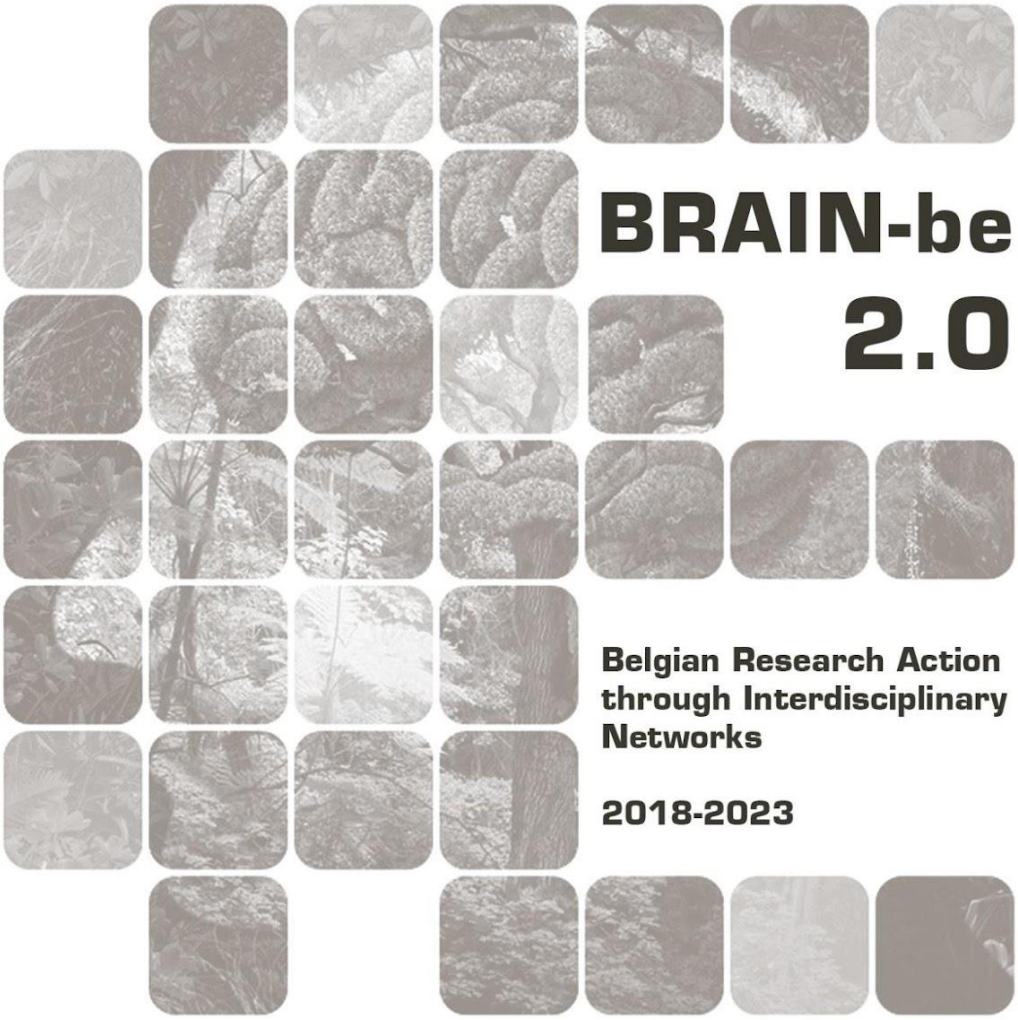

SEAD Sustainable employment in the age of digitalisation

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Pillar 3: Federal societal challenges

NETWORK PROJECT

SEAD

Sustainable employment in the age of digitalisation

Contract - B2/191/P3/SEAD

FINAL REPORT

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ABSTRACT

Context

The ever more rapid development and adoption of new technologies raises questions about the possible disruptive impact of this digital revolution on the world of work and employment. There is a general concern that automation and changing skill requirements will threaten many individuals' jobs and might affect the task content of occupations or hamper job quality. The way employment is organised in companies or organisations might also be heavily affected by technological development: technology-related increases in non-standard, flexible, and project-based forms of employment are often seen as problematic for the quality of work. Of course, new technologies do not only pose threats, but also come with tremendous new opportunities such as job creation in growing and/or new sectors, novel business models, innovative types of employment allowing for 'desirable flexibility' and intrinsically rich jobs with high levels of autonomy. However, knowledge on the sustainability of work in the digital era is lacking.

Objectives

The main aim of the SEAD project was to assess the potential for sustainable work and employment in the digital era, by identifying challenges, obstacles, and opportunities in new and changing labour market niches. Our findings allow policy makers to take measures aimed at optimizing opportunities and limiting vulnerability of workers.

Conclusions

Over the past 35 years, the total number of jobs in the Belgian labour market has grown by more than a third. The largest employment growth has been witnessed in business and administration, health care, ICT, legal and socio-cultural jobs, and education. Employment drops have been noticed for blue-collar occupations in manufacturing and the agricultural sector. On top of this, the labour force looks different now than it did 35 years ago, with higher shares of women, high-skilled workers, and older workers. Furthermore, our study suggests that skills required to perform non-routine tasks are likely to become more important in the future.

The outcomes of digital transformations are highly dependent on the work organisation and the context shaped by management strategies, HR measures and the extent of employee involvement. In turn, technological innovation will affect jobs and business processes in the organisation, sometimes even unintentionally. In a context of technological innovation, organisational change is always implied, and no one-size-fits-all solution can be envisaged. To make technological innovation a success, it is essential to simultaneously innovate regarding work organisation and HR policies, while at the same time strong employee participation in implementing these changes is desirable.

The context is also crucial in explaining variations in how workers respond to digital transformations, because the use of technology by workers is shaped by their interpretations of said technology and the rationale behind the introduction of new technologies. Technologies that are perceived as tools to

support process efficiency are received differently than technologies associated with deskilling or with the potential substitution of valued work tasks. When workers feel threatened by technology, they are more likely to develop (undesirable) coping strategies or to resist the use of these digital tools.

Finally, the digital transformation of the labour market also leads to the introduction of new ways of working, such as work through digital platforms. Our study shows that there is no such thing as 'the Belgian platform worker'. Platform workers are a rather heterogeneous group, with varying socio-professional and demographic characteristics. Our research highlights both positive features of this type of work (such as it being a convenient and flexible way to provide additional income) and the presence of certain groups in a very vulnerable position, for whom platform work is far less of a choice and more of a necessity.

Keywords
Sustainable work
Digitalisation
Technology
Platform work

1. INTRODUCTION

From existing research, it has become evident that digitalisation has a profound and even disruptive impact on most domains of life. The "Sustainable Employment in the Age of Digitalisation" (SEAD) project focuses on one domain in particular: the world of work. The project has two main aims: (1) to assess the nature and impact of technology-related change in existing and developing labour market segments in Belgium and (2) to identify the potential for sustainable employment and for limiting the vulnerability of workers in the context of digitalisation.

First, an introduction of the main ideas and concepts shaping the SEAD project is provided. Next, this report provides a state-of-the-art review of the literature considering the four main topics addressed in the SEAD project, all concerned with a particular aspect of the relationship between digitalisation and sustainable employment.

- Macro-economic insights about how digitalisation is affecting labour market dynamics, the occupational structure and job quality in Belgium (WP1).
- The role of organisational characteristics in shaping the impact of technology on the work experience, with specific attention for organisational models and managerial practices that promote sustainable employment in a context of technological innovation (WP2).
- How the skills composition and job quality of transversal occupations (i.e. occupations present in different sectors) in the Belgian labour market are changing because of the introduction of new technologies (WP3).
- The platform economy as an emerging employment phenomenon: job quality, perspectives for collective action and the socio-demographic profile and employment trajectories of those workers engaging in digital platform work (WP4).

For each main topic, the objectives of the SEAD project are presented. The data, measures and methods used to obtain the results are described in a methodological section. The presentation of the scientific results, overall conclusions and related recommendations constitutes the main part of the report and is followed by an overview of the dissemination and valorisation of the results.

2. STATE OF THE ART AND OBJECTIVES[1]

In the state-of-the-art, first, the overall conceptual framework of the SEAD project is presented. Second, a short overview of the four main topics addressed in the SEAD project is provided. For each main topic (studied in a designated Work Package), the study objectives of the project are presented at the end of each paragraph.

2.1 Overall conceptual framework of the SEAD project

2.1.1 Digitalisation: main concepts

The central concept in the SEAD research project, **digitalisation** can be defined as *"the process that converts information from a physical format into a digital format"* (Jakosuo, 2019, p.2). Since the end of the 20th century, a wave of new digital technologies in computing, information networks, robotics and artificial intelligence has emerged. Digitalisation can be described as a process of generalisation, amplification and intensification of the use of many digital technologies (Brynjolfsson & McAfee, 2014). Both information and communication technologies and more advanced, interconnected digital technologies were considered in the SEAD project. Hereafter, we provide a short description of the **main technologies** that can be conceived as key factors of change in the world of work.

- **Information and Communication Technologies (ICT)** facilitate the sharing and discussion of ideas independent of location and time. This category of technologies includes – but is by no means limited to – the internet, e-mail, chat and videoconferencing systems, mobile applications, laptops, mobile phones and social networks (Mazzuchelli et al., 2019).
- The **Internet of Things (IoT)** refers to the entire network of physical objects that are equipped with software and connected with other devices or applications over the Internet, for the purpose of exchanging data and communicating with each other. The IoT allows for real-time connectivity and interconnection between objects, which means that machines can generate content and more things can become a (monetised) service (Abdel-Basset et al., 2018).
- **Robots** are programmable devices that interact with the physical world. When robots are used to automate a business process through software capable of following a graphical representation of said process, this can be described as **Robotic Process Automation (RPA)** (Col, 2017; Lacity & Willcocks, 2016; Makkonen, 2017; Moreau, 2018).
- **Artificial Intelligence (AI)** concerns the actual simulation of human intelligence by machines and thus aims to think. AI is the development of machines or computer programs that can mimic human cognitive functions (CFB Bots, 2018). An example of the introduction of AI in the world of work is the use of screening software in recruitment (Lévy, 2018).

[1] This text is predominantly based on the publication "Van Aerden, K., Deschacht, N., Détilleux, C., Dessers, E., Smits, I., Pichault, F., Franssen, M., Beuker, L., Martinez, E., Brodersen, M., Joukovsky, A., Gevaert, J. & Vanroelen, C. (2021). SEAD Working Paper 2021.1 Introducing the SEAD project. https://sead.be/wp-content/uploads/2021/07/20210708-SEAD-Working-Paper-2021.1.pdf"

- **Machine learning** is a branch of artificial intelligence in which computer algorithms are automatically improved by a set of learning protocols to give machines the ability to perform tasks, instead of being explicitly programmed for these tasks (as is the case in conventional programming) (Naugès, 2016).
- **Big data** can be defined by three criteria: it concerns (1) large volumes of (2) extremely varied data that are generated, collected, processed and stored (3) at high speed (Laney, 2001). These data are created both through explicit data production and secondary data generation and come from different sources: the Internet of Things, social networks, digital surveillance, cookies and IP addresses gathered on the internet, businesses, governmental and social security institutions, etc. (Lupton, 2014; Menger & Paye, 2017). As such, big data are not a technology but rather a by-product of the use of technology.

2.1.1 The impact of digitalisation on the world of work and employment

From a historical perspective, predictions about the disruptive impact of technological innovations on work and employment are not new - see Marx, Smith and Ricardo (Woirol, 1996) and later Keynes (1930) and Rifkin (1995). Today, the increased use of digital technologies is widely considered to be the main (but not necessarily the only) source of automation in contemporary labour markets. Recent studies have fuelled the fear that digitalisation and the resulting processes of automation are threatening many jobs and occupations (Frey & Osborne, 2017; World Economic Forum, 2018). Paradoxically, the amount of people formally engaged in employment only grew – and even faster in technology-intensive firms (Koch et al., 2019). Critics of the thesis of technology-induced job destruction argue that various mechanisms compensate for labour-saving technologies: employment in the design of new technologies, increased demand because of increasing productivity and falling product prices, extra profits and increased investments (Autor & Salomons, 2018; Caselli & Manning, 2019; Vivarelli, 2015).

Either way, digitalisation has substantial but contradictory effects on labour markets and more precisely on the allocation, the nature and the quality of jobs. The adoption and implementation by organisations of the enormous technological potential results in a restructuring of the world of work: some sectors grow and others decline, some occupations disappear, others emerge and the job content and/or task requirements of still other occupations change (Autor, 2015; Acemoglu & Restrepo, 2019). The reallocation of workers from declining sectors and occupations to growing (or even new) ones also means that skill mismatches tend to occur (Aghion & Howitt, 1994). Recent evidence suggests that jobs done by lower educated workers have become substantially less skilled (Autor, 2019; Kunst, 2019), while on the other end of the skills-spectrum new opportunities for intrinsically rich jobs are created (Cascio & Montealegre, 2016). This process could thus lead to job polarisation between the most and the least qualified, which could in turn result in threats to employment sustainability for those in a less powerful position, increased income inequality and rising levels of poverty (Goos et al., 2014; Hurley et al., 2015).

As the introduction of new technologies is deemed to profoundly affect the world of work, several consequences for workers might be expected. It was one of the central aims of the SEAD project to study these consequences, which is grasped using the umbrella term **sustainable employment**. Our definition of sustainable employment draws heavily on Eurofound's framework (Eurofound, 2015; Eiffe, 2021). Sustainable employment can be described as "working and living conditions that support people in engaging and remaining in work throughout an extended working life" (Eurofound, 2015). In other words, a clear life course perspective is adopted: sustainable employment allows for workers to age in their job/career (van Dam et al., 2016; Vendramin & Parent-Thirion, 2019).

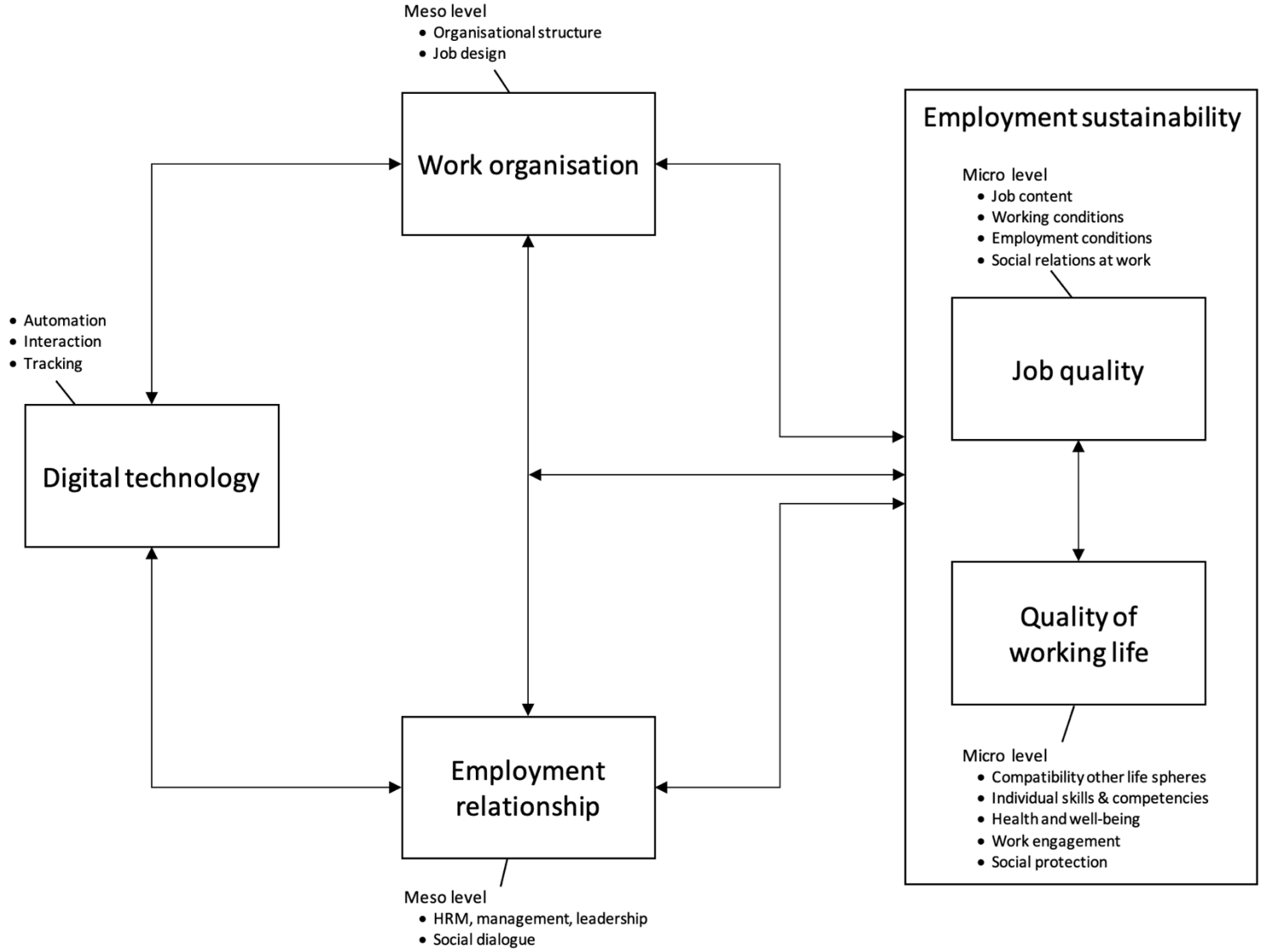
Drawing on the concept paper by Eurofound (2015), two main components are distinguished within the broad concept of sustainable employment. The first component, **job quality**, refers to the nature and quality of objective job characteristics and the work environment. Conceptually, a distinction can be made between two main categories of job characteristics (Munoz-Bustillo et al., 2009; Vandenbrande et al., 2012). The first category is the **work (task)** dimension, referring to job features that are strongly related to the performance of work tasks and thus represent the "intrinsic quality of work". This dimension contains both characteristics inherently linked to the nature of work tasks (job content) and the ergonomic, environmental and psychosocial exposures or demands related to these tasks (working conditions). The second main category of job characteristics is the **employment** dimension. This dimension is concerned with those job features that surround the actual performance of work tasks. Two subcategories can be distinguished: the mutual agreements between employee and employer about the organisation of employment (employment conditions) and the formal as well as informal relations between worker, colleagues and employer (employment relations or social relations at work) (Vets et al., 2009). However, to be able to meet the needs of the worker in the present without compromising his/her ability of future work requires more than the mere presence of high-quality working conditions in the current job (Eiffe, 2021). Therefore, a second component is distinguished – i.e. the **quality of working life**. This term refers to a broader (and for a part also more subjective) set of individual work outcomes such as social protection, job satisfaction, willingness and motivation to stay in (current) employment or work engagement, opportunities for personal growth such as the development of individual skills and competencies, health, well-being and the compatibility of work with other life spheres (Eiffe, 2021; van Dam et al., 2016). In other words: the job quality component is mainly related to the characteristics of the current job, whereas the quality of working life component is broader and relates to the fit between job characteristics and individual characteristics/circumstances now and in the future (Eurofound, 2015).

Figure 1 shows the overall conceptual framework that is used in the SEAD project. On the left-hand side of the model, we can find **digital technology**. Each of these technologies has a potential influence on the world of work. The organisational level is positioned in the centre of the conceptual model. It is through the process of adoption in a specific organisation that a technology can influence the jobs and individual work outcomes of workers. Two meso-level characteristics can have an impact on the selection of technologies to be introduced in the organisation and on the way they are used related to the organisation of work. The **work organisation** refers to organisational choices regarding the division

of labour, resulting in a certain organisational structure and job design. The **employment relationship** refers to the way in which the organisation deals with the workers assigned to the different jobs and includes aspects such as HRM practices, leadership styles and social dialogue at the level of the organisation (Huys et al., 2013; Van Hootegem, 2000). In turn, these two organisation-level characteristics can be impacted by the adoption and the use of new digital technologies (Van Hootegem, 2000).

The digital technology and the specificities/results of its adoption in an organisation then have an impact on the sustainability of employment for individual workers. As was mentioned supra, two components of **employment sustainability** are distinguished. The position of the first component, **job quality**, in the overall conceptual model indicates that it is treated both as an outcome and as a determinant in the SEAD project. Job quality is conceived as an outcome in the sense that job features depend (at least partly) on the use of certain (digital) technologies in the organisation. It is also conceived as a determinant, in the sense that job characteristics in turn are related to the second component of sustainable employment: the **quality of working life**. Within the concept of sustainable employment, we thus acknowledge that the nature and quality of job characteristics (job content, working conditions, employment conditions and employment relations) have an impact on workers' ability to engage and remain in work throughout an extended working life, either directly or in an indirect manner through the influence on individual work outcomes such as work motivation, health and well-being, work-life balance, etc.

Figure 1. Overall conceptual framework adopted in the SEAD project



2.2 Macro-economic effects of digitalisation on labour markets (WP1)

Only a few fragmentary studies have analysed Belgian data to investigate automation, occupational change and their consequences for labour market outcomes. Research on job polarisation confirms that middle-skill jobs are disappearing in favour of low-skill and high-skill jobs, but the growth of the share of low-skill jobs appears to be more limited in Belgium than in other countries (Goos et al., 2009; De Mulder & Duprez, 2015; Buyst et al., 2018). Goos et al. (2009) report that the share of middle-skill jobs in Belgium has decreased by 9.5 percentage points between 1993 and 2006, but the share of low-skill jobs has only increased by 1.5 percentage points. However, in the manufacturing industry in Belgium the number of low-skill jobs has declined considerably: in 2000, low-skill jobs accounted for 18 percent of industrial employment, but by 2013 this was only 5 percent (De Mulder & Duprez, 2015). A related study of manufacturing workers who lost their jobs when carmaker Ford closed its plant in Genk in 2014, shows that workers who were doing routine jobs at Ford had much lower re-employment probabilities afterwards, and that workers who did enter a new job now do more non-routine tasks than they did at Ford (Goos et al., 2020). An analysis of data about vacancies and job seekers from the Flemish Public Employment Services VDAB, investigates to what extent the task compositions of different occupations overlap, and finds that job seekers hardly move to occupations where they possess only part of the task competencies (Goos et al., 2019). The study by Arntz et al. (2016) estimates that 7 percent of all Belgian workers are in a job that has a high risk of automation and that these are mostly low-skill and low-income workers.

