are not included as the international data on robotics does not cover these countries.

Country	2019	2020	2021	2022f**	2023f**	2024f**	2025f**
IE	76.45%	88.50%	100.00%	111.50%	123.00%	134.51%	146.01%
IT	83.28%	87.46%	100.00%	111.18%	121.23%	130.32%	138.60%
NL	84.47%	90.20%	100.00%	109.80%	119.60%	129.40%	139.20%
PL	78.66%	84.90%	100.00%	113.23%	122.90%	138.20%	153.34%
PT	87.08%	93.03%	100.00%	106.97%	113.94%	120.92%	127.89%
RO	81.97%	88.10%	100.00%	110.15%	120.30%	130.46%	140.61%
SE	90.81%	92.24%	100.00%	102.73%	105.47%	108.20%	110.93%
SK	91.86%	94.66%	100.00%	104.86%	108.45%	113.70%	118.11%
SI	74.33%	85.25%	100.00%	114.75%	129.50%	144.25%	159.00%
EE	72.38%	86.45%	100.00%	113.55%	127.11%	140.66%	154.22%
HU	82.28%	90.04%	100.00%	108.73%	117.46%	126.19%	134.93%
LT	58.78%	75.73%	100.00%	127.50%	155.00%	182.50%	210.00%
BG	43.92%	50.90%	100.00%	149.10%	198.20%	247.29%	296.39%
HR	71.13%	83.63%	100.00%	116.37%	132.74%	149.11%	165.48%
MT	86.82%	90.70%	100.00%	109.30%	118.60%	127.91%	137.21%
LV	62.07%	77.59%	100.00%	118.96%	137.91%	156.87%	175.82%
EL	88.08%	92.72%	100.00%	107.28%	114.57%	121.85%	129.14%

(*) The analysis excludes Cyprus and Luxembourg as the International data on robotics did not provide such information.
(**) “f” in the visual indicates “forecasted”

Source: Authors’ own elaborations using International Federation of Robotics data and the ARIMA forecasting approach.

Though these trends in robotics do not provide any direct indication of the possible trajectory of AM usage, combining these insights with what was discussed prior in *1.2.3. Usage of AM: Evidence from proxies*, especially the subsection discussing the past trends of different technologies associated with AM, some very initial insights on the future of AM can be derived. As was discussed in the aforementioned subsection, the AI market should grow by around 29.6% in 2022-2026, while usage of cloud computing over the internet increased rapidly from 17.8% to 41% from 2014 to 2021, reflecting a 3.3% annual growth rate. A similarly rapid growth, in relative terms, was observed in companies buying computing power to run enterprise software, as in 2014 only 2.9% of companies bought such technologies, while in 2021 this percentage more than tripled to 9.8%. Finally, based on the employer’s survey, on average 44.3% of companies said that usage of algorithms in the last two years increased (a lot or a little) for different managerial functions. According to the survey, the usage of AM in firing increases the least (33%), while the usage of AM for recruitment increases the most (53%). In addition, only around 2.7% of companies said that usage of such tools decreased (a lot or a little) in the last two years. Though these results are not representative of the whole population, they corroborate the findings of other sources highlighting that AM usage is rapidly growing.

Combining this with the findings from the econometric forecast and initial predictions that around 25%-35% of organisations used AM in EU27 (in 2020), an **initial prediction can be made that AM usage will grow at around 2%-6% annually, at least in the next five years**. We specifically mention the next five years here as we believe the adoption of AM can slow down after the majority of companies who see value in such technologies and who have the know-how to use them integrate them into their day-to-day, while companies that lack resources, know-how, or face other issues would follow along at a slower pace. In addition, **this is a relatively optimistic prediction, which indicates that if we assume that currently around 25%-35% of organisations use AM in EU27, in five years this percentage can grow to 47.5%-57.5%, if we take the average of the predicted growth rate**. It is motivated by the high versatility of AM and the drivers that will likely drive the higher adoption of such tools in the EU27.

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