In work package 1, a comprehensive macro-analysis is presented of how new technologies are shaping labour market and employment sustainability outcomes, using both descriptive and econometric statistical methods. The main aim of the first work package was to study how digitalisation is affecting the occupational structure of the Belgian economy, as well as worker outcomes. The change in the sectoral and occupational composition of the Belgian labour market over the past decades was described and this evolution was compared to the one witnessed in neighbouring countries. Moreover, we investigated how this relates to workers' characteristics. We revealed the declining and growing occupations in Belgium and what this implies for skills and competence requirements. Furthermore, we investigated the effects of digitalisation on individual labour market outcomes of workers.

2.3 Organisations as a moderator between technology and work experiences (WP2)

Businesses are embracing new technologies to improve their effectiveness and resilience. Understanding these technologies' evolution, application, and impact is crucial for achieving human-centred organisations and securing a decent future of work for all. New technologies offer potential to enhance business processes and job quality (Eurofound, 2019). However, technology projects can fail or harm job quality, with the same technology leading to both positive and negative outcomes (Bal et al., 2021). One cannot automatically assume that the introduction of digital technologies will generate high quality work in which the technology augments human performance, nor can productivity benefits be taken for granted (Parker & Boeing, 2023). Ultimately, the success depends on how technology is deployed (Dessers et al., 2023). This WP focuses on how the division of labour and the employment relationship within an organisation influence the change in job content and job quality brought about by digital technology, both for general employees and specifically for line managers.

Recent literature on the ongoing digital transformation has highlighted the interconnection between the division of labour, the employment relationship and digital technology (Dessers et al., 2023). Shamim et al. (2016) suggest that digital transformation necessitates a division of labour characterised by decentralisation and teamwork for better innovation and change management. Fast decision-making and flexible responses to challenges are crucial (Veile et al., 2019). Rigid structures hinder implementation of digital changes (Fettig et al., 2018), whereas technologies in decentralised organisations foster innovation (Wilkesmann & Wilkesmann, 2018). Technology use is influenced by existing organisational structures (Lall et al., 2016). Cagliano et al. (2019) observe a shift towards more decentralised structures with increasing technical complexity. Job design adaptations for new technologies can enhance wellbeing and decrease stress (Veile et al., 2019).

The role of HRM in changing corporate culture is crucial, with an emphasis on learning, openness, creativity, and entrepreneurial mindset (Veile et al., 2019). Kiel et al. (2017) highlight a flexible culture reflected in leadership, training, and employee involvement. Rapid learning from failures is vital (Veile et al., 2019). Kadir and Broberg (2020) advice remuneration following task complexity, training opportunities, teamwork and social support. New technologies challenge traditional HRM and leadership practices, promoting autonomy (Hertel et al., 2017). Digital skills acquisition through training or hiring specialists is key (Veile et al., 2019). Employee involvement is essential for successful implementation and impacts wellbeing and performance (Kadir & Broberg, 2020), also ensuring support for changes and equal focus on job quality and organisational performance (Vereycken et al., 2020).

Specific attention is given to line managers who are key in translating policies into practice and are crucial for technology implementation success and employee well-being (Blanco-Oliver et al., 2018; Hasson et al., 2014). They are defined as first-line responsible managers in lower management layers (Hutchinson & Purcell, 2008). Krüger (2018) noted a lack of focus on line managers in digital technology literature, but highlighted the growing complexity of their work and the potential support from new

technologies herewith. Little research has been done since, but Khoreva et al. (2022) found line managers influential in the digitalisation process, aiding employees' adaptation to change. Drent et al. (2022) observed a shift in line managers' roles from operational control to coaching and people management, with HR tasks devolving faster than decision-making, financial, and knowledge powers. Meijerink et al. (2022) found that gig work changes and challenges the conventional work of line managers, rather than diminishing their role.

The literature review shows that while the impact of organisational choices on labour division and employment relationships during technology implementation is increasingly recognised, there is a need for a deeper understanding of how these choices affect job content and quality for employees. Additionally, few studies have explored the changes in job content and quality for line managers due to digitalisation. The main research question focuses on how and to what extent the division of labour and employment relationship influences the change in job content and job quality brought about by digital technology, both for employees and specifically for line managers. To this end, a qualitative research methodology was applied, containing an in-depth case study of 22 organisations. In these organisations, interviews were organised with people in different functions (including managerial and executing functions). This analysis targeted organisations making extensive use of digital technologies in various sectors in Belgium, including the service sector, the manufacturing sector and the platform economy.

2.4 Digitalisation and changing occupations (WP3)

Work package 3 focuses on the impact of technology-related change in five selected occupations (assembly line workers, customer advisors, middle managers, recruiters and R&D managers). Findings from our literature review indicate, first, that the concept of sustainable employment is scarcely investigated in relation to the five selected occupations. Second, when studied, the notion of (employment) sustainability often comes after other considerations such as economics or efficiency-related ones, either because economic or efficiency-related considerations emerged as the most prominent ones during fieldwork, or because they were more firmly embedded in the authors' theoretical foundations.

We notice that several studies argue that, in addition to human resource management, digitisation can increase productivity in various functions (Ghazy et al., 2022; Cette et al., 2022; Jaumotte et al., 2023), in particular through automation technologies, which is one of the dimensions our empirical approach aimed to explore. We found evidence of the importance of economics for assembly line workers, for which Brozzi et al. (2020) highlighted that the "*consideration of economic opportunities prevails over environmental and social ones*" (p.2). The improved working environment for workers has been rated overall "*of secondary importance*" (p.12). Similarly, McColl and Michelotti (2019) stated that recruiters perceived the implementation of digitised interviews as supported by economic efficiency rather than recruitment effectiveness. In addition, the changing role of HR management and HR functions in relation to the use of digital tools is highlighted in a number of studies in a broader sense (Ammirato et al., 2023; Jatoba et al., 2023; Zhang et al., 2023); showing as many opportunities as challenges (Vontris et al., 2022; Galindo & Leon, 2023; Ore & Sposato, 2022) notably in terms of ethics (Hunkenschroer & Luetge, 2022).

The notion of sustainability in customer advisors' related papers is often secondary to larger objectives about the effectiveness of digital implementation, such as how customer service workers' attitudes and motivation towards technological innovations permits good implementation of technological tools (Garrido-Moreno et al., 2014). The same can be said about studies focusing on middle managers' role in implementing technological change within companies (Paavola et al., 2017). More specifically, it is frequently observed that managers are encouraged to step back from their role as field experts and transform themselves into coaches, mentors, and teachers, leading to a complete re-evaluation and transformation of their functions (Gjerde et al., 2020; Leavy, 2023).

For R&D managers, preoccupations about sustainability often relate to the organisational structure surrounding the R&D team in a broader way. Loyarte-López et al. (2020) also briefly state that the rating system they developed enhances the employability of R&D workers. Besides the fact that employability is only a subdimension of sustainable work, we express serious doubts regarding the neutrality of that assertion, underpinned by control and standardisation objectives.

To conclude, relatively few studies approach the topic of employment sustainability in the way it was defined by Eurofound (2015) and was studied in this project. Some of its critical elements (especially regarding skills, work-life balance or autonomy) are approached, but studying the employment sustainability as a whole is rarely mentioned as an objective in the explored literature. This calls for comprehensive empirical studies regarding the impact of digital technologies on the work experiences and the sustainability of work within the five occupations.

The third work package aimed to study the processes and effects of occupational change related to technological innovation (in terms of skill requirements, job content and employment quality) from the perspective of workers in a selected number of 'transversal occupations' (i.e. occupations that already exist for a long time and are typically prevalent in several different sectors). The results of this research endeavour provided in-depth insights on how digitalisation has affected the five selected occupations (assembly line workers, customer advisors, middle managers, recruiters, and R&D managers) in Belgium, through semi-structured interviews with workers. For the interviews, an appropriate recruitment and fieldwork strategy was designed. Then, a topic list – common across all five occupations – was created, containing items on types of technologies, contextual factors, changes in job quality and employment sustainability. Indeed, some studies show that digitalisation is also characterised by horizontal communication, the removal of hierarchy and strategic flexibility in the structure of the organisation (Mustafa et al., 2022). This is in line with the work of Dhondt et al. (2021), according to which technological change is likely to have a greater impact on the working environment than on skills. This hypothesis is worth to be explored.

The interviews built on two narratives: 'the impact of technology-related change on a regular working day/week' and 'technology-related change from a career perspective'. The data analysis, using in-depth narrative methods, revealed the lived experience of changing technological and organisational environments in relation to aspects of sustainability. We also considered the implications of instantaneity and constant availability due to digitalisation and the hybridisation of the workplace (Petani & Menges, 2023). In neo-Taylorist contexts, time has become the main tool for measuring performance. Wearable technologies, for example, allow companies to monitor 'connected' workers, whether through real-time location systems for workers in the field or instant message monitoring for those at home (Patel et al., 2022). On the one hand, as shown in the experimental analysis by Angelici and Profeta (2023), when the constraints of time and place are removed, workers' productivity increases along with their well-being and work-life balance, allowing them to work 'smartly'. On the other hand, surveillance has increased for each category of worker, expanding monitoring prerogatives and data-driven decision making (Aloisi & De Stefano, 2022), and the working day has been infinitely extended as employees can work anytime and from anywhere (Miltsov, 2021). Through our analysis, we aimed to understand the extent to which digital technologies are changing the perception of time and control for the target occupations, as well as their impact on the evaluation of their performance.

2.5 Digital platform work as an emerging employment phenomenon (WP4)

A recent study suggests that approximately 84.000 Belgian individuals (between 15 and 64 years old) have worked at least one hour for digital labour platforms in 2022 (Statbel, 2023). Digital labour platforms are defined as organisational intermediaries, relying on digital infrastructures to coordinate transactions between workers and 'clients', and often include transactions such as the arrangement of services of tasks that can be performed online (e.g., copywriting, visual design) or at a physical location (e.g., food delivery, taxi services, household tasks) and can require both limited or higher levels of qualification (Caselli, 2019; De Groen & Maselli, 2016; Kovalainen et al., 2019; Vallas & Schor, 2020). In sum, the essence of platform labour is that it refers to the "*buying and selling of labour via digital platforms*" (Wood et al., 2023, p.3). Those that perform that type of labour are called 'platform workers'.

Whereas the emergence of these digital labour platforms has caused suspicion about their potential for generating precarious employment (Drahokoupil & Fabo, 2016), the available empirical data – specifically for Belgium – is extremely limited. Information on the job quality and working conditions of platform workers is not always clear (Statbel, 2023), and oftentimes limited to qualitative evidence or other countries (Badger & Woodcock, 2019; Gundert & Leschke, 2023). More research was therefore needed on its specific dynamics and effects in Belgium, especially since it has been established that the platform economy must be understood in interaction with local labour markets, legislation and regulation systems (Carelli, Cingolani & Kesselman, 2022; Piasna, 2024). Therefore, the main objective of work package 4 was to perform an in-depth study of the platform economy in Belgium. This larger objective was subdivided in smaller sub-objectives revolved around improving our knowledge of the boundaries and subcategories of the Belgian platform economy, improving our understanding of the socio-demographic profiles of workers active on digital platforms, and finally objectifying the work- and employment conditions and their potential consequences in terms of sustainable employment in platform work.

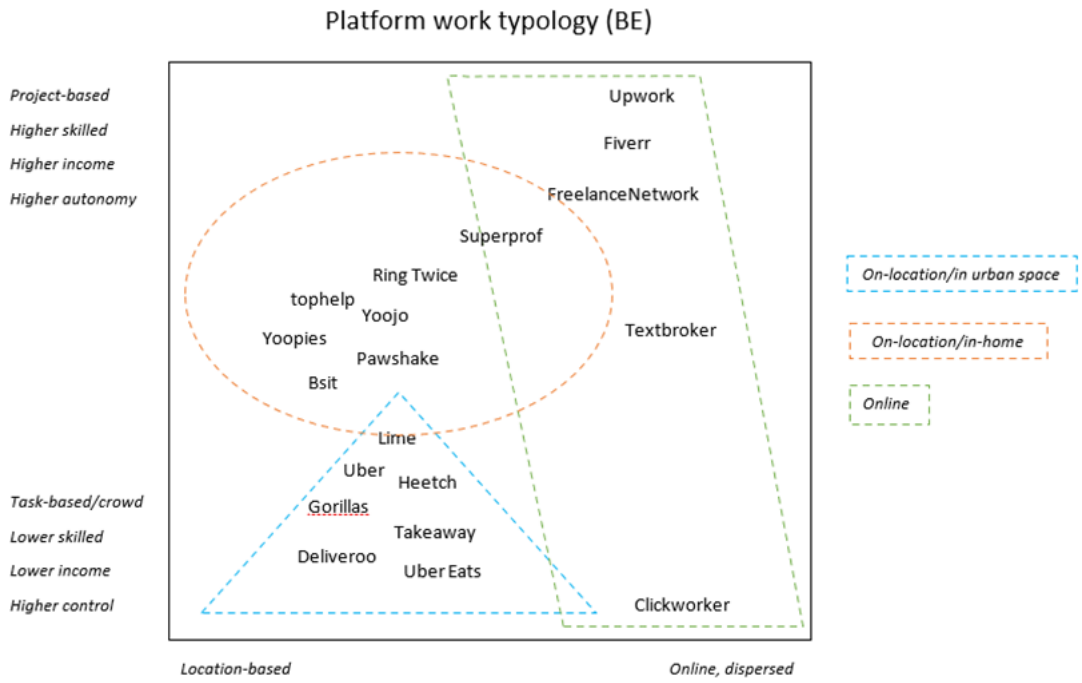
As the platform economy is an extremely complex, heterogenous and rapidly evolving phenomenon, its dimensions, boundaries and sub-categories have to be set first. An initial literature review (see Van Aerden et al., 2021) developed several common characteristics and criteria of differentiation within the platform economy. Then further, drawing on existing examples/typologies from other research efforts (Cañigueral, 2019; European Commission et al., 2020; Berg et al., 2018; Vallas & Schor, 2020; Cingolani, 2021), an operational typology was consolidated taking account of the exploratory fieldwork, as well as recent developments and local specificities. As can be seen from TABLE I, based on spatiality (urban space/in-home/online) and work content (type/sector of activity), four main groups of platform work activities were revealed: 'urban space work'; 'in-home (household) work'; 'online' work, the latter of which can be further subdivided into 'freelance work' (professional services) and 'microtask work' (low-qualified, fragmented tasks). These categories not only have a heuristic, but also an operational scope since they allow us to organise our fieldwork and further inspire the remaining research objectives of this work package.

TABLE I. Typology of platform work in Belgium

Socio-spatial category	Common characteristics	Activities/sectors	Labour platform examples
On-location/ urban space	Spatially dispersed yet locally bound on-demand mobile activities that take place predominantly in (public) urban space and based on triangular relationships of multiple actors besides the platform	Food & grocery delivery	Deliveroo, Uber Eats, Takeaway, Gorillas, Shopopop
		Personal transportation	Uber X, Bolt, Heetch, Blacklane
		Package delivery & transport	Howdy, Shippr, Vengo
On-location/In home	Spatially distributed, mostly locally bound labour that takes place predominantly at clients' residences and is mainly aimed at providing care or maintenance services to private individuals and households	Multi-services childcare, petcare, housekeeping, tutoring, handiwork, IT, beauty & wellness, catering…	Ring Twice, Yoojo, Yoopies, NeedHelp, Tophelp, Helpper, Pwiic, Care.com, StarOfService
		Tutoring	Superprof, Bijleshuis
		Pet Sitting	Pawshake, Holidog
		Childcare	Bsit, Nanny Nina, Babysits, Toptata, Sitly
Online	Globally dispersed and often fragmented, predominantly online activities for private or corporate clients	Freelance work	Freelance Network, Upwork, Freelancer.be, Fiverr
		Microtask work	Clickworker, Microworkers, Appen, Textbroker

After this initial exercise, a second, graphic typology was constructed (see figure 2), based on the literature, that classified platform organisations operating in Belgium both spatially and according to several criteria related to employment conditions/relations.

Figure 2. Typology of platform work in Belgium



As can be seen from the typology, the platform economy covers a wide range of organisational configurations that stretch across complex networks of actors and vary according to the *type of activity*, the *types of actors* involved and the *organisational and economic model* (Howcroft & Bergvall-Kåreborn, 2018). This heterogeneity can account for a great diversity of situations regarding work and employment conditions, health and well-being, as well as representation and regulation, which are also impacted by internal stratifications and inequalities as well as hierarchies among platforms (Vallas & Schor, 2020; Schor, 2020). By combining quantitative data on workers' profiles and work and employment conditions, as well as paying attention to worker trajectories in and out of platform work in relation to their motivation, overall careers and income (see for example Jourdain & Naulin, 2019; Bernard, 2023b), we fully consider the heterogeneity of platform work as well as its consequences.

In sum, the fourth work package contains an in-depth study of the platform economy in Belgium. The aim was to gain insight into the phenomena of (digital) platform work and platform-based freelance work, studying the socio-demographic profiles, the skills composition, the job content and the employment conditions of the workers involved. In this work package, multiple methods were combined to gain insight into this emerging employment phenomenon in Belgium. Given the recent and highly dynamic character of the platform economy in Belgium, mapping out the existing and relevant platforms requires exploratory fieldwork and thus was a first important objective for this work package. Platform data (obtained by means of agreements with platform owners) were used to create socio-demographic, professional and economic profiles of the workers engaging in platform work.

Furthermore, an online survey was conducted to gather information about the work and employment conditions, health and well-being situation, social protection, income (security) and career prospects of the workers involved. Finally, in-depth interviews with platform workers and representatives produced information on how they experience their work and shed light on the trajectories into and out of platform work, as well as perspectives for collective action in platform environments.

3. METHODOLOGY

3.1 Macro-economic effects of digitalisation on labour markets (WP1)

New technologies are automating some jobs, they raise the demand in other jobs, they shift the concrete tasks that workers perform on their jobs, and they alter the way we consume. The result is a restructuring of the economy in which some sectors grow, and others decline, in which some occupations disappear, and the task requirements of other occupations change, and in which some groups may lose, and others win in terms of income, employment and job quality (Goos & Manning, 2007; Acemoglu & Restrepo, 2019; Autor, 2019). This section describes the data and methods used for three studies about these macro-level effects of the digital revolution on the Belgian labour market.

3.1.1 The restructuring of the Belgian labour market

The aim of this study was to investigate longer-term trends in occupational change in Belgium by focusing on four research objectives: (1) to describe the extent of sectoral and occupational change in the Belgian labour market over the past 35 years; (2) to describe how these changes are related to worker characteristics such as gender, skills, age and geographical space; (3) to investigate the extent of job polarisation in the Belgian labour market (i.e. the disappearance of middle-skill routine jobs), and (4) to describe occupational mobility by studying transitions of workers between occupations.

Three datasets were used to carry out the analyses: (1) The “Enquête sur les forces de travail/ Enquête naar de arbeidskrachten” (EAK), the Belgian Labour force Survey, obtained from the Belgian statistical office Statbel, (2) The “European Labour Force Survey” (EU-LFS) obtained from Eurostat and (3) The “EU Statistics on Income and Living Conditions” (EU-SILC) obtained from Eurostat. All three data sets use sampling methods that allow for representativity of the samples for the employed population. The EU-LFS data were only used when comparing Belgium to its neighbouring countries. The EAK covers the period 1983-2020, but since information on occupations is only available from 1986 onwards, we restricted the analysis to the period 1986-2020. For the same reasons, we further restricted the sample to the period 1993-2018 when working with the EU-LFS dataset. The EU-SILC data are longitudinal data for the period 2012-2020 and are used to study transitions of workers across occupations. The numbers of workers reported in this study always refer to the numbers of workers in the population, which are estimated by reweighting the sample. The effective sample size of the EAK survey is 27,914 workers in 1986, 62,106 workers in 2020 and 1,385,729 workers for the entire period 1986-2020.

We restricted the analysis to the employed population aged 15 and older. The employed population refers to persons who indicate in the survey that they worked for at least one hour during a given week (the ILO definition) – be they salaried, self-employed, paid interns, helpers in a family business or persons who have a job but who are temporarily absent for reasons such as sickness (less than one year) or paid leave.

Age is reported in four categories: strictly younger than 30 years old (the minimum is 15), 30 or older and younger than 40, 40 or older and younger than 50, and 50 or older (the maximum is 96). Our educational variable contains three categories: low-educated (no high school degree), middle-educated (high school degree) and high-educated (tertiary education degree). The regional variable refers to the region of the workplace (not the place of residence of the worker) and contains four categories: Brussels, Flanders, Wallonia and abroad.

The sectors and occupations of workers in the EAK and EU-LFS data are measured using classifications that have gone through several changes and revisions over time. These changes were implemented to account for the emergence of new products and occupations, for the changing task content of occupations (for example an occupation that evolves to require more responsibilities and skills is regrouped with occupations that require similar skills), or to make classifications more comparable across countries. Every change of a classification leads to breaks in the time series, which complicates the study of changes over time. To study how the distribution of workers across sectors and occupations has changed over time, it is necessary to harmonize the different classifications to obtain consistent time series of sectoral and occupational information. For the occupational classifications, exact harmonisation via aggregation proved undesirable because too much information would be lost. Instead, we developed a method of statistical harmonisation which allows us to backward-extrapolate and estimate the occupational structure in time and to create consistent time-series spanning various decades.

This study mainly presents descriptive statistics (frequency tables and graphs), as well as the results of linear regression analyses where an evaluation of the statistical significance of the estimated effects is useful (particularly for the EU-SILC data where the sample sizes are more limited). To analyse how much the sectoral and occupational structure has changed between 1986 and 2020 for various groups in the labour market, we calculate Dissimilarity Indices because they can be given a clear interpretation: the index ranges between 0 and 1 and it can be interpreted as the percentage of workers than would need to change sectors or occupations in 1986 in order to arrive at the sectoral or occupational distribution in 2020. In other words, the Dissimilarity Index can be interpreted as a measure for the degree of turbulence in a particular labour market. Formally, it is calculated as half of the sum of the absolute differences between the employment shares in 1986 and 2020. The EU-SILC longitudinal data for the period 2012-2020 are used to study worker flows across occupations. We distinguish between three transitions: staying in the same (ISCO 1-digit) occupation, moving to another (ISCO 1-digit) occupation, and moving to non-employment. We define a transition to another occupation using an indicator variable that takes the value 1 when the ISCO-08 category at the 1-digit level of aggregation of a respondent differs from the ISCO category the year before (so we study year-to-year transitions). To limit the problem of false transitions, which is common in this type of approach, the indicator variable only takes the value 1 if the change in the ISCO code is accompanied by a job change (the respondent is asked whether (s)he changed jobs over the past year).

3.1.2. The changing task composition of Belgian workers

This study empirically examines the task composition of Belgian workers over the past 25 years. The aims of the study were (1) to describe work tasks of workers and their relationship with workers' characteristics and occupations, (2) to study the evolution of the task composition of workers and (3) to decompose the overall change in work tasks into a part that results from changing work tasks within occupations and another part that results from changes in the occupational structure. The analysis was based on data from the European Working Conditions Survey (EWCS) for the period 1995-2021 and the Survey of Adult Skills (PIAAC) for the period 2011-2018.

We used the task framework developed by Fernández-Macía et al. (2016), who identified a number of task categories that best describe the recent developments of labour demand and structural change in employment. Tasks are classified based on two characteristics, the 'content' of work and the 'methods and tools' used at work. Broadly speaking, this approach divides tasks based on *what* workers do at their jobs and *how* they do their jobs. The content characterizes the skills required to perform a task and contains (1) physical tasks, which refer to tasks in which workers perform physical manipulations and transform material things, (2) intellectual tasks, which refer to tasks that involve the transformation of information and the active resolution of complex problems, and (3) social tasks, which refer to tasks in which workers interact with other people. The methods and tools used at work describe how the work is organized and the type of physical objects that are used to perform the tasks. The methods characterize whether workers work in teams or autonomously and whether their jobs involve routine tasks. The tools describe whether workers need machines and/or information and communication technologies (ICT) to perform their jobs.

We created task indices for each of the elements of the task framework by aggregating information from a set of survey questions from the two micro-level datasets. For example, the task index "physical strength" was constructed by aggregating variables on whether a worker's main paid job involves, respectively, tiring positions, lifting, or moving people and carrying heavy loads in the EWCS. Because the variables were measured on different scales, we first normalized each of them into a normative scale that ranges from 0-100 indicating the intensity by which the task is performed. For the EWCS, our analysis focuses on 2021 (or evolutions until 2021) when possible. However, the task indices for creativity, teamwork, standardisation, and machines are based on 2015 data since the required information was missing in 2021. Similarly, some variables were missing for 1995, so to study evolutions over time we only used variables that are observed since 1995 to compute the task indices. For example, the task index "Physical strength" is only based on the two variables when we study evolutions over time, because a third variable was not observed in 1995.

In order to study to what extent the changing work tasks between 1995 and 2021 can be attributed to changes in the structure of employment (changes between occupations) or changes in the tasks within jobs (changes within occupations), we performed a decomposition analysis. The between occupations part refers to changes in a task that are due to a decline or an increase in the number of workers in an

occupation where that particular task is performed a lot (for instance, the physical task index would decline if less workers were performing jobs that require physical tasks). The within occupations part refers to changes in a task that are due to changes over time in the type of tasks workers perform within a same occupation (for instance, the physical task index would decline if workers in a job that used to be intensive in physical tasks no longer perform physical tasks).

3.1.3 The effects of the digital revolution on individuals' labour market outcomes

This study examines the effects of occupational growth and automation potentials on various individual labour market outcomes: employment and unemployment probabilities, unemployment duration, health, and income. For each of these outcomes, we performed four types of analysis: (1) a descriptive statistical analysis in which we examine how their means differ by occupations' growth and automation potential groups, (2) a linear regression analysis in which we estimate the direct effect of occupations growth and automation potential on each of these measures, (3) we studied how the effects have evolved over time and (4) we studied how the effects differ by gender, age and education. The European Labour Force Survey (EU-LFS) was used for our analyses, and we focus on the period 2011-2021.

Our independent variables include a dummy for growing occupations (ISCO groups 21 to 26 and 31, 33, 34 and 53) vs declining occupations (ISCO groups 72 to 75), occupational growth rates and the automation potential of occupations. We ranked occupations based on changes in the absolute number of workers in each of these occupations between 1986 and 2020. The 10 occupations with the biggest positive changes represent the growing occupations and the 4 occupations with the biggest negative changes the declining occupations. To obtain the occupational growth rates we took the log of the ratio between the absolute number of workers in each occupation in 2020 and the one in 1986. This variable thus represents the percentage change in the number of workers between 1986 and 2020. We obtained the occupations' automation potential from the study of Schaffers (2019) who, building on the work of Frey and Osborne (2017) and applying a novel class probability estimation model to (principally) the O*NET data, determined the probability of a certain occupation to be automatable, i.e. the automation potential.

We performed regression analyses to study how the effect of the occupational growth and automation potential on worker outcomes has evolved over time and how it differs by gender, age, and education. In a first analysis, we ran the above regression models separately for each year and presented the results in a figure. This allowed us to check whether the effects of our measures for the digital revolution on individuals labour market outcomes have remained constant over time or not. In a second analysis, we performed interaction analyses in which the independent variable for growing occupations is interacted with gender, age, and education, to study whether the effects differ across these groups.

3.2 Organisations as a moderator between technology and work experiences (WP2)

WP2 focuses on how the division of labour and the employment relationship within an organisation influence the change in job content and job quality brought about by digital technology, both for general employees and specifically for line managers. Sociotechnical systems (STS) theory emphasises that for any system to reach its ultimate performance, joint optimisation of the social and technical components is required. Consistent with STS principles, it is recommended that non-technological innovation should complement and integrate with technological innovation (Kaye Parker & Boeing, 2023). Based on STS, Huys et al. (2013) developed a model suggesting that an organisation can be viewed as the outcome of integrated choices made in areas of division of labour and employment relationship (including human resource practices and social dialogue). In WP2 we applied this model to investigate the impact of digital technologies on job content and job quality of employees in general, and of line managers in particular, mediated by choices in the field of labour division and employment relationship (Smits et al., 2022).

The main research question focuses on how and to what extent the division of labour and the employment relationship influence the change in job content and job quality brought about by digital technology, both for employees and specifically for line managers.

Before we started the case studies, we did a scan of the literature review which showed that while the impact of organisational choices on labour division and employment relationships during technology implementation is increasingly recognised, there is a need for a deeper understanding of how these choices affect job content and quality for employees. Additionally, few studies have explored the changes in job content and quality for line managers due to digitalisation.

Data was collected through case studies using qualitative methods: semi-structured interviews, document analysis, and observation. 22 organisations across various sectors and sizes were selected in Belgium, all with significant digital technology implementation. This included 10 from production, 5 each from private and public services, and 2 platform-based services. We conducted 121 interviews, averaging 5.5 per organisation, including a 'generalist' (e.g., manager, HR expert), a line manager, and an employee, all with sufficient seniority to assess pre- and post-technology introduction scenarios. Interviews were conducted in the native language of each interviewee. The HIVA-KU Leuven team handled the interviews within primarily Dutch-speaking organisations, whereas the Lentic-ULiège team focused on those that were predominantly French-speaking. Subsequently, each team was responsible for compiling the case reports for the organisations they had interviewed.

We followed a mainly deductive approach, using a conceptual model and variables to guide data collection, categorise data analytically, identify regularities, and ensure comparability between cases. Interviews and other collected data were consolidated into 22 individual case reports, each following a consistent structure. Each report covered a specific case, discussing various topics outlined in our conceptual model: introduction of technology, division of labour, human resources management,

social dialogue, impact on job quality, and impact on line managers. Coding of these case reports was conducted based on the concepts from the conceptual model.

In a second step we performed a cross-case comparative analysis using pattern-matching to compare empirical patterns with theoretical propositions (Yin, 2003). This analysis was aimed at answering the research questions and was based on the reported findings of the 22 case studies. This was done in three steps.

Initially, a comprehensive cross-sectional analysis was undertaken, where the contents of case reports were systematically broken down into parameters aligned with various research questions and sub-questions. A detailed table was assembled to provide a summary of the codes, which facilitated the identification of general trends in how digital technology impacted the quality of work across different organisations, as well as the similarities and differences among these organisations in this context. Furthermore, the analysis probed whether the influence of digital technology was shaped by prior organisational choices, especially concerning the degree of labour division or functional concentration.

In the second phase, the case studies were scrutinised based on the strategies employed by various stakeholders in adopting and implementing digital technology. This examination centred on managerial actions but also considered the influence of higher decision-making levels and employee responses. Despite acknowledging the uniqueness of each case, efforts were made to categorise the decision-making processes related to digitalisation and the management of its consequences. A narrative actor analysis was conducted to assess the potential mediating roles of management, the HRM department, and social dialogue mechanisms.

Lastly, a synthetic thinking exercise was carried out to derive insights—or formulate hypotheses for future validation—about how digital technology, serving as both the driver and navigator of the production process, is reshaping the role of human labour. This transformation has significant implications not only for the daily experiences of workers but also extends to broader societal sub-fields, including the labour market and education sectors. This analysis drew on findings from the previous phases, highlighting the contingent nature of technology's impact on the workplace and society at large.

The results of the comparative analysis of the 22 cases, aimed at unpacking the organisational level, were published in a separate report.

3.3 Digitalisation and changing occupations (WP3)

Firstly, a narrative literature review per occupation has been carried out. A narrative literature review aims to provide a comprehensive, critical, and objective analysis of the current knowledge of the topic (Onwuegbuzie & Frels, 2016). The literature reviews featured in this section primarily rely on empirical evidence, although other types of publications were also incorporated, often serving the purpose of providing context and delineating specific terminologies. TABLE II displays an overview of the different categories of papers mobilised for the literature reviews.

TABLE II. Strategy for Literature Review

Occupation	N° of papers analysed	Paper type						
		Empirical paper				Non-empirical paper		
		Quantitative methods	Qualitative methods	Mixed methods	**Subtotal**	Literature review	Other*	Subtotal
Assembly line workers	32 (100%)	3 (9,5%)	10 (31,5%)	7 (22%)	**20 (63%)**	4 (12%)	8 (25%)	12 (37%)
Customer advisors	20 (100%)	5 (25%)	5 (25%)	7 (35%)	**17 (85%)**	2 (10%)	1 (5%)	3 (15%)
Middle managers	18 (100%)	3 (17%)	8 (44%)	2 (11%)	**13 (72%)**	4 (22%)	1 (6%)	5 (28%)
Recruiters	35 (100%)	12 (34%)	10 (29%)	5 (14%)	**27 (77%)**	4 (11,5%)	4 (11,5%)	8 (23%)
R&D managers	33 (100%)	9 (27,5%)	9 (27,5%)	7 (21%)	**25 (76%)**	2 (6%)	6 (18%)	8 (24%)
All occupations	138 (100%)	32 (23%)	42 (31%)	28 (20%)	**102 (74%)**	16 (12%)	20 (14%)	36 (26%)

* E.g. conceptual or technical papers

Table 1 - Methodological overview of the papers selected for the narrative literature reviews

We searched for empirical papers in both white literature (peer-reviewed papers) and grey literature (institution reports, consultant reports, conference proceedings, book chapters, working papers, case studies, research reports, and commissioned reports) within sources such as electronic databases (ScienceDirect, Business Source Premier, Scopus, Jstor, Web of Sciences, Google Scholar), international research institutes (Eurofound, ILO, OECD), governmental organisations, European employers and unions federations (ETUI, Business Europe), consulting organisations and manufacturers associations.

Keywords used included the occupation name or synonyms in combination with digital-related keywords (digitisation OR digitalisation OR digital transformation OR industry 4.0 OR industry 4.0 OR the fourth industrial revolution OR the 4th industrial revolution OR smart manufacturing OR smart production OR smart factory OR smart factories OR cyber-physical system OR cyber-physical production system OR internet of things OR industrial internet OR big data OR algorithms OR RPA OR robotic process automation OR RDA OR robotic desktop automation OR artificial intelligence OR digital tools OR digitisation OR technological innovation) or specific occupations-related keywords derived from first searches. We covered a period starting from 2010 to document the evolution of the situation, with a focus on the most recent papers (starting from 2015) regarding the actual uses of the technologies. We looked mostly for papers in English, but in some cases publications in French or Dutch

were also included. From this literature review, we then designed the appropriate research protocol and interview guidelines for our fieldwork for the five selected occupations.

The research protocol has been organised around a qualitative methodological approach based on semi-structured interviews. Interview grids were the same across occupations. The interview questions were based on a keyword search in the academic literature linked to the following concepts: digitisation, digitalisation, digital transformation, industry 4.0, the fourth industrial revolution, smart manufacturing, smart production, smart factory, smart factories, cyber-physical system, cyber-physical production system, internet of things, industrial internet, big data, algorithms, robotic process automation, robotic desktop automation, artificial intelligence, digital tools, technological innovation, or specific occupations-related keywords derived from first searches.

Following the identification of questions linked to these keywords, we designed appropriate research protocols and interview guidelines for the selected occupations. The research protocol was organised around a qualitative methodological approach based on semi-structured interviews. As regards the recruitment strategy to create a diversified sample of professionals, we engaged in the recruitment of interviewees by reaching out to the relevant professional associations representing these occupations, which then assisted in disseminating our request. Furthermore, we extended our outreach to potential interviewees through posts on LinkedIn and direct contacts within our networks. Our study employs a purposive sampling strategy, a method of non-probability sampling where the sample is selected based on specific characteristics and criteria defined by the researchers. The primary aim of employing purposive sampling is to gather in-depth insights from a carefully targeted group of professionals. The selection process is planned to include enough participants from each category of occupations to reach the threshold of saturation. According to Glaser and Strauss (1967), saturation occurs when no new information or themes are observed in the data. To achieve saturation, various strategies are employed to engage participants, ensuring a diverse representation within each targeted occupation. These strategies may include direct outreach, snowball sampling techniques, and leveraging professional networks. The goal is to conduct interviews until saturation is reached, meaning subsequent interviews do not yield significant new insights or alter the research trajectory. All 75 interviews were recorded with the consent of the people involved and then transcribed in full. The empirical data were then analysed using NVivo software. The coding grid was drawn up jointly by the researchers involved and validated by triangulation.

TABLE III. Description of the sample

Occupations	**Assembly line workers**	**Customer advisors**	**Middle Managers**	**R&D Managers**	**Recruiters**
Interviews number	N=11	N=13	N=21	N=13	N=17
Size	3 small (<50) 8 big (>250)	1 small (<50) 2 big (>250) 4 large (>1000) 6 missing information	Missing information	2 small 7 large 4 missing information	2 small (<50) 2 medium (<250) 8 big (>250) 5 missing
Sector	2 pharmaceutics 2 metal works 1 motorcycle manufacturer 1 beverage 2 construction materials manufacturer 2 mechanical mechanisms 3 car manufacture	12 bank/insurance sector: daily banking operations, credits, investment, insurance 1 retail	3 Motor vehicle parts & manufacturing 3 construction materials 3 production 2 logistics 1 tutoring 3 construction 1 retail 5 bank & insurance	1 HR sector 2 construction 2 research org 2 agriculture 1 building materials and chemical 1 IT 1 textile 1 financial 1 missing	5 public 2 banking 1 distribution 1 transport 1 energy 2 social secretariat 4 HR 1 education

Interviewees were asked a series of questions, ranging from contextual details to digital perceptions. We investigate people's seniority in the company, age, gender, sector of employment, size of the company, and technologies used. We then proceeded to ask questions on their work content; specifically, we asked questions about their job content (work tasks), effective use of digital tools, and working conditions. We further investigated their employment conditions concerning the use of digital tools and employment relations, in terms of actors involved in the digitisation process, topics discussed, and frequency of meetings. We were also interested in understanding how tasks were distributed following digitalisation and how work organisation evolved, if it evolved, with the introduction of digital tools. Finally, we asked questions about the quality of working life post-digitalisation and perceptions of the digital tools themselves.

As regards the analysis, we proceeded to encode the information derived from interviews into the above-mentioned generic categories, as well as into more detailed categories. For each category, information was retrieved directly from the interviews. After the interviews were analysed and the information compiled for each category, we proceeded to identify patterns for occupations belonging to different sectors and positions.

3.4 Digital platform work as an emerging employment phenomenon (WP4)

The findings in work package 4 are the result of a mixed methods approach with a combination of quantitative analyses on primary data and qualitative analysis based on in-depth interviews and (participant) observations. The work package was structured in three empirical sub-studies: (1) analyses of administrative platform data, (2) a survey among platform workers, and (3) qualitative fieldwork.

3.4.1 Quantitative data and analyses

The quantitative analyses for work package 4 are based on two separate data sources. First, to understand the platform landscape and Belgian platform workers' socio-demographic and professional profile (work task 4.2.), we used **(back-end) administrative data** that were provided by ten different digital labour platforms active in Belgium. For a detailed description of the received data from platforms, see Gaublomme et al. (2023). The activities of these ten platforms were: education and tutoring, freelance services, babysitting, interim work, elementary jobs, taxi driving, and food delivery. Eight of the platforms provided us with micro-level *public profile information* of their registered users. Some platforms additionally supplemented the data with *anonymized (back-end) administrative data* (incl. log-in frequencies, membership status, most recent log-in, date of profile creation, number of completed jobs, number of received messages etc.). In total, we received micro-level data of 386.886 individuals registered on Belgian (digital) labour platforms (around 100.000 of them were considered 'active users' based on having conducted at least one paid job). Data points cross a timespan of nearly 10 years between 2011 and 2021.

Second, in order to conduct an in-depth study of work and employment conditions of platform workers in Belgium (work task 4.3.), a **cross-sectional internet survey** was developed. The survey covered topics such as work- and employment conditions, health and well-being, social protection, income (security) and career prospects of workers in the platform economy. Data was collected between February 2022 and June 2023. Using a variety of non-probability sampling techniques (Gevaert et al., 2024) a sample of 528 Belgian platform workers was achieved who participated in platform work on a semi-regular basis[2]. Because of missing data, the final sample used for analyses consisted of 406 respondents.

To achieve the first two objectives of this WP (improve our knowledge on the socio-demographic and professional profiles of platform workers in Belgium), we conducted case-by-case descriptive analyses on socio-demographic characteristics such as gender, age, and education level, and on professional characteristics such as type of occupation, labour market status, average earnings, and work quantity of workers on individual platforms. Afterwards, an overarching meta-analysis was conducted – considering the relative market size of certain segments of the platform economy – to form an adequate socio-demographic and professional description of Belgian platform workers (Gaublomme et al., 2023).

[2] (Almost) daily, weekly, monthly, at least once in the last six months, or so irregularly that it is difficult to estimate a frequency.

To achieve the third objective of this work package (to objectify the work- and employment conditions and their potential consequences in terms of sustainable employment), we performed careful index construction (incl. confirmatory factor analysis to create a measurement of employment quality). To establish relationships between the subdimensions of job-quality and to relevant socio-demographic (e.g., gender, age, education, migration background), professional (e.g., labour market status, type of platform work), and health outcomes (e.g., mental well-being, general self-rated health, and musculoskeletal complaints) we conducted descriptive analyses by way of cross-tabulations and chi-square tests, as well as Pearson correlations (Gevaert & Vandevenne, 2024).

3.4.2 Qualitative data and analyses

The qualitative study (work task 4.4) involved in-depth interviews as well as (participant) observations. A detailed report on the qualitative fieldwork and analysis can be found in annex (Joukovsky, Brodersen & Vandevenne, 2024).

We conducted 96 **interviews with platform workers**, ensuring diversity based on platform type and geographic region. The Brussels Capital Region was particularly well represented due to its notable presence of platform-based activities).

TABLE IV. Distribution of interviews by groups of activities and region

Socio-spatial category	Brussels	Flanders	Wallonia	Total
'Urban space' workers	29	19	3	50
'In-home' (household) workers	19	8	12	39
'Online' (microtask & freelance) workers	2	5	0	7
	50	32	15	96

Recruitment strategies ranged from the mobilisation of existing networks and snowball sampling to on-site and online recruitment, and varied according to the groups of activities. Some of the 'urban space' workers were recruited either in urban space, or (marginally) through ride-hailing (in the case of taxi drivers), in which case the interviews were conducted in the vehicle during the journey. Some of the 'in-home' and 'online' workers were recruited directly through the platforms, by responding to advertisements or gigs we had posted. Finally, participants from all groups were also recruited via the online survey (after consenting to a qualitative follow-up interview in the questionnaire).

Interviews were conducted using a **semi-structured interview guide** (see in annex) available in several languages (French, English, Flemish)[3]. It contained a series of key questions on topics such as the work trajectory, the motivations for engaging in platform work, the working conditions, the work aspirations

[3] One interview was conducted in Pashto.

and collective action. It was designed to be broad enough to elicit storytelling, along with a sequence of follow-up questions.

To systematically analyse the platform workers' interview data, we did a **thematic coding of the interviews** using NVivo software. The process was iterative, with researchers revisiting and refining the codes as needed. To enhance the reliability and validity of the coding process, peer review and validation were conducted.

In addition to interviews with platform workers, a series of **interviews with relevant stakeholders** were also conducted: trade unions and workers' collectives (5), platform managers and employees (11), cooperatives (2) and companies (1).

Finally, a series of **(participant) observations** were made over time during collective mobilisation events involving couriers and drivers. These were supplemented by a participation to meetings and activities organised by *La maison des livreurs*[4] (in Brussels).

[4] *La maison des livreurs* was co-constructed by le Collectif des coursier.e.s and union representatives, as a space dedicated to welcoming all couriers, informing them about their rights, assisting them when they encounter problems (e.g. blocked or disconnected account) and also organize them.

4. SCIENTIFIC RESULTS AND RECOMMENDATIONS

4.1 Macro-economic effects of digitalisation on labour markets (WP1)

4.1.1 The restructuring of the Belgian labour market

TABLE V presents occupational growth at a detailed ISCO 2-digit level. In absolute terms, the largest employment growth has been in business and administration occupations (groups 33 and 24), health professionals, legal and socio-cultural jobs, ICT jobs and teachers. In relative terms, the fastest growth has been in ICT jobs. The business administration groups 33 and 24 mainly contain workers in occupations such as executive secretaries, sales representatives, accountants, HR personnel, etcetera. Relative growth has also been very rapid in groups 26 and 34, which mainly contain social workers but also personal coaches and fitness workers.

The largest employment drop in absolute terms has been in group 72, which mainly contains blue-collar occupations such as motor vehicle mechanics, machinery mechanics, welders, and other metal workers. The second largest drop has been in group 75, which mainly contains occupations such as butchers and bakers. The largest drop in relative terms has been in group 73, which mainly contains printers and press technicians.

TABLE V. Number of workers by occupation (ISCO 2 digit), 1986-2020

	1986	2020	Growth (absolute)	Growth (percent)
33. Business and administration associate professionals	147,387	310,250	162,863	110.5%
24. Business and administration professionals	52,616	214,539	161,923	307.7%
22. Health professionals	84,741	237,625	152,884	180.4%
26. Legal, social and cultural professionals	53,710	194,154	140,444	261.5%
25. ICT professionals	21,889	138,469	116,580	532.6%
23. Teaching professionals	225,991	337,700	111,709	49.4%
21. Science and engineering professionals	61,064	151,754	90,690	148.5%
31. Science and engineering associate professionals	73,978	162,033	88,055	119.0%
53. Personal care workers	90,360	166,793	76,433	84.6%
34. Legal, social, cultural and related associate professionals	33,209	91,479	58,270	175.5%
51. Personal service workers	102,158	150,001	47,843	46.8%
52. Sales workers	203,457	239,843	36,386	17.9%
32. Health associate professionals	76,626	96,008	19,382	25.3%
35. Information and communications technicians	13,787	27,313	13,526	98.1%
54. Protective services workers	38,927	52,115	13,188	33.9%
71. Building and related trades workers, excluding electricians	207,758	203,493	-4,265	-2.1%
74. Electrical and electronic trades workers	83,206	68,756	-14,450	-17.4%
73. Handicraft and printing workers	43,513	20,942	-22,571	-51.9%
75. Food processing, wood working, garment and other	103,540	65,507	-38,033	-36.7%
72. Metal, machinery and related trades workers	171,592	117,699	-53,893	-31.4%

Note: Table is sorted by absolute growth. EAK data. The numbers for 1986 are harmonisation estimates (see text).

Figure 3 compares the (percent) growth rates of ISCO 1-digit occupations in Belgium with those of its neighbouring countries France, Germany and The Netherlands. Most sectors are close to the 45° diagonal implying that the process of occupational change in Belgium is broadly in line with that of neighbouring countries – although group 3 (technicians and associate professionals) has grown more rapidly and group 2 (professionals) less rapidly in Belgium.

Figure 3. Occupational change in Belgium and neighbouring countries, 1995-2018 (EU-LFS)

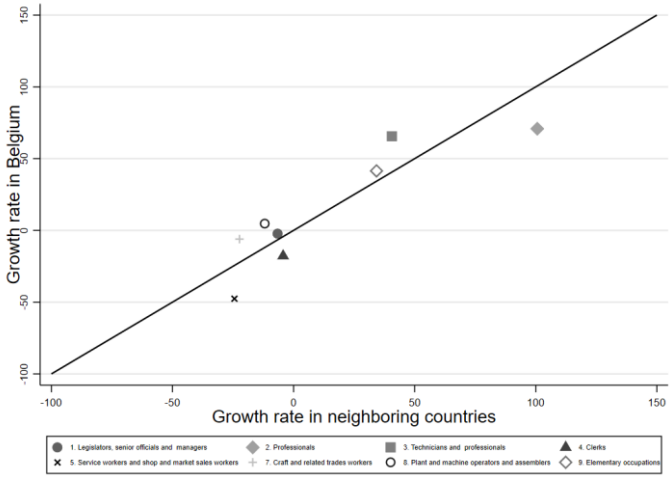


TABLE VI presents occupational employment shares in 1986 and 2020 by gender. The occupational segregation of men and women persists in 2020 with more than 28 percent of male employment in

the blue-collar occupation groups 7 and 8, as opposed to less than 3 percent of female employment. However, the changing occupational structure seems to have affected both men and women in similar ways. Occupational groups 2 and 3 have increased their shares in both male and female employment by about 15 percentage points, at the expense of the other occupations. The decline of the share of the blue-collar occupation groups 7 and 8 has been stronger for men (11 percentage points) than for women (6 percentage points). The decline of the share of administrative occupations (4. Clerks) has been stronger among women. The dissimilarity index (measuring the percentage of workers who would have to change occupations in 2020 to reproduce the occupational structure in 1986) is similar for men and women.

TABLE VI. Occupational employment shares by gender in 1986 and 2020 (ISCO 1-digit)

Occupation	Men			Women		
ISCO 1-digit group	1986 (pct.)	2020 (pct.)	Change (ppt.)	1986 (pct.)	2020 (pct.)	Change (ppt.)
1. Legislators, officials and managers	9.6	10.7	1.2	6.7	6.4	-0.4
2. Professionals	13.0	23.6	10.6	18.9	31.4	12.4
3. Technicians and professionals	10.3	14.2	3.9	10.5	15.2	4.6
4. Clerks	13.2	8.2	-4.9	21.0	13.5	-7.5
5. Service, shops and sales workers	8.0	8.0	0.1	22.2	18.6	-3.6
7. Craft and related trades workers	26.5	18.1	-8.4	4.7	1.2	-3.5
8. Plant and machine workers	13.0	10.2	-2.8	4.0	1.6	-2.4
9. Elementary occupations	6.6	6.9	0.3	11.8	12.2	0.4
Total	100%	100%	0 ppt.	100%	100%	0 ppt.
Dissimilarity index			16.1			17.4

Note: EAK data. Change is in percentage points (ppt.). The dissimilarity index measures the difference between the distributions in 1986 and 2020.

The dissimilarity index does vary strongly according to educational level (TABLE VII). For workers with a degree in tertiary education, the occupational structure at the 1-digit ISCO level has hardly changed. The dissimilarity index is much higher for low-educated and even higher for middle-educated workers. This finding that middle-skill workers have experienced the greatest degree of occupational turbulence is in line with theories of routine-biased technological change and job polarisation. The share of middle-skill workers (with a high school degree) in administrative occupations (4. Clerks) has halved from over 28 percent in 1986 to less than 14 percent in 2020. Middle-skill workers today are more likely to work in occupation group 9 (elementary occupations), which includes occupations such as cleaners, shelf fillers and kitchen helps, and in group 5, which includes occupations such as shop sales assistants, childcare workers, and cashiers. For low-skill workers, the share of blue-collar occupations in group 7 has declined substantially, while the share of elementary occupations in group 9 has increased.

TABLE VII. Occupational employment shares by education in 1986 and 2020 (ISCO 1-digit)

Occupation	Low			Middle			High		
ISCO 1-digit group	1986 (pct.)	2020 (pct.)	Change (ppt.)	1986 (pct.)	2020 (pct.)	Change (ppt.)	1986 (pct.)	2020 (pct.)	Change (ppt.)
1.	6.5	3.9	-2.6	9.3	5.8	-3.5	10.0	12.2	2.2
2.	1.3	1.7	0.4	5.8	5.2	-0.6	55.0	51.0	-4.0
3.	4.9	5.5	0.6	13.6	13.7	0.1	15.9	17.9	2.0
4.	11.5	7.7	-3.8	28.1	13.8	-14.4	11.8	9.2	-2.5
5.	15.4	18.2	2.8	17.2	22.0	4.9	4.1	4.7	0.7
7.	26.7	18.6	-8.1	15.3	17.2	1.9	2.2	2.4	0.2
8.	16.0	14.9	-1.1	5.7	9.8	4.1	0.4	0.9	0.5
9.	17.6	29.4	11.8	5.0	12.5	7.4	0.6	1.6	0.9
Total	100%	100%	0 ppt.	100%	100%	0 ppt.	100%	100%	0 ppt.
Dissimilarity index			15.6			18.5			6.5

Note: EAK data. Change is in percentage points (ppt.). The dissimilarity index measures the difference between the distributions in 1986 and 2020. ISCO groups are: 1. Legislators, officials and managers; 2. Professionals; 3. Technicians and professionals; 4. Clerks; 5. Service, shops and market sales workers; 7. Craft and related trades workers; 8. Plant and machine workers; 9. Elementary occupations.

TABLE VIII describes the characteristics of workers in growing versus declining ISCO 2-digit occupations. The growing occupations are the 10 occupations with the largest absolute employment growth such as business administration, health professionals, social workers, and ICT workers. The declining occupations include the 4 blue-collar occupations with the largest negative employment growth. TABLE VIII reveals that there are strong relations with gender, skill and region of employment. 94 percent of the workers in the declining occupations are men, whereas most workers in the growing occupations are women. 90 percent of the workers in declining occupations are low- or middle-skilled, whereas almost three quarters of the workers in the growing occupations are high-skilled. The employment share of the (urban) Brussels region is much larger in the growing occupations than in the declining occupations.

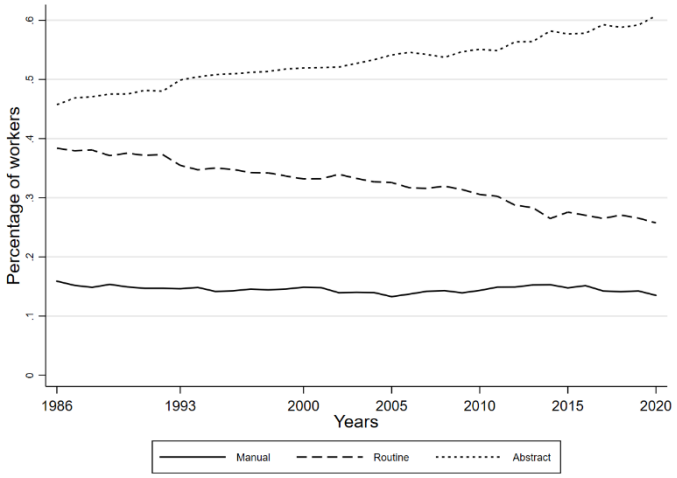
TABLE VIII. Characteristics of workers in growing and declining occupations

	Growing occupations	Declining occupations
Total	100%	100%
Gender		
Men	45%	94%
Women	55%	6%
Education		
Low	4%	28%
Middle	22%	62%
High	73%	10%
Age		
<30	15%	20%
[30-40[	27%	24%
[40-50[	27%	26%
>=50	31%	30%
Region		
Brussels	21%	9%
Flanders	46%	55%
Wallonia	29%	29%
Abroad	4%	4%

Note: EAK data 2013-2020 (pooled). Growing occupations are ISCO 33, 242, 22, 26, 25, 23, 21, 31, 53 and 34. Declining occupations are ISCO 72, 75, 73 and 74 (see TABLE V). The effective sample size N=42,388 in the declining occupations and N=163,026 in growing occupations.

To study the extent to which the Belgian labour market has experienced job polarisation, we categorize occupations into broad skill levels as has frequently been done in the literature on job polarisation. We follow Autor (2014) and collapse occupations into manual, routine, and abstract occupations. The share of workers in routine occupations has fallen by over 10 percentage points over the past 35 years in Belgium, and this share has gone to abstract occupations (the share of manual occupations has been roughly constant over time).

Figure 4. Job polarisation – the decline of routine occupations in Belgium, 1986-2020



The main findings of this study can be summarized as follows. Over the past 35 years, the total number of jobs in the Belgian labour market has grown by more than a third. This impressive job growth is hard to reconcile with the mistaken view that technological change leads to substantial job losses and unemployment. Some sectors and occupations have indeed declined, but many others have grown. From a sectoral perspective (in terms of what products are being produced), the largest employment growth has been witnessed in cleaning and security services, hospital and care work, computer programming and employment agencies. The largest drops in employment have been concentrated in a number of manufacturing sectors, as well as in the agricultural sector. From an occupational perspective (in terms of which tasks workers do), the largest employment growth was seen in business and administration occupations (executive secretaries, sales representatives, accountants, HR personnel, …), health professionals, legal and socio-cultural jobs, ICT jobs and teachers. In relative terms, the fastest growth can be noticed for ICT jobs and social workers but also for personal coaches and fitness workers. The largest employment drops have been in blue-collar occupations such as motor vehicle mechanics, machinery mechanics, printers, and press technicians, etc. This industrial and occupational restructuring is broadly in line with the evolution in Belgium's neighbouring countries France, Germany, and The Netherlands.

These evolutions have had very different impacts for different parts of the labour force. Over the past 35 years, the share of women in the employed population, the share of high-skilled workers and the share of older workers have increased substantially. The rising female employment has been mainly absorbed by the expanding sectors of education, health and social work, and business activities (real estate, legal and accounting, cleaning, and security, …), while there have been declines in the shares of some sectors in female employment such as retailing and manufacturing. Male employment has declined dramatically in the manufacturing sector, and it has grown in business activities. In terms of occupations, the well-known horizontal gender segregation persists, but the broad occupational changes have affected men and women in similar ways. An exception is the decline in administrative occupations (clerks), which has been stronger among women while the decline in blue-collar occupations has been stronger among men. The substantial declines of manual routine jobs in

manufacturing (a male dominated occupation) and secretary office jobs (a female dominated occupation) show that no gender is immune to the challenges posed by the digital revolution.

Sectoral and occupational change is also strongly related to skills. 35 years ago, low-skilled workers used to be concentrated in the manufacturing sector while greater shares today work in sectors such as cleaning, security services, health, and social work. The occupational structure has hardly changed for high-skilled workers. Our analyses thus show that occupational changes have been more present for low-skilled workers, in the sense that much larger shares of low- and middle-skilled workers have been reallocated to other sectors and occupations than is the case for high-skilled workers. We find that the occupational turbulence has been most severe for middle-skilled workers which is in line with theories of routine-biased technological change and job polarisation.

Older workers have seen declining employment shares in sectors such as agriculture and retail. In terms of occupations, younger workers have seen substantial drops in the employment shares in blue-collar occupations and in administrative occupations, whereas almost 20 percent of the younger workers today work as shop sale assistants, childcare workers, and cashiers.

The evolutions have also been uneven across geographical space, especially in terms of occupational change. The share of administrative jobs in the urban region of Brussels has collapsed from 27 percent in 1986 to less than 12 percent in 2020, while the shares of high-skilled occupations is increasing in this region. Our analysis suggest that occupational change has been more pronounced in the urban Brussels region than in other Belgian regions, and that this changing occupational structure has been particularly challenging for middle-skill workers.

The fact that occupational change has been very uneven across worker characteristics becomes even more clear if we compare workers in growing and declining occupations (in the analyses we identified growing and declining occupations as occupations that experienced the largest absolute change in the number of workers employed). 94 percent of the workers in the declining occupations are men, compared to only 45 percent in the growing occupations. Only 10 percent of the workers in declining occupations are high-skilled, compared to 73 percent in the growing occupations. Finally, 21 percent of the workers in growing occupations are employed in the urban region of Brussels, compared to only 9 percent in the declining occupations.

Our evidence also shows that the Belgian labour market has been experiencing job polarisation. Over the past 35 years, the share of workers in middle-low-skill occupations has fallen substantially by about 20 percentage points and the share of workers in what can be identified as routine occupations has fallen by about 10 percentage points. The growth has been in so-called abstract occupations while the share of manual occupations has been roughly constant.

Part of the occupational restructuring results from workers moving from one occupation to another, while another part arises from the fact that young workers enter the labour market in other (growing)

occupations. Our analysis of occupational mobility that looked at yearly occupational changes in longitudinal data, shows that workers in declining occupations do show much higher levels of mobility than workers in growing occupations such as ICT professionals, teachers, and security workers, which are essentially absorbing states in the sense that once workers start in these occupations, they are very unlikely to move to other occupations. This implies that the changing occupational structure is at least partly channelled through occupational mobility of workers. We also find that occupational mobility sharply decreases with age, which could be explained by the fact that workers and/or employers are less likely to invest in the required human capital for such changes as workers get older.

4.1.2 The changing task composition of Belgian workers

The first objective is to study how tasks vary across workers in the Belgian labour market. TABLE IX presents the mean task indices scores in the whole sample and separately by sex, age, and education.

TABLE IX. Task index scores

	All	Sex		Age				Education		
		Men	Women	<=30	(30-40]	(40-50]	>50	Low	Middle	High
EWCS										
Physical: Strength	25.8	23.6	28.0	27.1	25.2	25.6	25.7	34.0	31.2	20.9
Intellectual: Problem solving	65.5	65.9	65.1	67.9	67.6	65.6	61.8	57.7	61.7	69.6
Intellectual: Creativity[a]	77.9	78.0	77.8	74.0	78.5	78.0	80.3	65.6	75.9	84.1
Social	57.4	52.7	62. 7	59.7	57.1	58.5	55.1	55.9	57.5	57.9
Method: Autonomy	62.3	63.5	61.2	61.9	62.5	62.2	62.5	57.4	60.2	64. 4
Method: Team work[a]	45.7	48.1	43.0	43.9	48.1	49.7	40.6	36.0	44.8	50.3
Routine: Repetitiveness	60.1	60.0	59.9	58.6	61.0	59.5	60.8	72.0	67.1	53.4
Routine: Standardisation[a]	59.9	65.5	53.5	61.7	57.8	61.0	59.5	56.1	62.5	59.1
Tools: Machines[a]	12.4	17. 9	6.2	14.4	13.3	12.7	9.8	18.3	18.3	5.2
Tools: Technology	75.2	72.7	78.3	68.8	79.1	76.8	74.9	42.4	64.1	88.8
Number of obs.	2,736	1,397	1,301	530	639	697	842	269	861	1,593
PIAAC										
Intellectual: Business literacy	56.5	55.2	57.9	48.7	60.8	59.9	56.2	30.1	46.5	73.1
Intellectual: Technical literacy	45.7	49.5	41.6	41.7	47.9	47.9	45.2	31.7	41.6	53.5
Intellectual: Humanities literacy	23.7	24.8	22.4	18.5	25.7	25.3	25.1	9.4	15.5	35.0
Intellectual: Accounting numeracy	38.7	42.2	34.9	34.3	42.7	42.1	35.3	21.4	32.3	49.2
Intellectual: Analytical numeracy	18.3	22.3	14.0	16.7	21.1	20.4	14.7	5.9	11.5	27.7
Intellectual: Learning	55.1	56.4	53.7	61.7	56.6	52.1	50.4	45.0	52.3	60.1
Social: Selling	44.4	45.5	43.1	39.5	46.7	47.0	44.1	28.5	38.6	54.2
Social: Teaching	24.3	26.1	22.2	20.0	26.5	27.0	23.3	9.9	17.0	34.9
Social: Managing	22.4	26.3	18.3	16.1	25.8	25.6	21.2	12.1	19.1	28.0
Method: Autonomy	65.9	65.7	66.0	59.9	67.9	66.8	68.5	52.3	60.8	73.7
Tools: ICT	53.8	55.6	51.9	50.9	57.6	54.8	51.0	34.6	44.8	61.2
Number of obs.	2,617	1,340	1,277	592	676	759	590	176	900	1,442

The sample consists of Belgian workers in year 2021 (EWCS) and between years 2011 and 2012 (PIAAC). The task indices are measured on a scale from 0 to 100 indicating the intensity by which the task is performed (the higher the value, the more intensively the task is performed). The construction of the task indices is presented in the Appendix A. The numbers of observations give the lowest sample that is used to calculate the task indices.

[a] Data not available for 2021 so indices are measured in year 2015.

TABLE X gives the mean task indices in 1995 and 2021 and the absolute and percentage change between these two mean scores. The last column gives the linear trend coefficients obtained for each task index separately, which are estimates for the average annual increase in the task index. The estimates show that the two routine tasks average scores have consistently increased over the 1995-2021 period. The mean repetitiveness task index increased by almost 50% between 1995 and 2021 and the standardisation task index increased by about 13% between 1995 and 2015. Regarding the tools used at work, we find that there is a decline in the use of machines at work while the use of computers at work has increased dramatically over the period. The mean technology score in 1995 was 27.5 and it more than doubled to 77.4 by 2021.

TABLE X. Aggregate changes in average scores of task indices, 1995-2015

	Mean		change	% change	Trend coefficients
	1995	2021			
Physical: Strength	24.1	31.4	7.3	30.4%	0.220***
Intellectual: Problem solving	65.0	66.1	1.1	1.7%	-0.130***
Intellectual: Creativity[a]	80.6	86.7	6.1	7.5%	0.078
Social	59.0	56.5	-2.4	-4.1%	-0.138***
Method: Autonomy[a]	76.2	74.4	-1.8	-2.3%	0.048
Routine: Repetitiveness	39.4	58.9	19.5	49.4%	0.703***
Routine: Standardisation[a]	53.1	59.9	6.8	12.8%	0.510***
Tools: Machines[a]	11.8	9.3	-2.5	-21.1%	-0.111***
Tools: Technology	27.2	77.4	50.2	184.4%	1.905***

The sample consists of Belgian workers in 1995 and 2021. The task indices are measured on a scale from 0 to 100 indicating the intensity by which the task is performed (the higher the value, the more intensively the task is performed). The construction of the task indices is presented in the Appendix A. The trend coefficients represent the estimated coefficient of the variable year in the linear regression: $task\ index_i = \beta_{i,0} + \beta_{i,1} year + \epsilon_i$.*$p < 0.10$, **$p < 0.05$ and ***$p < 0.01$

[a] Data not available for 2021 so indices and trend coefficients are measured over the period 1995-2015.

We perform a decomposition analysis (TABLE XI) to examine whether the overall changes in the task indices between 1995 and 2021 can be attributed to changes in the structure of employment (changes between occupations) or changes in the tasks within jobs (changes within occupations). The results suggest that the increase in the use of computers is mainly due to changes within occupations. The change in the problem-solving task index is mainly due to changes between occupations while the change in the creativity task index can be attributed to changes within occupations. The decline in machinery use is largely due to changes in the occupational structure and, finally, the increase in the routine task indices is due to changes within occupations.

TABLE XI. Decomposition analysis of task changes, 1995-2021

	Task			Changes within	Changes between	
	1995	2021	Change	occupations	occupations	Residual
Physical: Strength	24.1	31.5	7.4	11.7	-3.1	-1.1
Intellectual: Problem solving	64.9	66.1	1.2	-1.4	6.0	-3.4
Intellectual: Creativity[a]	81.9	87.4	5.5	5.4	0.8	-0.6
Social	58.9	56.5	-2.4	-2.0	3.7	-4.0
Methods: Autonomy[a]	76.4	74.8	-1.6	-2.7	1.1	-0.1
Routine: Repetitiveness	39.4	59.0	19.6	23. 3	-4.8	1.1
Routine: Standardisation[a]	53.3	60.0	6.7	7.6	-1.3	0.4
Tools: Machines[a]	12.1	10.4	-1.7	0.1	-1.2	-0.7
Tools: Technology	27.3	77.4	50.1	42.8	4.0	3.2

The sample consists of Belgian workers in 1995 and 2021. The task indices are measured on a scale from 0 to 100 indicating the intensity by which the task is performed (the higher the value, the more intensively the task is performed). The construction of the task indices is presented in the Appendix A. The first two columns give the mean task indices in 1995 and 2021, respectively, and the third column the change in the task indices. Columns 4 to 6 give the results of our decomposition. Changes within occupation changes in a task that are due to changes in the type of work workers perform within a same occupation and changes between occupations describe changes in a task that are due to changes in the occupational distribution.

[a] Data not available for 2021 so trend coefficients are measured over the period 1995-2015.

The main results and conclusions of this study can be summarized as follows. We find that intellectual task indices are much higher than physical and social task indices. High-educated workers have higher intellectual task scores compared to low- and middle-educated workers and the opposite is true for the physical task index. We also find that physical and social task indices are higher for women compared to men. Looking at the method and tools used at work, we find that technology is much more intensively used than machines (not ICT) and that machines are more intensely used by low-educated workers. Low-educated workers also more often perform repetitive jobs and high-educated workers more often work autonomously. Next, we find that the physical, machine and routine task indices are concentrated in blue collar occupations. The physical task score is also high among health professionals and personal care workers. Because women are concentrated in these occupations, this could explain why the physical task index is higher for women. Intellectual and technology task indices are higher in white collar occupations. Since the growing occupations are mainly represented by white collar occupations and declining occupations by blue-collar occupations, we also find that intellectual and technology tasks are more common in growing occupation while physical, routine and machines tasks are more common in declining occupations.

Looking at the evolution of task indices, we find that there has been a large increase in the use of computers at work between 1995 and 2021, and that this trend accelerated between 2015 and 2021 which could be related to the Covid-19 pandemic. We also find that routine tasks have increased over the past 25 years and that the use of machines at work has decreased between 1995 and 2015. The increase in the routine tasks is concentrated in white-collar occupations and the decrease in machine tasks in elementary occupations. Our decomposition analysis suggests that the change in the routine and technology task indices are largely due to changes within occupations while the change in the machine task index is due to changes in the occupational distribution. There are no clear overall changes in intellectual, social and autonomy task indices. Intellectual tasks have been decreasing over time in white-collar occupations and we find that while the social task index has decreased in white-collar occupations, it has increased in blue-collar occupations. Somewhat surprisingly, we find that physical tasks have been increasing over the past 25 years and especially between 2015 and 2021. Our

decomposition suggests that the changes in this task index are mainly due to changes within occupations.

Some results such as the increase in physical strength at work, the decline in problem solving, the average physical task index that is higher in the female sample compared to the male sample are somewhat unexpected. There are various possible explanations for this. The results might be explained by real trends such as the substantial increase in healthcare jobs, which often require physical work, or these results could be related to the quality of the survey. As explained before, the advantage of survey data compared occupational databases is that one can study the evolution of tasks over time. Yet, workers themselves answer the surveys and this may lead to imprecise estimates of the task composition when respondents find it hard to respond to questions about the intensity by which they perform a task. The 2021 data are quite exceptional because the questionnaires had gone through major modifications and the collection of the data was done during the Covid-19 pandemic. During the pandemic some sectors had been closed down (e.g. the HORECA) while the importance of other sectors had grown (e.g. the health sector) and these circumstances may be driving our results. Future data are required to tell whether the trends we observe are part of longer-term trends or not.

Our study on the consequences of the digital revolution for skill requirements suggests that skills required to perform non-routine tasks (expert thinking and complex communication skills, as well as digital skills) are likely to become more important in the future. We argue that because of the rapid pace of changes introduced by the digital revolution, the tasks of workers are expected to evolve and change over workers' careers. Workers will thus need to be capable to adapt themselves to changes and to be able to learn new skills. A stronger emphasis on general education, and basic numeracy and reading skills, may teach workers how to learn and, hence, arm them for the challenges ahead in this digital era.

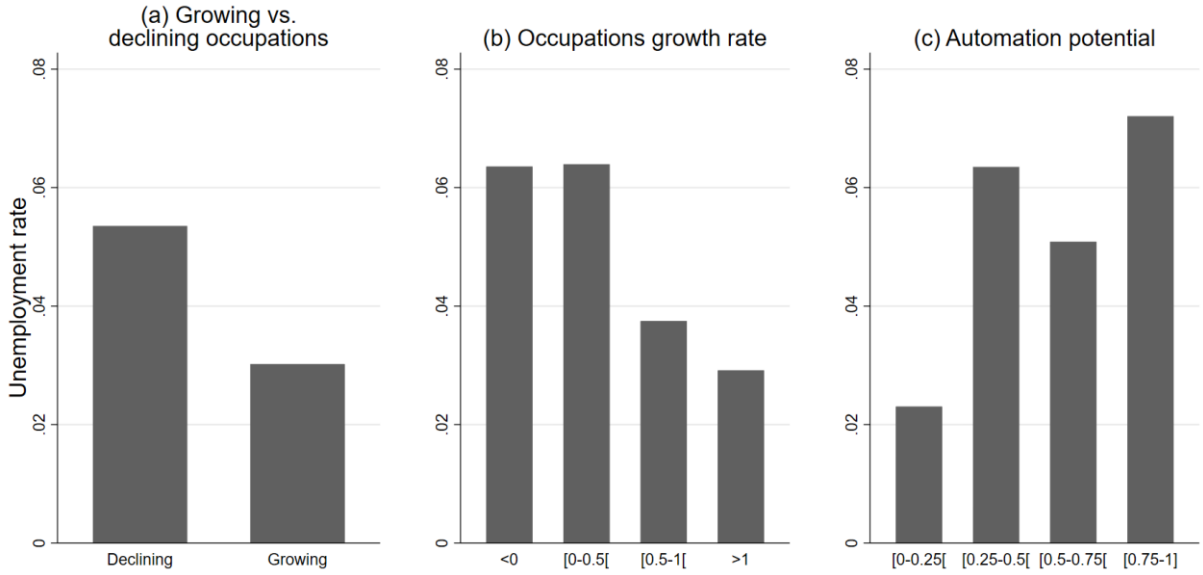
4.1.3 The effects of the digital revolution on individuals' labour market outcomes

This study relies on data of the European Labour Force Survey (EU-LFS) for Belgium, and we restrict the analysis to the period from 2011 on because of the break in the ISCO classification from the ISCO-88 to the ISCO-08 in that year. The sample consists of employed, unemployed and non-employed Belgian individuals aged 21 to 65. Note that, the sample is further restricted to the employed and unemployed individuals for the analyses on unemployment.

We focus this discussion on the effect of occupation growth and automation potential on the probability to be unemployed. In Figure 5, we present the mean unemployment probabilities by growing occupations, occupations growth rate and automation potential groups. The results in Figure 5 show that the unemployment probability is larger in declining occupations (at around 5.4 percent) than in growing occupations (at 3 percent). For occupations growth rate, we see that the mean unemployment is above 6 percent in occupations with growth rates below 0.5 while it is below 4 percent in occupations with growth rates above 0.5. The last sub-figure shows that the mean

unemployment probability is at the highest (at 7.2 percent) in occupations with automation potential between 0.75 and 1 and at the lowest (at 2.3 percent) in occupations with automation potential below 0.25.

Figure 5. Unemployment rates by growth and automation potential of occupations



Note: Belgian population aged 21-65 for the period 2011-2021 (pooled data). N=147,738 for (a); N=334,596 for (b) and N=334,539 for (c). For the list of growing and declining occupations in (a), see the main text.

4.2 Organisations as a moderator between technology and work experiences (WP2)

4.2.1 Results

4.2.1.1 Introduction of technology

We studied the adoption of digital technology in business functions and the challenges faced during its introduction. Digital technology is central to the production processes in 13 companies, encompassing manufacturing and services, and used for mechanical actions or data management. All 22 cases employ digital tracking for actions or value-adding information. Digital technology is integrated into support functions like administration, HR, and finance in 18 cases, and internal communication in 11 cases, using platforms like intranets. Only 6 cases reported a fully integrated system linking various digital functions. The transition to digital technology has been mixed: half of the companies have completed it, while the rest face ongoing challenges, including employee resistance due to skill changes, GDPR compliance, and dual data maintenance. Every company has an IT function, centralised in 15 cases, decentralised in 3, and outsourced in 4.

4.2.1.2 Division of labour

The division of labour concerns the distribution of tasks among employees (task division) and the level of centralisation of control (coordination). High division of labour means employees in a department perform similar tasks, with a centralised control. Low division of labour involves employees handling diverse tasks, allowing for more autonomy at the team and individual levels. We first categorised cases based on their labour division before the implementation of the digital technology. Eight cases had high, process-oriented labour division, mainly in the industrial sector. Three cases in smaller or medium-sized organisations in tertiary or public sectors had lower labour division with a customer-focused team structure. The remaining 11 cases were a mix, with employees combining multiple tasks or roles for workflow efficiency. Digitalisation's impact on labour division varied. In 11 cases, there was an increase in labour division, especially in small companies, with a shift from execution to planning, leading to uniform procedures, and devaluing craftsmanship and knowledge. Seven cases saw a decrease in labour division, dissolving departmental 'silos' and challenging the separation of qualification-based tasks. Four cases showed no significant change. Hierarchical control was highly centralised in three cases, especially in multinational companies. Digitalisation's effect on control was mixed: in nine cases, control became more centralised, while only one case became more decentralised. In three cases, there were conflicting trends with leaders becoming more coach-like, but headquarters gaining more control through data.

4.2.1.3 Human Resources Management

We explored Human Resources Management (HRM) practices, focusing on recruitment, competency management, and disciplinary measures. In recruitment, 20 out of 22 cases required new hires due to digitalisation. In 13 of these, there was a substitution of less digitally adept employees with new staff. Some companies utilised a flexible workforce of temporary workers, which digitalisation made easier to integrate, as tasks became less dependent on product and customer knowledge. For competency management, training was essential in 13 cases to handle new digital work forms. Only 6 cases had explicit company-provided training programs, with the rest leaving employees to seek relevant training, with employers covering costs if necessary. Digitalisation also led to de-skilling in 4 cases, where certain job skills became redundant. Disciplinary measures shifted from visual supervision to measurable targets in 14 cases, sometimes linked to bonuses. In 9 cases, performance evaluations became data-based rather than supervisor assessments. Digitalisation also allowed for greater work flexibility, including remote work, in 9 cases.

4.2.1.4 Social Dialogue

We investigated social dialogue around the introduction of digital technology in companies, focusing on both formal negotiations between employers and unions and informal internal discussions. In the examined cases, union involvement in digital technology implementation is generally limited. In 13 out of 22 cases, there was minimal or no union involvement, especially in smaller companies. In 4 cases, unions were informed but remained unresponsive. However, in 5 cases, unions did play a role, either protesting issues like late communication and hyperconnectivity or assisting employees with task changes, with significant union input in one instance. Employee participation in decision-making was often just being informed about the technology introduction, either before or after the fact. Only in 3 cases was there a limited form of consultation. In a few cases, there was neither social dialogue nor minimal information sharing.

4.2.1.5 Impact on job quality

We explored the consequences of digitalisation on job quality. Per case, only a general assessment was made, while the effects may vary across employee categories. Digitalisation led to increased task standardisation in 14 out of 22 cases. However, in four cases, tasks became less standardised, especially in sectors where creative use of digital technology is part of the job. Autonomy, or the independence in task execution, decreased in 7 cases, particularly in production companies, but increased in 5. Task variety, denoting the extent to which a job involves different activities and skills, grew in 11 cases, and decreased in 4. Support from colleagues or supervisors increased in 7 cases due to enhanced connectivity yet decreased in 5 cases because of reliance on external services and formalised communication. Work pressure escalated in 9 cases, predominantly in smaller companies. Physical strain lessened in 6 cases in sectors like construction and industry. The complexity of work rose in 9 cases and fell in 5, affecting skill development and responsibilities, regardless of sector or

size. Technostress was prominent in 9 cases, mainly in larger companies, caused by formalised communication, constant monitoring, and feelings of being underqualified. Work-life balance improved in 7 cases due to remote work opportunities but worsened in 2 cases due to increased connectivity demands. Subjective well-being, or job satisfaction, decreased in 10 cases, increased in 1, and showed mixed results in 4, influenced by factors such as bore-out, de-skilling, and software dependency. Employment conditions improved in 6 cases, including target-based bonuses. Job security improved in 3 cases, linked to retention strategies in a competitive job market. In 3 cases, tasks were temporarily adjusted for employees struggling with digitalisation.

4.2.1.6 Impact on line managers

We investigated the impact of digitalisation on job content and quality of line managers. In 9 cases, line managers' roles in work assignment and supervision decreased due to digitalisation facilitating direct data communication between management and employees. This led to a loss of power and status for line managers, through increased digital monitoring, loss of informational advantage, or IT-proficient team members gaining control. In 18 cases, line managers took on additional roles, including financial tasks, quality control, HRM, and scheduling. This was more prominent in production companies and varied in the tertiary sector. Line managers also adopted IT coaching roles in 18 cases. Their new responsibilities include assisting employees with lower digital skills and enhancing digital communication. Work pressure for line managers decreased in only 4 cases. In 13 cases, pressure increased not due to more work but because of higher responsibility and handling system or staff errors.

4.2.1.7 The mediating role of the division of labour

Given the background hypothesis of this study, we also examined whether the influence of digitalisation on the content and quality of work is mediated by the degree of division of labour and the extent to which division of labour is influenced by digitalisation. We examined this mediating role successively for the influence on the standardisation of (executive) tasks, on the line manager's task package, and on the job quality of employees. The material from the cases allows us to indicate the division of labour both as it was before digitalisation (static) and as it has evolved through/after digitalisation (dynamic). We combined both these conditions to examine where standardisation of tasks occurs most frequently. The data clearly indicated that increased division of labour also leads to increased standardisation of tasks. Regardless of whether the initial division of labour was categorised as high, medium, or low, it was noted that the division of labour could either increase or decrease after digitalisation, influencing the degree of task standardisation accordingly.

Regarding the impact on line managers' tasks, the relationship between digitalisation and changes in the managerial role is less clear. While the data did not conclusively show whether changes in the degree of division of labour due to digitalisation directly affect line managers' tasks, it was evident that under different scenarios of labour division, the role of the line manager could be substantially altered.

Typically, we found that digitalisation can erode traditional managerial responsibilities while simultaneously introducing new functions such as staff oversight and coaching, often resulting in an increased workload for line managers.

In scenarios where there was a high division of labour initially, digitalisation tends to make work less facilitated and less challenging, leading to a more passive work environment. This aligns with concerns about de-skilling and reduced reliance on worker skills. Conversely, in contexts where the division of labour was initially middle to low, digitalisation seems to enhance job facilitation and adjustability while also increasing job requirements, thus leading to more 'active jobs' as classified by Karasek. Notably, these settings often experience an increase in task variety or task enrichment.

Additionally, the cases showed that the division of labour itself is influenced by digitalisation, which further complicates its impact on work. The study observes that both job control and job demand features generally increase, regardless of whether the level of division of labour increases or decreases as a result of digitalisation. However, autonomy and complexity are exceptions, showing no clear trend of increase or decrease with changes in the division of labour. This mixed result suggests a nuanced effect of digitalisation on job characteristics, where the outcome can vary significantly depending on the existing division of labour and how it evolves with technological advancements.

This observation appears to support the prevalent notion that digitalisation generally fosters more active jobs. However, the existence of a high or increasing division of labour can act as a deterrent, potentially leading to a reduction in the richness of job content. Additionally, the data suggest that the division of labour may not be a decisive mediating variable in explaining why job quality improves in some aspects and in some firms but not in others. However, the significant variability among the cases studied could obscure potential explanatory connections.

It should also be noted that the impact of the division of labour might vary significantly based on factors such as the nature of the production process, which can range from standardised and predictable to customised and rapidly evolving, and the technology employed, which can range from simple and straightforward to complex and multifunctional. Future research could benefit from focusing on 'most similar' case studies, examining cases that are closely aligned in terms of product or service type, organisation size, and technology used, but primarily differ in their approaches to the division of labour.

4.2.1.8 Actor-approach

We adopted an actor approach to specifically examine groups of cases that share similarities in their digitalisation management strategies, aiming to uncover deeper insights into how these strategies influence job quality across different contexts. This part shifts focus from the cross-sectional analysis of factors to a more actor-centric examination, specifically exploring the motives and drivers behind the adoption of digital technology in production processes. The analysis primarily considered the role

of management and revealed a consensus across most cases that digital technology is introduced primarily to enhance production efficiency, both qualitatively and quantitatively. However, a successful integration depends on whether the staff are willing and capable of adapting to the new technology, considering factors such as company size, task division, cooperation culture, and the impact of the technology on the work itself. Ideally, this would involve not just management but also a representative survey of employees to gauge their readiness and potential resistance to changes.

Three distinct patterns of management action in the integration of digital technology emerged from the cases:

- A rapid and comprehensive introduction often mandated by higher decision-making authorities, such as multinational groups, where management is compelled to implement organisational and job content changes regardless of employee attitudes.
- A dialogue-driven approach where the adoption of digital tools is influenced by input from the shop floor, facilitated by a decentralised work organisation, an existing pro-digital culture, or a participatory consultation culture.
- An intermediate strategy where digital technology is introduced incrementally, requiring management to experiment with adjustments in organisation, job design, training, and disciplining.

Employees' reactions to these strategies vary: they might participate actively in the selection and implementation of new technology, adapt cooperatively to changes in job content through training, seek employment elsewhere, or resist the changes and refuse to work in the new digital paradigm.

The impact of digital technology extends beyond production and executive departments, affecting other areas such as the IT department, which often assumes a more central role, and line managers, whose task scope and power positions may be redefined.

This actor-centric approach in the report further explored these three management strategies to provide a deeper understanding of their implications for digital technology integration in organisational settings.

- In five companies, digitalisation was implemented rapidly, top-down, focusing on integrating central digital systems such as ERP, MES, or ATS. This approach affected task division, increasing it in two cases and decreasing it in three to enhance cross-departmental integration and potentially broaden tasks, while significantly bolstering IT departments. The transition, however, led to notable disruptions in production and labour processes, primarily due to the unpreparedness of some employees. Rather than retraining existing employees, companies opted to hire new, digitally skilled staff, resulting in high turnover and an erosion of traditional skills. This led to a split among employees between those who adapted well and those who struggled with increased workloads and decreased informal communication. Overall, the quality of work decreased, turnover remained high, and in three cases, trade unions

intervened to protect job security and working conditions, ensuring that some workers could continue their old tasks while they acquired necessary digital skills.

- Two online platform companies, as well as two cases from the knowledge sector, all were characterised by substantial support for digitalisation. The support is more pronounced in the online companies, where services are entirely digital, compared to the other two where digital data flow aids service delivery. These firms have a low or reduced task division to facilitate rapid data flow, supported by their smaller size and flatter hierarchies. Despite avoiding task standardisation, digitalisation has increased task variation, which in turn has led to challenges such as digital stimulus overload and high levels of technostress in employees. When digital technologies were introduced, neither unions nor line managers played a significant role; instead, these companies focused on recruiting digital natives or enthusiasts. This emphasis on recruitment over training existing staff suggests a preference for digital proficiency but may negatively impact the sense of belonging among employees. This scenario highlights that while digitalisation can enhance operational flexibility and offer advantages, it also presents significant challenges and does not automatically represent an ideal approach.
- The remaining 13 cases across various industries illustrate incremental digitalisation, driven not by a top-down mandate or a strong digital-first culture but by competitive pressures for cost savings and efficiency. Digital tools are adopted progressively, starting with those expected to yield the greatest efficiency improvements, and expanding to other areas. This shift often leads to increased division of labour (in 10 cases) and greater standardisation of tasks (in 11 cases). Resistance, particularly from older employees, was evident in six cases, reflecting challenges in integrating digital tools into everyday routines. These companies struggled to balance productivity demands with employee acceptance, often resorting to stricter discipline via digital monitoring (in seven cases) and focusing on recruitment, sometimes at the expense of existing staff (in 11 cases). Training was secondary, with informal learning and task rotation noted in just four cases. Notable strategies to foster digital adoption included creating new HRM functions, using bonuses to encourage digital engagement in the financial sector, and promoting mutual aid for digital skills in distribution. Meanwhile, two day-care centres faced increased workloads by maintaining both digital and analogue systems, highlighting the diverse and complex nature of digital transitions in different organisational contexts.

Digitalisation is often viewed as a neutral and beneficial process, but real-world experiences in various companies indicate a more complex reality. Management's role is crucial in shaping how digitalisation impacts the workplace, influenced by factors like strategic decision-making proximity, customer and external expectations, employee skills and preferences, and the availability of digital tools. These factors can limit management's actions but also guide them in aligning digitalisation with business goals. Companies typically adopt one of three digitalisation approaches: top-down, bottom-up, or incremental, each with unique outcomes and variations. Effective management teams adapt their strategies based on ongoing insights and changing conditions to optimise digital integration. Other stakeholders, such as HRM and line managers, although playing smaller roles, significantly affect

certain employee groups. HRM policies often mirror corporate culture, focusing either on recruiting external digital skills or fostering internal development. These policies generally emphasise strict discipline and monitoring over developmental competency management. Line managers sometimes have to balance supportive and disciplinary roles, while trade unions may advocate for more gradual digital adoption for older workers, although they traditionally focus less on digital issues. Overall, there is an opportunity for companies to better utilise the various drivers of employment relationships to engage all stakeholders more effectively in ensuring sustainable, quality jobs as digital transformation progresses.

4.2.1.9 Quality of work and digitalisation: enabling elements

Digitalisation, often viewed as a neutral process, in reality presents various complexities and challenges across different companies, revealing that its impact is far from uniformly positive. The case studies illustrate varying approaches to digitalisation—top-down, bottom-up, and incremental—each with its own set of implications for the workplace. These cases show that management's strategies, influenced by factors such as organisational structure, customer expectations, and staff skills, significantly shape how digitalisation is implemented and experienced.

Examples from specific cases highlight both positive and negative outcomes:

- An online platform saw a reduction in labour division and increased task variety but also increased workload and overstimulation.
- A bank experienced less siloing and more learning opportunities yet had to hire externally due to skill gaps.
- A retail company approached digitalisation as a team but ultimately saw a shift in job significance from execution to planning.
- A manufacturing firm broke down silos and introduced training, but jobs suffered in autonomy, support, and work-life balance.

These instances underscore that while certain elements like limited labour division and decentralised management can foster positive change, digitalisation can also exacerbate job impoverishment, increase technostress, and lead to skill mismatches. The involvement of various stakeholders – HRM, line managers, and trade unions – can mitigate some negative impacts by promoting tolerance for adaptation speeds, especially among older workers, and by managing the integration of digital tools to prevent them from becoming oppressive.

Moreover, the cases reveal a dynamic of potential conflict where the interests of different workplace actors might not align, creating a perception of winners and losers. For example, gains in efficiency might come at the expense of employee autonomy and satisfaction. Addressing these issues requires a comprehensive approach that includes competence management to prevent de-skilling, support for informal communication, and a sustainable use of digital tools that considers long-term employee engagement over short-term gains.

Ultimately, embracing digitalisation also means acknowledging and preparing for its continuous and evolving nature. It involves adapting not just workplace practices but also broader educational and union activities to better align with these digital shifts. This comprehensive approach aims to balance productivity, innovation, and worker well-being in a way that avoids zero-sum outcomes and fosters an inclusive, supportive work environment.

4.2.2 Main conclusions

Five main conclusions can be drawn from this study.

1. The work organisation creates the context which shapes the outcomes of the digital transformation. Technological innovation should be part of a broader workplace innovation approach.
2. There is no technological innovation without organisational change. If you are not careful, technological changes can unintentionally affect business processes and jobs, increasing levels of task division between workers, making their work less varied and more monotonous.
3. HR-related measures seem to remain underused, highlighting the need for more competence management and employee participation in times of digital transformation.
4. There is no one-size-fits-all solution that works for every organisation. Depending on the organisational context, management strategies, and related job quality risks and opportunities, different measures are needed.
5. Digital transformation is not a neutral process: conflicting interests require an understanding of different perspectives and moving towards a common narrative through consultation and adjusting strategies. A strong input from workers and trade unions is crucial. Their active participation not only ensures broadly supported changes, but also guarantees that job quality receives as much attention as the performance of the organisation.

The use of any technology can turn out both positively and negatively. No matter how smart, technology remains a tool. Ultimately, the way we use and implement technology is decisive. To make technological innovation a success, it is essential to simultaneously innovate your work organisation and develop an adapted HR policy with strong employee participation.

4.2.3 Recommendations and policy lessons

Based on the WP2 results and conclusions, we formulate the following recommendations and policy lessons.

1. Integrative approach to technological and organisational change
    - Embrace holistic innovation: Ensure that technological innovations are integrated with organisational changes. This dual approach prevents technological advancements from unintentionally making work monotonous and less varied due to increased task division.
    - Customise solutions: Recognise that there is no one-size-fits-all solution in digital transformation. Tailor strategies to fit the specific context of the organisation, considering its size, sector, and existing work culture.
2. Management Strategies and Work Environment
    - Foster flexibility and decentralisation: Promote a flexible work culture that supports quick decision-making and adaptability. Encourage decentralisation to foster innovation and better manage change.
    - Support from management: Equip managers with the tools and training necessary to transition from traditional supervisory roles to more supportive, coaching-oriented responsibilities.
3. Employee involvement and HR practices
    - Enhance employee participation: Increase employee involvement in the digital transformation process to ensure that changes are broadly supported, and that job quality is maintained alongside organisational performance.
    - Competence management: Invest in comprehensive training and development programs to help employees adapt to new technologies and prevent de-skilling. This includes promoting continuous learning and adaptation as core skills.
    - Adaptive HR policies: Develop HR policies that support the acquisition of digital skills, either through hiring or training, and that promote job security and employee well-being.
4. Social dialogue and labour relations
    - Strengthen social dialogue: Enhance formal and informal negotiations and consultations with trade unions and employee groups to address concerns about digitalisation's impact on work conditions and job security.
    - Union involvement: Encourage trade unions to actively participate in digital transformation discussions, ensuring that their input helps shape strategies that are favourable to both employees and management.
5. Policy implications and broader engagement
    - Develop inclusive policies: Policymakers should consider creating frameworks that encourage companies to pursue digital transformation in ways that do not compromise job quality. This includes regulations that promote fair labour practices and prevent discrimination or inequality in the digitalised workplace.

- Community and educational role: Strengthen the connection between educational institutions and the business sector to ensure that curriculums align closely with the evolving needs of the digital economy. Encourage lifelong learning and re-skilling among the workforce.

6. Continuous monitoring and adaptation
    - Implement feedback mechanisms: Establish systems to continuously monitor the impact of digital technologies on job quality and organisational performance. Use insights gained to refine strategies and practices.
    - Prepare for ongoing change: Recognise that digital transformation is a continuous process. Organisations should remain agile, ready to adapt strategies in response to new technologies and market changes.

4.3 Digitalisation and changing occupations (WP3)

4.3.1 Results

After presenting the main digital tools used by occupations, our analysis provides evidence on how digitalisation affects i) work content (changing tasks, complexity, fragmentation, role clarity, flexibility, and workload); ii) perception of control (autonomy, control, and evaluation); iii) relation to time (work pace and predictability); iv) effective uses of digital tools and perceptions; and v) skills.

4.3.1.1 Main uses of digital tools

Middle and R&D managers primarily utilize tracking technologies for monitoring people and objects, alongside automation technologies for data mining, project management, calculation, and measurement. Collaboration tools are also essential for coordination and remote meetings. Assembly-line workers predominantly rely on automation tools for regulating quality standards and transportation, as well as tracking technologies for inventory management and process monitoring. Customer advisors and recruiters utilize automation and collaboration technologies in similar proportions, empowering them to efficiently handle job-matching data, operational tasks, and client interactions.

4.3.1.2 Changes in work content

Digitalisation significantly impacts the content of work across all studied occupations. Middle managers experience more digital and faster tasks due to collaboration tools but also increased complexity and workload from automation. R&D managers benefit from collaboration tools for remote work, altering communication and project management, while automation shifts focus towards modelling and data analysis. Assembly-line workers face less administrative and routine-based tasks but encounter increased data coding and repetitiveness. Customer advisors outsource tasks to chatbots, but digitalisation amplifies error-checking duties. Recruiters delegate administrative tasks but face higher standardisation and fragmentation levels due to multiple tools.

As regards *complexity*, we observe that Middle managers deal with more stages and cognitive tasks due to automation. For R&D managers, collaboration technologies generate confusion due to the emergence of unstructured shared workspaces and additional reporting from tracking tools. For assembly-line workers, certain procedures reduce task complexity, thanks to new methods and interfaces workers had to learn and get used to ('*it was always necessary to output a line to be able to be up to date to have a truly regular follow-up of the documents, […] whereas now, everything is digitalized, and it is already entered in the files*' [ALW04]). Tasks for customer advisors become more commercial-oriented and focus on more complex cases mobilizing expertise and advice skills, outsourcing simple tasks to clients or administrative support personnel. Thanks to automation tools, recruiters handle more complex tasks with fewer administrative and low-added-value duties. Overall,

they experience a standardisation of processes and information, now easier to share and compare, but a higher number of platforms and tools to handle (‘*the tool supports us in this interchangeability to the extent that as it standardizes both processes and practices, it makes it possible to smooth out the methods of each, to direct them to a single practice which is dictated and decided thanks to the system and therefore it is much easier to be interchangeable’* [RE18]).

Digitalisation leads to higher ***fragmentation*** across all occupations. Middle managers find tasks more fragmented, while assembly-line workers face increased repetitiveness. Customer advisors struggle with constant adaptation to various tasks and interfaces. Recruiters face higher fragmentation due to multiple platforms (‘*Ultimately these tasks have multiplied, so ultimately it’s doing the same task but on different platforms, and what's more the platforms are not the same, so it takes a lot of time’* [RE03]).

The introduction of digital tools also has effects on ***role clarity***. Middle managers adopt a supporting role with empowered teams, while R&D managers need effective leadership for remote work due to collaboration technologies. For assembly-line workers, we observe the now prevailing role of IT technicians in day-to-day operations and in case of problems. Customer advisors face conflicting roles of client service and commercial objectives. Additionally, there appears to be a strong contradiction between the official speech surrounding digitalisation (‘we need to focus on the clients’, ‘we want to ensure the well-being of workers’) and the actual motive behind it (namely, reducing costs). Similarly, recruiters perceive their role to have become more commercial, proactive, and present on social networks. Their role of attracting candidates who are difficult to find in a tight job market sometimes clashes with the need to adapt to certain target audiences and the concern about the digital divide.

Some digital tools also make tasks more ***flexible***. For middle managers, collaboration tools enable them to work from home, leading to more flexibility in schedules, better coordination, and higher levels of organisation. R&D managers also experience a higher degree of freedom and flexibility in their work organisation and schedule. Customer advisors need to be flexible in the way in which they interact with digital tools. In case of failure, they need to be able to adapt, find solutions, and sometimes go back to manual practices (‘*If the client tells me “I can never send this mail, these links never work for me”, I move away from this technology a little and I say to him “Maybe it’s simpler if we send everything back by post*”?’ [CA12]). Recruiters gain flexibility through remote meetings and interviews.

Finally, as regards ***workload***, we observe that for middle managers workload has increased either due to automation technologies, which fasten the processes and allow for higher productivity (‘*even if the tools have facilitated the tasks, there are always other tasks, so the time saved is used for other things*’ [site manager, 32]) or because of the need to spend more hours working to get the same result due to technology-related issues or coordination problems across teams. For R&D managers, collaboration technologies lead to higher complexity and workload. Automation tools, on the contrary, allow them to reduce their workload. Assembly-line workers face an intensification of work, especially in big assembly lines, because of an increase in the workload, especially during tool malfunction, workers

must go back to the manual procedure, causing a heavier workload as the workforce has been reduced. Customer advisors face intensified work with more quantified objectives in a competitive environment. Recruiters experience workload reduction from automation tools: fewer messages and document sending or encoding are necessary thanks to the automation of recruitment schedules.

4.3.1.3 Perception of control

TABLE XII hereunder displays the forms of control exercised through technologies, and the effects these have on workers' perceived autonomy. This dimension also has implications for the performance evaluation methods to which they are subjected, whether intentionally adopted or implemented for accountability or quality, particularly in the context of managerial functions. Consequently, middle managers and R&D managers experience heightened autonomy, as the responsibility of monitoring their teams is partly delegated to these technologies, allowing them to reallocate their time to other tasks. They also admit that employees get *"a bit of a Big Brother feeling*" (MM07).

Apart from the surveillance of their activities, assembly line workers are additionally subjected to a secondary form of peer control. Nevertheless, it doesn't necessarily imply changes in the perceived autonomy since this control is performed by technologies and less by direct superiors on site. Additional implicit control is manifested through the continual dissemination of information related to performance and productivity targets across the organisation, facilitated by collaboration technologies. Younger workers, especially those in a more precarious employment situation (e.g. temporary workers), are said to be more sensitive to those techniques because they still have to prove themselves: "*They've entered the 'race for jobs', either as temporary workers or on fixed-term contracts, and so they're used to reacting to these performance indicators (...) they're chasing figures, basically. Always being positive, always being in the green*" (ALW10, pharmaceutics).

Lastly, customer advisors and recruiters experience heightened control due to increased visibility of their activities, now monitored through data generated by the technologies employed for organizing and executing their tasks. One recruiter gives some details: "*We can find out how many minutes a day, consultants are on the phone, how many CVs they send out, how many candidates they see, whether they are using H-Interview properly, how many times they have used it, for how long, how many videos they have recorded, so these are all things we can monitor*" (RE14). Nevertheless, they perceive these technologies as affording greater autonomy by enabling remote work and facilitating self-organisation of their tasks. These perceptions appear therefore in a tension.

The digitisation of control methods in workplaces raises HR concerns regarding worker ***evaluation***. Tools and data generated by digitisation provide additional inputs, particularly quantitative, for assessing performance. For instance, an R&D manager notes that these tools can quantify task completion, making evaluations more objective. Similarly, customer advisors and recruiters have their interactions with customers or candidates factored into their evaluations, increasing pressure on

workers. For example, customer advisors are evaluated based on customer satisfaction surveys, adding pressure to meet numerical targets.

TABLE XII. Perception of control and autonomy, by occupation

MM	RD	ALW	CA	RE
Control				
Tracking technologies lead to easier, more frequent monitoring and more detailed monitoring of both products and people in the company	Tracking features, not intended to be used for performance reviews but rather increasing self-responsiveness	Tracking technologies: increased control, leaving workers less room for manoeuvre. Prevents workers from delivering a product that does not comply with quality standards Collaboration: Omnipresence of screens displaying daily objectives, performance and information on the production process, encouraging self-control among workers	More visibility (through online appointment systems, agenda and status), lead to less direct supervision of managers, but more control through (real-time) remote monitoring and surveillance tools and software	Data generated by digital tools increases the visibility on the tasks carried out by recruiters, and consequently the control of their activity
Autonomy				
Increased autonomy as regards organisation. Progressive disappearance of the original hierarchical structure of companies, leaving space to self-organized teams	Higher flexibility and freedom, allowing them to explore new innovative ideas and work on their own terms. BUT the constant influx of digital interactions and the need for rigorous reporting can sometimes threaten this autonomy	Increased feeling of autonomy when it allows workers to be less dependent on other occupations in the factory BUT limitation of the autonomy by the generalized control (surveillance) performed through digital systems, sometimes underestimated by workers because it is not performed by humans	Collaboration tools (remote work) allowing more autonomy to self-organize work	Collaboration tools (remote work) allowing more autonomy to self-organize work

4.3.1.4 Relation to time

Digital tools affect targeted occupations in their relation to time, their work pace, and their tasks' predictability. Middle managers experience both an increase in workload and time saved thanks to automation making tasks faster, leading sometimes to a feeling of emptiness ('*sometimes [hopes] to have problems, because there are times when it's too quiet, in fact, the day is very long*' [MM, 38]). R&D managers claim that collaboration technologies force round-the-clock availability, while

automation technologies allow for larger amounts of time dedicated to cognitive tasks. For assembly-line workers, automation disrupts the typical allocation of time for various tasks, leading to increased speed and occupation rates. Customer advisors attribute the extension of working hours to collaboration tools, which makes it challenging for them to disconnect. This continuous workflow creates the impression of an endless process. In the case of recruiters, there has been an acceleration of the processes and time savings due to automation tools, especially in the selection process and data management, and to collaboration tools, concerning remote interviews and data sharing (‘*It’s just 1 page that you have to look at and where you can see everything. And that makes things easier’* [RE19]).

Middle managers argue digitalisation has hastened tasks, thereby boosting work efficiency ("*work more efficiently, faster, more thoroughly*" [MM, 41]). R&D managers note meetings occur rapidly, aligning with heightened expectations for responsiveness. Assembly-line workers observe increased work pace and reduced downtime ("*My tasks have accelerated due to these changes; no extra time is allocated*" [ALW01]), necessitating higher productivity standards. Customer advisors perceive accelerated work due to the expectation of instantaneity and availability ("*customers prefer digital communication, expecting access anytime, anywhere*" [CA01]). Recruiters experience a similar trend: heightened expectations from candidates for responsiveness coincide with overall work acceleration facilitated by automation and collaboration tools (e.g., videoconference interviews reducing travel times).

Finally, as regards ***predictability***, middle managers think digitalisation has made it easier to predict tasks or even to estimate and anticipate future workload. Assembly-line workers are better able to visualize the incoming workload. However, in case of malfunctions, they must adapt the procedures and highly depend on technicians. As regards customer advisors, the ‘by appointment only’ policies and the online screening of clients’ demands lead to higher levels of predictability in tasks, but malfunctions and the constant changes in methods and tools can also make them less predictable. The same applies to recruiters, who experience an increasing number of interruptions and changes in priorities, making day-to-day tasks less predictable (‘*we add a layer with this multitude of tasks. We are constantly interrupted in our work*’ [RE03]).

4.3.1.5 Effective technology uses

We observe differences between what the finalities and prescribed uses of technologies are, and what the effective uses are: individuals utilize technological infrastructure to shape a viewpoint, indicating that technology may either hinder their ability to achieve goals or present an opportunity for accomplishment. The uses vary according to the occupations and following the category of technologies and their perceptions.

For middle and R&D managers, compliance with the protocol is predominantly observed. Their practical utilisation of tracking and collaboration tools aligns with the prescribed scripts, as the rationalities of these actors do not conflict with the tools, or because they perceive no fundamental

change in work. Indeed, these tools serve as valuable aids, enhancing managers' efficiency without supplanting their pivotal roles. While prioritizing the indispensable human aspect of their duties, these professionals recognize the role of digital tools in streamlining specific processes. As stated by a middle manager: '*the human aspect cannot be underestimated', especially 'empathy, and motivation', which are very important qualities in management*" (MM07).

Assembly line workers express mixed sentiments: they acknowledge the benefits of automation in reducing physically taxing tasks, yet they harbour concerns about job displacement by machines. This apprehension underscores the recognition of humans' indispensability for complex tasks requiring specific skills, such as perception, manipulation, or access to difficult-to-reach areas. Additionally, workers note the increased workload due to certain procedures, occasionally leading to shortcuts to save time. A worker explains: "*Sometimes we have to fuss a little. In the case of certain revisions, for example, usually the draftsman sends it back for cutting, and then I have to reprogram it, which involves reserving material, re-encoding a time, and so on. But sometimes, in fact, we simply take the piece again; sometimes a hole is missing (...) we won't reuse material, we'll just put the piece back and redo the hole. But then, if they put it back into the [software], I must reserve material that doesn't exist, that isn't used. So sometimes, we place it "informally" (...) I create a small program without going through the [software] because it's faster. There are so many special cases that it would be complicated to encode them all*. "(ALW02) However, these deviations often necessitate justification, ultimately resulting in an increased workload. This leads to a narrowing of their manoeuvring space in task execution, constrained by the automation of these processes.

Finally, customer advisors and recruiters may deviate from the prescribed uses of both collaboration and automation technologies. Concerning collaboration technologies, deviations from prescribed procedures are observable when customer advisors interact with clients, particularly when clients are unwilling or unable to use digital channels. This leads to advisors assuming their counselling role differently than anticipated by the inherent nature of the digital tool. Moreover, while company directives lean towards extensive technology usage and maintaining quality relationships with customers, there exists a paradoxical directive perceived by customer advisors regarding the use of digital tools, as illustrated by the following quote: "*What the customer can do, in technical terms, remotely, we have to push to get it through there, which is extremely uncomfortable (...) because you know you're sawing off the branch you're sitting on. The decline in the number of agencies over the last few months has been staggering. (...) we're no longer in the service and advice business, we're purely and simply in the sales business*" (CA05).

Similar dynamics apply to recruiters who may opt to bypass collaboration tools or diverge from parts of the automated process to align with their targeted audience. Their explicit defence of human and non-fully technological relationships with clients and applicants, coupled with concerns about the digital divide, reflects a group-oriented perspective on digitalisation. In general, these two occupations exhibit a certain scepticism towards data-driven decision-making and adopt a defensive stance towards technologies perceived as a threat to their profession in the way they conceive it in interaction

with the end consumer. Beyond concerns about data security, their primary apprehension revolves around the risk of dehumanisation in their professions. Finally, recruiters tend to misuse or 'circumvent' specific automation tools or functionalities, seeking increased flexibility in the selection and recruitment process. These rationalities aim to tailor the tools to their priorities and the specificities of each recruitment process, attempting to avoid standardisation of these processes and, by extension, their approach to the candidates themselves.

4.3.1.6 Skills development and needs

In the realm of training and skills development, there is a noticeable lack of investment across various occupations. The predominant approach involves self-training through online resources or learning-by-doing methods. However, there is a growing demand for specialized skills, particularly in utilizing digital tools. Professionals, apart from R&D managers who emphasize participatory approaches, exhibit limited engagement in digital tool utilisation. This contrasts with emerging roles like "digital experts" or "technical coaches" that aid in technology adoption among workers and clients. IT support is often partially outsourced abroad, meaning that in case of a problem, workers are sometimes dealing with people from different contexts and with different qualifications. Middle managers highlight the absence of substantial training investments by their companies. Learning predominantly occurs through team interactions facilitated by collaboration technologies, with individual opportunities often being generic and online-based. The evolving landscape necessitates the development of 'soft skills' and their adaptation to digital formats, especially for remote interactions like virtual meetings.

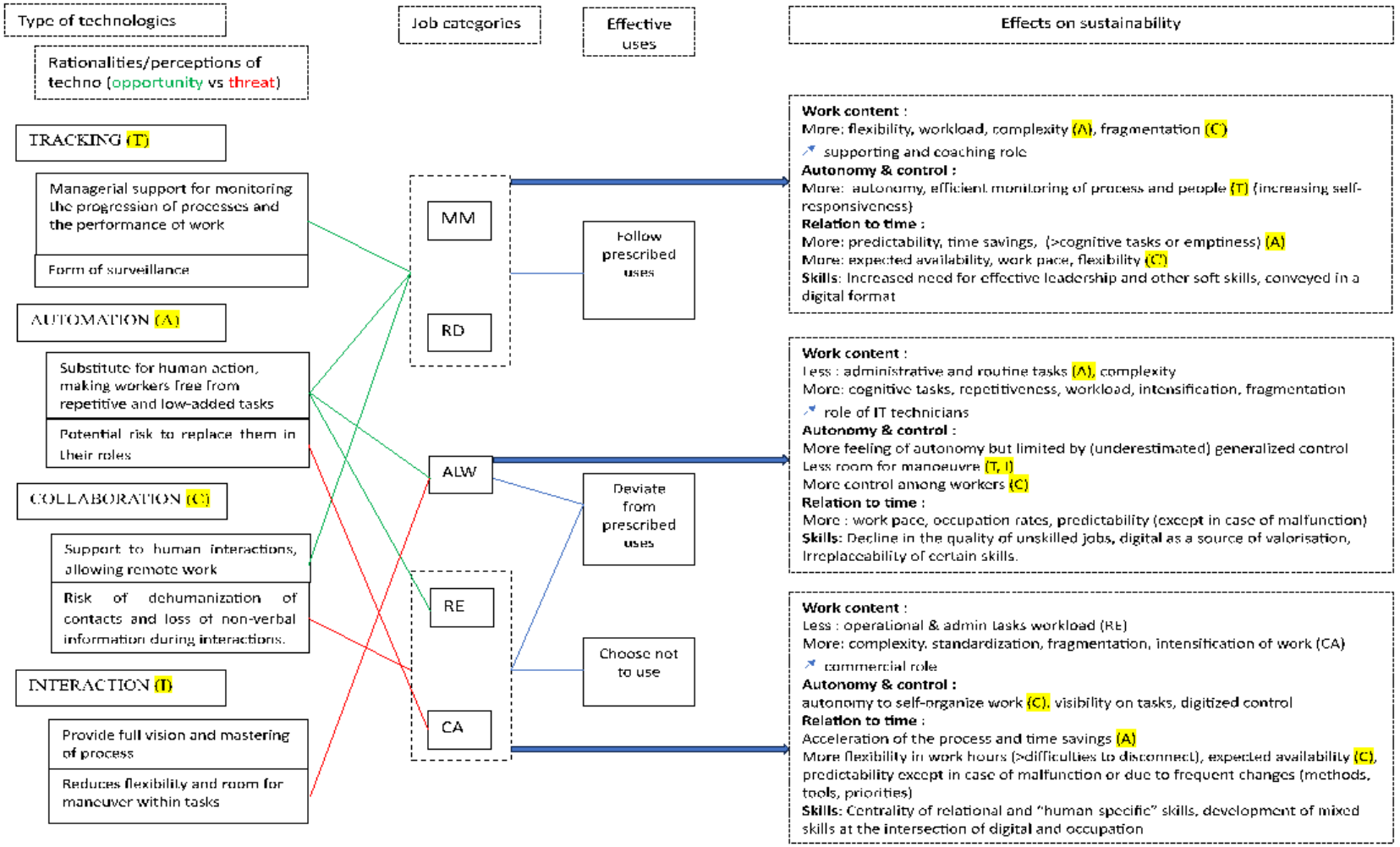
Technological advancements have prompted managers to enhance communication and organisational skills while also acquiring digital and technical competencies, facilitating collaboration with machines and software. Rather than entirely new skills, the trend leans towards refining existing competencies in the digital age. For managerial roles focused on interpersonal skills, the shift is less pronounced compared to roles requiring technical expertise.

Assembly line workers face challenges with the integration of digital tools, leading to concerns about job quality and insufficient training opportunities. Older employees may struggle with technological interfaces, emphasizing the need for personalized training approaches within smaller enterprises. Despite challenges, digital tools offer opportunities for skill development and job enrichment through a hands-on learning approach. The acquisition of advanced technological competencies may, in turn, catalyse the formulation of novel training initiatives within corporate settings. In industries like pharmaceuticals and automotive sectors, automation tools mitigate errors and emphasize product quality. However, there is a shift towards recruiting highly skilled professionals with advanced digital competencies. Educational qualifications have become more critical, alongside technical skills, leading to an increase in IT and office-based roles.

Customer advisors and recruiters express a need for a deep cognitive understanding of digital tools to enhance their job performance amidst digitalisation. They emphasize maintaining human-centric aspects in their roles to avoid dehumanisation, highlighting the importance of face-to-face interactions. Concerns about automation replacing their roles drive them to develop expertise in managing complex tasks and offering specialized services. The evolving landscape requires specific skills at the intersection of business acumen and digital proficiency for customer advisors and recruiters. These include understanding digital tools, and data protection regulations, interpreting data effectively, and adapting to evolving technology trends. Regular skill updates are crucial due to the dynamic nature of technology and the diverse range of tools in use.

The diagram below (Figure 6) summarises the relationships between the main variables. The green arrows indicate the perception of technology as an opportunity, while the red arrows indicate the perception of technology as a threat (for the occupation in the way that the actors see it).

Figure 6. Relationships between the main variables



4.3.2 Main conclusions

Our results present contrasting perspectives on the rationales of actors in response to the rationales assigned to various technologies implemented in their work. While the changes experienced by middle managers and R&D managers appear to be of limited scope, with technologies being perceived as tools supporting process efficiency not fundamentally transforming the work and role of these actors, the reality is quite different for assembly line workers, recruiters, and customer advisors. For these three job categories, digitalisation resembles more an intensification of control over their work performance, as well as a risk in terms of potential substitution by machines for a fundamental part of their work, and deskilling (for assembly line workers). In this scenario, the rationales of the actors, displayed in their actual use of technologies, involving the adoption of off-script practices, or choosing not to use them as intended by the company, align more closely with coping strategies and, in some cases, resistance. These strategies aim to regain control over their workload or work pace, particularly for assembly line workers, or to preserve the quality of the relationship with their end customers. These strategies are notably driven by a concern for the risk of the digital divide, particularly for recruiters and customer advisors. Our results highlight the significance of context in explaining variations in technologies and how people respond to them. This considerable complexity depends on various factors: the types of technologies introduced, and the rationales associated with them, both by the company and the actors. Professionals' utilisation of technology is markedly shaped by their interpretations of it. The adoption of unscripted uses, and at times, the deliberate deviation from prescribed uses or abstention from using technologies, closely resembles coping strategies. When implemented, these strategies aim at safeguarding a profession or practices perceived to be under threat by this digital evolution.

The challenges, obstacles, and opportunities posed by digitisation in the context of sustainable careers vary across the analysed job categories. In terms of complexity, the higher mental charge and potential conflicts are compensated by enriching cognitive tasks, where employees experience satisfaction in resolving problems and using new skills. As regards connection, the risks brought by digitalisation include a loss of hierarchy, responsibility, structure, and purpose as employees tend to not always know what they are supposed to do and how. On the other hand, for some, it may increase role clarity as technologies help keep track of tasks and performance, as well as increase organisational efficiency. Going back to socio-materiality, tracking technologies may create opportunities for people management but also risks losing human interactions while increasing pressure on employees.

Another risk is associated with employees' growing reliance on technology to execute their tasks. This dependency can manifest as a source of stress and anxiety when faced with unavailability due to technical issues or difficulties encountered during usage, as well as when the problems encountered by the workers can only be solved by technicians, which can also cause frustration depending on other actors. This risk highlights the potential implications of such technological reliance and warrants further consideration in the context of workforce well-being and performance. This also connects to the transformation of the workplace, which creates unrealistic expectations of instantaneity and

availability, affecting employees' ability to remain focused, as well as creating feelings of obsoleteness. Associated with obsoleteness is the age gap present in a company. Overall, we observe both positive and negative aspects linked to flexibility, especially concerning their relation to time and to the control they perceive in their work. Techno-dependency affects all categories depending on their tasks. On this subject, a fear of substitution is generated for recruiters and customer advisors, specifically when the human-machine relationship becomes threatening. As regards task complexity, technologies allow one to focus on more complex tasks, while the simpler ones can be entrusted to machines, support staff, or outsourced to the customer (in the case of customer advisors) or the candidates (in the case of recruiters). As regards monitoring and evaluation, these processes are partly entrusted to machines, including the monitoring of activity data, or clients in the case of customer advisors via feedback on social media. As regards training and skills development, these usually occur voluntarily. While technologies are progressively introduced, training programs remain limited, digital, and general, causing employees to misunderstand the effective use of certain technologies, as well as require assistance from the higher profiles where possible. In other words, the analysis shows that training programs are not provided in adequate quantity and quality.

4.3.3 Recommendations and policy lessons

Based on our results, we recommend the following actions. First, to ensure that the expected and effective use of technologies coincides, it is necessary to provide employees with *ad hoc* training. This training should be designed according to the needs of both the profile of the worker and the sector of reference and type of technology used. What emerges from our analysis is that the difficulty in complying with the adequate use of the technology, and consequently the rise in dissatisfaction or inefficiency at work, is proportional to the low range of training programs offered and the lack of incentives to take part in them. In connection with this, companies looking for higher-skilled profiles should be prepared to invest more significantly in training programs. From a more general and policy perspective, regional policymakers in Belgium should shift their focus on active labour market policy investment to guarantee that their companies' workforce is prepared to use technologies via skills development and human capital investment, as well as aware of the changes in ways of working and organising work due to the new techno-economic paradigms brought by the technologies.

In connection with this, further attention should be brought to labour market institutions and other stakeholders interested in the impact of digitalisation. What emerges from our analysis is a relatively low level of trade union involvement in discussions on the introduction or development of digital tools. In this regard, we recommend policymakers enhance a social dialogue that comprises parties both in favour and against technologies to reach an agreement that benefits firms, employees, and society more in general. While skills development is crucial to enhancing productivity and understanding of the technology, attention should be paid to the mental and physical consequences of introducing digital tools abruptly or without the necessary forms of support, including social support. While, in most cases, employees were able to voice their doubts and questions thanks to the increase in meetings and forms of communication, we believe more space should be granted to employees and

their representatives to answer their specific needs in terms of quality of working life. As such, the role of trade unions may need to be reconsidered at the company level. The dialogue between labour market institutions and economic agents should be promoted also to account for the risks brought by digitalisation concerning the sustainability of certain job profiles.

Finally, while companies welcome digitalisation to stay competitive in their markets, our transversal analysis shows that all our targeted occupations insist on maintaining a certain level of human component in their work. This was particularly evident for those working closely with end customers, such as recruiters and customer advisors. Indeed, in addition to being concerned about the threats posed by digitalisation to their relationship with customers and candidates, as well as how the digital divide may affect them, advisors and recruiters also care deeply about their category being replaced. In the case of managers, instead, the lack of a direct link with the external world allows for a more individual-oriented perspective on digital tools and their use. In this sense, managers only need to worry about the threats they may experience at the individual level, such as how their tasks will be affected by the introduction of digital tools, or how responsibilities towards their staff will increase or decrease. While the risk of being substituted is lower if not inexistent, new issues emerge as tasks are accelerated or taken over by technologies. In parallel, managers take a new coaching role, as they are asked to guide their employees concerning the usage of and problematics linked to digital tools. With new responsibilities and the possibility of emptiness in time usage, there is a new need for managers to justify their role and understand their digital selves. To avoid the emergence of extreme individual-oriented attitudes, where excessive overwork is accompanied by feelings of emptiness, or group-oriented attitudes, where concerns of substitution and digital divide lead to a dismissive or inadequate use of technologies, experts such as occupational psychologists should meet regularly with employees to ensure balance and a ‘re-humanisation’ of work and management.

4.4 Digital platform work as an emerging employment phenomenon (WP4)

In line with the main tasks and work packages involved in work package 4, we present our results by first discussing the socio-demographic, professional and economic profile of platform workers. We then discuss trajectories into and with platform work (adopting a career perspective), and present our results of an-in depth evaluation of the job quality of platform workers in Belgium. We end with a series of main conclusions regarding the research objectives.

4.4.1 The platform landscape and profile of platform workers

In line with work task 4.2., to understand Belgian platform workers' socio-demographic and professional profile, we first sketch a profile of Belgian platform workers according to the four main groups of platform work activities (as identified in the platform work typology), based on (back-end) administrative data provided by ten digital labour platforms.

Urban space workers. The types of work in this category includes food delivery and taxi driving, which are conducted on platforms like Takeaway, Uber (Eats), and/or Deliveroo. From aggregated data of a food delivery platform, we learn that food delivery is a male-dominated platform task (94%). Workers are often younger or middle-aged (36% is between 21-30 years old; 25% is between 31-40 years old). Similarly, aggregated data from a taxi drivers platform illustrates that taxi drivers are also mostly male. Nevertheless, contrary to food delivery workers, their average age is slightly higher (38% is between 30 and 39 years old). Remarkable is that a large portion of taxi drivers (43%) hold a degree in higher education. Examining the survey results, where both types of work are considered together (N=185), we confirm the findings on gender (80% male), age (the age group most represented (37%) is 26 to 35 years old), and education (50% holds a higher education degree). Moreover, the survey reveals that 33% of **urban space platform workers** are migrants, with 73% of them having migrated from outside of Europe.

On-site (household) workers, mostly – but not exclusively – work in customers' homes and includes chore and care work incl. manual handiwork and pet sitting, household tasks, babysitting and childcare-related tasks, tutoring, and tasks related to the events' sector. Digital labour platforms which arrange such tasks are Bsit, Yoopies, Yoojo, Pawshake, Ringtwice etc. Administrative data from platforms show us that *tutoring* activities through labour platforms are rather equally conducted by men and women (54% is female). Many of the tutors are young (75% are between 19 and 35), and they are generally well-educated (96% have an academic bachelor or higher). *Babysitting* was almost exclusively done by female workers (90%) and by younger individuals (av. age 24 years old) who were still completing their studies. On the contrary, *chore work* was mostly executed by men (68%) of slightly older age (av. age 38 years old). Looking at the 134 **on-site (household) workers** in our survey, the gender distribution is more balanced (60% male). Their mean age is 47 years old with 46% being older than 50 and 26% younger than 34. Qualification levels are generally high (60% have a higher education degree) and 14% have a migration background – albeit mostly from neighbouring countries (47% of them migrated from outside of Europe).

Microtask workers. Online platforms mainly offer services that can be carried out remotely and online. They can include 'microtasking' and 'freelancing' platforms. Microtask workers generally conduct small, short, or low-skilled tasks such as answering a questionnaire, verifying web information, contributing to AI dataset development etc. Digital labour platforms that organise such tasks in Belgium are Clickworker (Microsoft UHRS) and Prolific. With few administrative and survey data (N=17) to go on from, we cautiously conclude that microtask workers are often male (70%), middle-aged (av. age 34 years old), higher educated (64%) and don't often have a migration background (12%).

Freelancers conduct work tasks arranged by online labour platforms and cover tasks such as administration and customer support, writing and translation, HR, and training, development and IT, design, sales, and marketing etc. Platforms which arrange these services in Belgium are Fiverr, FreelanceNetwork, Freelancer, Upwork, etc. While the administrative information from one professional freelance platform tells us that freelance workers are relatively evenly distributed in gender (55% is male), the survey (N=66) gives us more information on their other characteristics: their average age is 38 years old, 72% of them has a degree in higher education, and 22% has a migration background (but only 33% of them migrated from outside of Europe).

When setting out the Belgian platform landscape, and in particular investigating their socio-demographic and professional profile, the **main conclusion is that there is no such thing as 'the Belgian platform worker'**. Platform workers in Belgium are a heterogeneous group, with varying characteristics within and between platform activities, similar to the distribution in the traditional labour market (in terms of gender distribution for example, this implies care tasks by women, transport-related tasks by men etc.).

TABLE XIII. Socio-demographic characteristics by type of platform work (freq. and column percentages) (SEAD Platform Survey, 2022, N=406).

	On-site		Online		
	Urban space workers	On-site (household) workers	Microtask workers	Freelance workers	Total
Gender					***
Male	146	80	12	33	271
	80%	60%	71%	49%	67%
Female	37	54	5	35	131
	20%	40%	29%	51%	33%
Age					***
Younger than 34	117	35	8	32	192
	64%	26%	47%	47%	48%
Between 34 and 49	53	37	7	19	116
	29%	28%	41%	28%	29%
50 and older	13	62	2	17	94
	7%	46%	12%	25%	23%
Education					***
Primary	38	9	2	4	53
	21%	7%	12%	6%	13%
Secondary	52	44	4	15	115
	29%	34%	24%	22%	29%
Tertiary	90	78	11	49	228
	50%	60%	65%	72%	58%
Migration background					**
Born in Belgium	104	103	13	48	268
	57%	76%	76%	72%	67%
Born in Belgium, parents not	18	13	2	4	37
	10%	10%	12%	6%	9%
Not born in Belgium	59	19	2	15	95
	33%	14%	12%	22%	24%

Note: p-values chi-square test: *** .001; ** .01; * .05

4.4.2 Trajectories into and within platform work – a typology

Below we highlight the principal profiles that emerged from our qualitative data, with findings from the quantitative survey confirming certain trends. They are associated with workers' socio-demographic characteristics, socio-professional trajectories, and different modes of commitment to and level of dependency on platform work. No interviewee considered in isolation corresponds perfectly to one of the profiles, but rather to a combination of profiles. The diversity of situations highlights the different ways in which platform work is integrated into the broader context of individual professional lives and into wider labour market dynamics. These cases illustrate how platform work contributes to a broader tendency of job fragmentation, and also challenges narratives that depict platform work primarily as voluntary, flexible work or as a stepping stone to enter the labour market more durably.

4.4.2.1 Platform work as a supplementary income

Platform work is perceived by many as an activity "on the side", supplementing income from a main job, from replacement income, or as one part of a range of insecure or precarious jobs. It can be an essential supplement when other forms of income are not enough to cover expenses, or simply a way of earning “a little extra”, a welcome buffer when living costs are rising. Given the flexible working hours that characterise it, platform work is often easily compatible with the fixed or variable hours of a main job and can also be used as an economic adjustment variable. Indeed, flexibility is the main motivation for engaging in platform work as indicated by the quantitative survey (52% of cases). Earning extra income (40%) and making ends meet (30%) were also among the main motivations.

4.4.2.2 Platform work as a default

In this case, platform work is a main source of income. This is often the case for (recent) migrants who come to Belgium for the purpose of higher education, to join a parent or spouse, to find work, or applying for asylum. Apart from being compatible with day or evening classes, the low entry barriers of platform work may make it the single possible source of income in a situation of severe barriers and discrimination on the labour market (Graham & al., 2017). As confirmed by many studies, personal services, food delivery and personal transport are examples of low-threshold jobs that have become niches for racialized workers who experience barriers to integration into traditional employment (see van Doorn, 2017; Mateescu & Ticona, 2020; Sophie Bernard, 2023b). The quantitative survey showed that “not being able to find another employment” was a motivation to engage in platform work for 19% of the respondents, and that it was especially the case for people who were not born in Belgium.

4.4.2.3 Platform work as a refuge after a biographical upheaval

Several people have turned to platforms in a transitional phase of their life. In this case, there are a variety of different situations, starting with the transition to retirement. Apart from topping up a pension that is deemed insufficient or limited, platform work can in this context be a way of keeping busy, maintaining social connections or a sense of social value. A second type of event is a sick leave due to illness (such as accident or burn-out) for which platform work constitutes a way to slowly re-enter the labour market on one's own terms, to supplement benefits when they are insufficient, or to explore new, more fulfilling work activities (career reorientation). In general, financial profitability is not the primary criterion in these situations, as often there is another source of income.

4.4.2.4 Platform work as a stepping stone for self-employment

By providing instant access to a pool of potential customers, and giving non-professionals access to certain markets, platforms are a source of employment for aspiring self-employed. Indeed, platforms can constitute a means of setting up a self-employed business in the absence of an existing professional network and/or prior experience, and before making investments and taking formal steps. For example, we found that some ‘in-home’ workers doing catering or handiwork were considering the idea of setting up on their own, whereas most of the drivers started their activity with the platforms. The idealisation of independence and entrepreneurship is frequently encountered in interviews, especially with the ‘urban space’ workers, and is often associated with (stereotyped) negative view of

salaried employment. These perceptions are often better understood in relation to their trajectories in the labour market, which can be marked by experiences of prescriptive work organisation, discrimination, marginalisation, exploitation, or precariousness.

4.4.2.5 Platform work as part of a portfolio of employment sources

For some already active self-employed workers, platform work provides an opportunity to broaden their customer base. It is fairly the same principle that also works for personal service providers, like students who usually find babysitting or dog sitting jobs by word of mouth, or for cleaning workers. Another example would be a temporarily unemployed plumber looking to practise while looking for an employment contract in a company, or a freelancer, already used to working with a diversified clientele and looking to expand their customer base by prospecting online. Rather than representing a source of completely new employment opportunities, we see a shifting of providers and clients to the platforms, and vice-versa. Indeed, in quite a lot of cases, workers who found gigs through 'in-home' platforms end up contacting or being contacted by clients directly, thus by-passing the platform. This also puts into perspective the potential of 'formalisation' of undeclared work as a benefit from platform work (Brodersen et al., 2024a).

4.4.3 Job quality in the platform economy

In the following sections, we discuss the job quality of Belgian platform workers by combining quantitative and qualitative evidence. Job quality is usually assessed through two main components: employment quality and intrinsic quality of work (Holman & McClelland, 2011; Muñoz de Bustillo et al., 2011; Wright et al., 2018). Employment quality encompasses contractual terms and conditions (Piasna et al., 2017; Vets et al., 2009; Wright et al., 2018), while intrinsic quality of work refers to the inherent characteristics of job/work tasks (Vets et al., 2009). We begin each section by offering a descriptive overview of results based on the quantitative survey, then we discuss a series of insights that warrant more detailed elaboration based notably on the qualitative analysis.

4.4.3.1 Employment quality of platform work in Belgium: quantitative dimensions

Throughout the quantitative analyses, employment quality was measured using the Employment Precariousness Scale (EPRES) (Vives et al., 2010) which can be adapted to evaluate dimensions such as temporariness, disempowerment, workplace rights, vulnerability, working times, economic sustainability, and employment opportunities for platform workers (Vandevenne & Vanroelen, 2023). To demonstrate ***temporariness*** of platform employment, we analysed employment contracts. We assessed ***disempowerment*** through membership in various types of interest organisations. ***Workplace rights*** were evaluated based on entitlements like paid holidays, benefits, cost contributions and insurance. ***Vulnerability*** was determined by authoritarian platform relationships (incl. abusive treatment or incorrect payment of salary). ***Undesirable working times*** were measured by exposure to unpaid working hours, work during leisure time, and dependency on platform work. ***Economic sustainability*** was gauged by income levels, fringe benefits and reimbursements, and satisfaction with

working hours. Finally, we evaluated ***employment opportunities*** through having received training (for a more detailed explanation on the operationalisation, see Gevaert and Vandevenne (2024)).

Looking at the distribution of the employment quality features among Belgian platform workers, we can conclude that employment quality is a good measure to investigate the varied nature of platform work. Our results show that the dimensions: disempowerment, vulnerability, undesirable working times, and economic unsustainability are subject to wide and considerable variation among platform workers. Other dimensions, like temporariness, lack of workplace rights, and lack of employment opportunities on the other hand are rather skewed with many platform workers reporting to operate under self-employed contracts or without a contract, being not entitled to workplace rights, and not having received training.

Social inequality comes into play when investigating variation in employment quality in platform work as it is often the same groups of people who end up with the least favourable employment quality among platform workers. Particularly, older platform workers, platform workers who aren't active in other labour market activities or unemployed (next to platform work), and platform workers doing microtasks or on-site (household) tasks have poorer employment quality regarding temporariness, disempowerment, lack of workplace rights, and lack of employment opportunities. For economic unsustainability, younger workers are in a poorer situation. Additionally, looking at vulnerability and undesirable working times, younger workers, platform workers who are temporary workers or self-employed in addition to their platform work, and urban space workers seem disadvantaged.

From a sustainability of work perspective, our findings confirm – for the most part – that poor employment quality in platform work correlates with poor health outcomes. This is especially true when looking at mental well-being, as all dimensions of poor employment quality (except 'vulnerability' and 'undesirable working times') positively relate to poor mental well-being. Relationships to self-rated general health and musculoskeletal complaints are less straightforward, showing only rarely statistically significant associations to the employment quality dimensions, and showing a mix between positive and negative associations to certain features of poor employment quality.

In conclusion, our comprehensive analysis across seven dimensions of employment quality in platform work in Belgium underscores the multifaceted nature of the challenges faced by platform workers and highlights considerable disparities across demographic characteristics, with certain groups facing heightened vulnerabilities. They further underlined an important relationship between poor employment quality and poor mental well-being among platform workers.

4.4.3.2 Employment quality of platform work in Belgium: qualitative insights

Employment status and dimensions of precariousness

As highlighted by the quantitative survey, a significant share of platform workers operates under non-standard contracts or without an employment contract. This was also reflected in the qualitative fieldwork. With only one platform employing its workers (directly or via temporary work agencies), the others were either self-employed, and a large portion of the interviewees worked in the framework of the 'collaborative economy' or 'peer-to-peer' (P2P) regime; which has been adopted by a large number of platforms covering a wide range of services, from 'neighbourly' to more professional services, and sometimes services organised on a more industrial scale (approximately 85% of Deliveroo and UberEats couriers, according to union representatives). This regime, however, unlike employment status, does not give workers access to any social security rights nor to labour protections. Moreover, many of them end up working informally, e.g. when they bypass the platform after the matching process, or when they work under the identity of someone else. Nevertheless, we have seen that the work status of platform workers is a controversial issue that has given rise to collective and legal action by workers' collectives and trade unions.

Employment relations and (dis)empowerment

The quantitative survey illustrated variation in employment quality across platform workers. The qualitative fieldwork highlighted that the capacity to negotiate or contest poor work and employment conditions similarly varied across groups and platforms models. Indeed, online or on-location platform workers associated with large multinational platform companies tend to have limited possibilities to get in touch with platforms' management in case of a problem, to complain or give feedback. This is particularly problematic in case of emergencies or when workers have trouble with their account or get disconnected. On the other hand, workers registered on a smaller, national platform reported a more direct relationship with more responsive, available, and accessible support staff and more visible platform management.

On a collective level, mobilisation and representation of platform workers is known to encounter a series of obstacles (see Bellini & Lucciarini, 2019; Bogliacino & al. 2020, Brugière, 2019; De Stefano & Taes, 2023; Tassinari & Maccarrone, 2020; Aloisi & De Stefano, 2022). The results of the quantitative survey showed that a slight majority of respondents were not part of any interest organisation. However, our qualitative fieldwork involved attending multiple representation and organisation efforts of couriers and drivers by worker's collectives and trade unions (see Brodersen et al., 2024b). If their mobilisations followed different dynamic in relation to their respective historical contexts, political and legislative evolutions in the last few years have provided conditions for couriers and drivers to join forces: the institutionalisation of platform companies on the local market ('Plan Taxi') and the positioning of trade union players (agreement between UBT-FGTB and Uber) on the one hand; and legislative processes (the European directive and the recent Belgian law) dealing with the meta-category 'platform workers' and based on the principle of the presumption of employment, on the other hand. In this context, unions have deployed 3 main strategies: the integration in a sectoral logic

(UBT-FGTB), organisational innovation (the founding of United Freelancers[5] at ACV-CSC) and taking legal action (ACV-CSC). We found that demand and mobilisation logics were therefore the result of interaction between platform strategies, the local sectoral context, the structure of trade union organisations and regulatory initiatives.

(Un)desirable working times and work intensities: the ambivalence of flexibility

A central feature of platform work is highly flexible working times. As the survey and the interviews highlighted, flexibility is also a central motivation to engage in platform work – as well as a central argument put forward by the platforms themselves – because it is compatible with other (main) jobs, or because working hours are not (formally) imposed on workers. However, this flexibility is limited as workers become economically dependent on their platform work income and have little actual control over the availability and the terms of the work (e.g. the distribution of tasks and the remuneration). This tension was often revealed in the interviews, with workers who, while getting to '*choose'* when to work or not, actually *had to work* many hours a week in order to make a living. While an employment contract comes with some insurance, the level of flexibility may still vary according to the type of arrangement (e.g. fixed or unfixed shifts) proposed. Moreover, as the quantitative survey finds wide variation in undesirable working times, the qualitative fieldwork shows that pressures to work at unusual working hours may also be the result of the nature of the job itself (meal delivery, passenger transportation…) or, in the context of online work, the international provenance of clients living in different time zones.

Income uncertainties and unpaid labour

In the quantitative survey, 67% of platform workers indicated to be submitted to task-based payment. As highlighted in the interviews, in a context where the availability of work is not predictable, this results in income uncertainty and can induce pressure to accept gigs, especially for workers who are economically dependent on the platform. It is also associated with unpaid labour (e.g. waiting and looking for work, doing pre-assessment, maintaining their profile). Moreover, platforms often actively encourage unpaid labour as part of establishing a client relationship and building individual client networks. We found that the room for pricing negotiation, however, is variable. Urban space workers and micro-taskers have no agency in this regard in most cases; whereas on-site (household) workers and online freelancers usually have more opportunity to negotiate their own prices with clients. However, depending on their rates, reputation and the 'low demand' on platforms, the latter can also be pressured to keep their prices low. We also found that the level of remuneration varies according to the sector and the level of qualification required. Microtasks are usually very low-paid, as opposed to online freelance services, even though the (international) competition tends to drive prices down. The remuneration of on-site (household) services, however, depends on the type of service, as female-dominated care work services tend to be less remunerated than the male-dominated activities (e.g.,

[5] United Freelancers is a cross-functional service of the CSC created in 2019, and aimed at unstaffed self-employed and platform workers.

handiwork). Finally, the problem of non-payment by clients is recurring. Given the imbalance of power generated by some platforms' design, especially their evaluation systems, workers are often in a difficult position to contest those practices.

4.4.3.3 Intrinsic quality of platform work in Belgium: quantitative dimensions

In addition to employment quality, we examined intrinsic quality of work among platform workers in Belgium, focusing on dimensions such as autonomy, work intensity, skill discretion, physical, and social work environment. In that sense, ***autonomy*** reflects platform workers' *freedom to organise* tasks, methods, and pace of work; ***work intensity*** reflects the pace (*working really fast)* and effort (*working really hard)* required in platform work; ***physical work environment*** includes physical exertion in platform work; ***skill discretion*** covers whether platform work involves meeting quality standards, self-assessment, problem-solving, task complexity, and learning; and finally, the supportiveness of the ***social environment*** in platform work is assessed through colleague interest, kindness, and helpfulness.

Our results reveal variation within the platform economy in terms of the intrinsic quality of work, more specifically regarding indicators such as work intensity, physical demands, and skill discretion. While slight skews are observed in the distribution of these features among the general group of platform workers, such as a tendency towards higher work intensity and more skill discretion, other aspects of intrinsic work quality exhibit more pronounced disparities. For instance, platform workers generally report high levels of autonomy, while opinions on the social work environment vary widely, with some reporting no colleagues at all, while others experience supportive environments.

Similar to employment quality, patterns of social inequality run through the distribution of intrinsic quality of work, although the disadvantaged groups are not always the same as we found for employment quality. For example, whereas older workers were often disadvantaged from an employment quality perspective, younger workers often have lower autonomy and skill discretion, and higher work intensity and physical demands in platform work. Similarly, whereas often microtask workers and on-site (household) workers were disadvantaged in employment quality, in intrinsic quality of work, urban space workers were more often disadvantaged, reporting low autonomy, high work intensity, and high physical demands.

Despite both being aspects of job quality, poor intrinsic quality of work does not always align with poor overall employment quality. Low autonomy and low skill discretion show only weak and few associations with employment quality features. Conversely, high work intensity and physical demands correlate moderately negatively with most dimensions of poor employment quality, indicating that high intensity and demands may surprisingly coincide with more favourable employment conditions. In contrast, an unsupportive social environment tends to positively correlate with most dimensions of poor employment quality. These findings suggest two key points: First, engaging in *poorer* work or labour (illustrated by poor scores on intrinsic quality of work) in the platform economy doesn't always equate to worse employment conditions. Second, the indicators of 'vulnerability' and 'undesirable

working times' exhibit systematically inverse patterns compared to other dimensions of employment quality, with differing correlations to intrinsic quality of work characteristics and opposite health consequences. Finally, once more reflecting on the sustainability of platform work, intrinsic quality of work also relates to health outcomes (just like employment quality). Low autonomy, low skill discretion, and having an unsupportive social work environment relate positively to both poor mental well-being and poor self-related general health. Additionally, high physical demand increases the prevalence of musculoskeletal complaints.

4.4.3.4 Intrinsic quality of platform work in Belgium: qualitative insights

The qualitative fieldwork allows for a certain degree of nuance and further, in-depth discussion. In particular, the meaning and impact associated with autonomy and agency in the context of platform work and algorithmic management will be discussed further, as well as the varying relationships of platform work to health and safety.

Conflicting dimensions of autonomy

The online survey highlighted that a considerable portion of workers report high levels of autonomy in relation to work organisation, with urban space workers among the least advantaged. Based on the qualitative fieldwork, we also identified a variation in the degree of interference by platforms in the organisation and control of the work according to the group of activities. Especially, high reliance on 'algorithmic management' (Aloisi & De Stefano, 2022; De Stefano & Taes, 2023; Stark & Pais, 2021) significantly limits the autonomy (and independence) of 'urban space workers' as well as 'microtaskers'. Indeed, we found that their work involved highly standardised tasks, that they had to follow specific instructions to complete them, and that the prices were imposed by the platforms. Moreover, they are submitted to fairly invasive surveillance mechanisms while carrying out the work (e.g., couriers and drivers are geo-localised and constantly get notifications they have to answer to; whereas microtaskers' completion time is controlled by the platform). In this context, economic dependency often pressures them to accept gigs and work long hours, contrasting with the advertised freedom and flexibility that often attract workers when engaging in platform work. Despite this, 'being one's own boss' is one of the more emblematic (positive) conceptions associated with platform work in drivers and couriers' narratives, which can be understood not only by the *invisibilisation* of the authority relationship, but also in relation to their respective socio-professional trajectories and their (negative) relationship with salaried employment and the traditional labour market (see also result section 2). On the other hand, on-site (household) services and online freelance workers enjoy greater autonomy since most negotiations take place directly between customers and service providers with much less interference by the platform. Nevertheless, the lack of intervention by the platform, as well as its design, can still create or reproduce an imbalance of power between clients and service providers. For example, we saw that enforcing limits, contesting assessments, or claiming payments may prove more problematic for women in female-dominated segments of in-home/domestic services, especially in absence of resources to contest reviews or report abuse (see Brodersen et al., 2024a).

Physical environment, health, and safety

While not being covered by collective regulations related to health and safety in the workplace, platform workers are exposed to health and safety risks which are increased not only by poor job quality (as illustrated by the quantitative survey results), but also due to several related factors such as the generalised lack of health and safety training, the lack of professional skills, as well as algorithmic management (European Agency for Safety and Health at Work & al., 2021). For example, while all delivery couriers are exposed to traffic accidents and injuries, our interviews highlighted that Deliveroo and Uber couriers were more likely to adopt risky behaviours (e.g., going very fast, running red lights) in order to get as many orders as possible and that they were more involved in traffic accidents, which in several cases led to hospitalisation and immobilisation. As current events have sadly reminded us, exposure to traffic risks can lead to even more dramatic consequences, such as the tragic death of a courier in Brussels in February 2023[6]. If platforms do sometimes provide basic accident insurance, it was repeatedly highlighted in our interviews that those were very difficult to trigger (e.g. difficulties with the procedures or to communicate with the insurance company). Besides traffic accidents, physical pain and fatigue due to prolonged hours on the bike were also reported. Moreover, platform work can also be associated with mental health risks such as stress, anxiety, or depression. For example, we found that some micro-taskers are regularly exposed to violent and possibly traumatic content when doing moderating tasks, without having any psychological support at their disposal; while freelancers have work with limited infrastructure and commonly experience work pressures because of tight deadlines.

4.4.4 Main conclusions, recommendations, and policy lessons

Work package 4 presents a comprehensive study on the platform economy, focusing on the socio-demographic and professional profile of platform workers as well as their job quality and the sustainability of their work. In this section, we present our main conclusions and combine them with recommendations and policy lessons.

4.4.4.1 The diversity of platform workers

The research emphasises that there is no such thing as '*the Belgian platform worker*'. Platform workers are a heterogeneous group, with varying demographic and socio-professional characteristics within and between different platform activities. This diversity is also reflected in the variety of trajectories into platform work. From a job quality perspective, the research finds that platform workers share some common positive features as well as vulnerabilities, however it also highlights considerable disparities with certain groups facing heightened vulnerabilities. The difficulty to establish a cohesive platform worker category has a direct impact on recommendations and policies. As we will stress further on, it also means platform work cannot be considered in isolation from the sectors and labour markets it evolves in.

[6] https://www.rtbf.be/article/le-livreur-a-velo-sultan-zadran-meurt-ecrase-par-un-flixbus-le-dossier-classe-sans-suite-par-le-parquet-11280226 (consulted on 09/04/24)

4.4.4.2 The tension field of employment status

Our research underscores that a significant proportion of platform workers operate either as self-employed or without formal contracts. This trend is particularly pronounced among socio-economically vulnerable groups, such as older individuals and people who are unemployed (outside of their platform labour) or outside of the labour market. The employment status of platform workers is a major issue with cascading effects at many levels, as workers are often deprived of the rights and protections that are associated with a regular employment relationship. Recent legislative developments in Belgium[7] and Europe[8] seek to address this issue by introducing a **legal presumption of employment** for platform workers (De Becker & Bruynseraede, 2024; Kullmann, 2022). While this aims to enhance working and employment conditions for platform workers by combating false self-employment and proposing a viable alternative to intermediary ('third way') employment regimes which have proven problematic[9], it also creates a delicate balance concerning the contrasting realities in which these workers are anchored. For example, the interviews revealed divergent perspectives: some platform workers aspire to maintain their independence, viewing platform work as an entrepreneurial endeavour (such as is often the case for 'taxi' drivers). Additionally, stories from undocumented migrants highlight that regulation of platform work could jeopardise their sole source of income. In order to create sustainable work for all platform workers, an alternative approach involves **prioritising fair employment practices and social protection for all workers irrespective of their status**. Transparency regarding algorithms and automated decision-making processes, data protection, clearer terms of service and equitable remuneration should be encouraged (ILO, 2024). Additionally, targeted policies addressing gender, ethnicity, and socio-economic disparities can create fairer and more sustainable platform work for all. One example of this is that platforms could make design choices that mitigate or counterbalance bias effects (e.g., discrimination) (Brooke & Rao, 2024; Mateescu & Ticona, 2020; Hannák & al., 2017).

4.4.4.3 The ambivalence of autonomy and flexibility in platform work

Autonomy and flexibility are often mentioned as selling points by platforms, but also as main motivations for platform workers to join digital labour platforms (Sun et al., 2023). In the survey as well, we find that workers mention flexibility as their main motivation for choosing to work through platforms. On one hand, this assumption of platform work seems to come true, as generally, the survey finds high levels of autonomy in terms of workers' freedom to organise their tasks, methods, and pace of work. However, the interviews offer a more in-depth perspective regarding autonomy, and illustrate that, in many ways, the autonomy and flexibility offered by platforms is articulated to a series of pressures and constraints. On the one hand, we have the platforms' features and algorithmic management policies. For example, the standardisation of tasks; the degree of competition; the

[7] In Belgium, a law containing various provisions relating to work, including a chapter on platform economy providing for a presumption of employment for platform workers, is in force since January 2023. See CHAPITRE 4. - Economie de plateformes, on https://www.ejustice.just.fgov.be/cgi/article_body.pl?language=fr&pub_date=2022-11-10&caller=summary&numac=2022206360 (consulted on 09/04/24)

[8] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698923 (consulted on 09/04/24)

[9] See above for discussion of Belgian P2P regime; see also Aloisi (2022) for examples from other countries.

imposition of low fares and dynamic pricing; the policies on acceptance, cancelation and rejection of jobs; and the outsourcing of the evaluation to clients. Moreover, if workers may be exposed to atypical working hours due to the nature of the work (e.g. delivery and taxi services), this can also be the result of global time schedules in the context of online work. Finally, these constraints are more effective as the workers are economically dependent on the platforms' income (which is also found by Sun et al. (2023)), restricting their freedom of choice in deciding to accept or decline work, how to organise the work, and choosing their working hours. In that sense, the flexibility that is inherent to platform work does not necessarily grant freedom to the worker; in many cases it *imposes* flexibility upon the worker, thereby limiting true autonomy (Bernard, 2023a). As a result, the hyper-flexibility and 'casualisation' of work as a characteristic of platform work predominantly falls on the shoulders of the platform worker and contributes to blurring lines between work and private life (Cingolani, 2021) as well as work intensification. To ensure that workers themselves are also able to benefit from this flexibility, **transparent algorithms and automated decision-making processes** are crucial for workers to understand how the autonomy associated with platform work is challenged by the platforms' design and policies, which can limit their opportunities for flexibility and their ability to generate an income. Platforms should provide clear information about their algorithms and explain to workers how reviews, ratings, job acceptance rates etc. influence their work prospects to empower workers to navigate the platform environment effectively and more sustainably. This would also facilitate a reclassification of the employment status in case a subordination relationship is suspected.

4.4.4.4 Representation, agency, and voice

(Collective) Representation is a complex aspect when it comes to the platform economy and platform workers. A study by ETUI (Piasna, 2024) has already highlighted various issues related to representation and social dialogue. Especially, the role of the social partners has become blurred as platforms often refuse to consider themselves as employers, and platform workers find it challenging to align with worker organisations due to their narratives around entrepreneurship and independence, as well as their heterogeneous profiles (e.g., interests of student workers are different from interests of full-time platform workers) (Piasna, 2024). This may explain why in the survey we find that a slight majority of platform workers is not represented by any sort of interest organisation. Those that *are* represented are found across different types of organisations (e.g., 11% is part of a workers' collective, 31% is part of trade unions, 10% has joined a cooperative, and 7% is part of a self-employment organisation). The results of the quantitative study highlight a necessity for **collaborative efforts between interest organisations** to ensure that **access to collective bargaining and representation is guaranteed for all platform workers regardless of their status.** Nevertheless, given the heterogeneous demographic and socio-professional vulnerabilities of platform workers, a convergence of struggles might prove essential.

At a more individual level, the study showed effective communication with the platform in case of a problem (being able to have a human contact quickly when necessary) to be another area where workers lose their voice, especially when working through large, multinational digital labour platforms. In order to solve this issue, policy makers should recognize that certain challenges may differ based on platform size, but mainly investments should be made in **robust communication infrastructures that**

allow for effective mechanisms to report problems or abuse and enable them to contest platform organisation's decisions that affect their working conditions. A positive characteristic for example, of usually smaller, national platforms, was the possibility to have more personalised interactions with platform operators.

4.4.4.5 Beyond the platform economy

In sum, work package 4 has focused on broad and specific problem areas surrounding work in the platform economy. Nevertheless, it is important to emphasise that the threats to work and employment sustainability mentioned above do not only concern platform workers as an isolated segment of the labour market (Rahman & Thelen, 2019). Firstly, the lessons learned from this study share a glimpse of potential worker consequences of the deconstruction of the employment relationship through companies' changing employment models (Drahokoupil & Jepsen, 2017), and the externalisation of the workforce and the (consequent) progressive disappearance of the employer as a social dialogue partner (Brodersen & Martinez, 2022; Piasna, 2024; Carelli et al., 2022). While it has been pointed out that digital tools have contributed to the exacerbation and systematisation of such trends that have been underway for decades (Rahman & Thelen, 2019; Carbonell, 2022), the platform economy in particular contributes to the *invisibilization* of labour and labour relationships (Casilli, 2019; van Doorn, 2017; Cingolani, 2021). This calls for much **broader regulation of work and employment conditions, as well as worker representation and democracy, than legal initiatives solely targeting platform workers**. Secondly, problems relating to platform labour need to be **re-examined in a broader light of generally adverse labour market conditions, social policies, and migration policies.** While platform work can be convenient and provide additional income for some individuals, the study evidenced that for others it is far less of a choice and more of a necessity (resulting from adverse perceptions, experiences, and exclusion from the labour market).

5. DISSEMINATION AND VALORISATION

5.1 Dissemination

Dissemination of the results of the SEAD project is crucial to create awareness about the impact of the digital revolution on the world of work and employment. Therefore, disseminating the results was considered an essential component of the project.

The results of the SEAD project have been disseminated to a wider academic as well as non-academic audience. A list of all (peer-reviewed) publications related to the project is provided in the next section of the report. The total number of published or submitted scientific articles related to the project is 9. Moreover, 3 book chapters, and 21 reports and working papers related to the project have been published. In addition, 2 master thesis, 3 bachelor thesis and 4 PhDs were (partly) prepared in the context of the SEAD project. On top of this, results were presented at different national and international congresses, workshops and symposia. Several media contributions related to the project appeared in Belgian media. A full list of these communications is provided below. Finally, a project website (https://sead.be) was developed and a Twitter account was set up (@ProjectSead).

Two events were organised within the SEAD project: a webinar and a concluding symposium.

On 22 April 2022, an international webinar (https://sead.be/webinar/), entitled "Digitalisation and the world of work", was organised by means of the iBridge People platform, offering simultaneous translation to English, French and Dutch. Five talks were included in the webinar programme: four talks about the key topics present in the project and one talk presenting the SEAD project itself. Presentations were given by contributors from within and external to the SEAD project consortium:

- The economics of automation: how will digitalisation affect the Belgian labour market? (Nick Deschacht)
- The effects of digitalisation on the organisational level: reflections on workspace innovation (Steven Dhondt)
- Protecting workers in the digital age: labour and social protections in an era of automation (Janine Berg)
- Digitalisation and the world of work: the effects on jobs, occupations and workers (Zachary Kilhoffer)
- The aims and themes of the SEAD project (Karen Van Aerden)

The webinar was attended by more than 160 participants from different countries, including policy makers, researchers, students, trade union members, stakeholders, etcetera.

On 6 May 2024, a concluding symposium, "Digitalisation and the world of work. The effects on jobs, occupations and workers", was organised at the premises of the Vrije Universiteit Brussel. A first goal of this symposium was to present the most important research results of the SEAD project and thus

inform representants from the policy field and other researchers about the current situation and the important new knowledge regarding four main topics:

1) Changes in the labour market relating to training and skills
2) Technological innovation and organisation-level dynamics
3) Employees and the impact they have on the use of digital tools
4) Platform work and the ambivalence of autonomy and flexibility

A second goal was to actively involve stakeholders and relevant actors in the policy and research fields. The Concluding Symposium was attended by around 60 participants from various organisations, including different federal public services, private companies, trade unions, research institutes, the Social and Economic Council of Flanders and workers advocacy groups.

To ensure active involvement of stakeholders in the Symposium, four presentations highlighting key project results were complemented with six interventions from discussants with (different types of) experience in the field. Here, we list the four presentations and six discussants:

1) “A changing labour market and the role of training and skills policies” by Nick Deschacht
    - Discussant: Jean-Luc Fasseur (SERV)
2) “No technological innovation without organisational change” by Ezra Dessers
    - Discussant: Jan Laurijssen (SDWorx)
    - Discussant: Lieven Eeckelaert (Workitects)
3) “Modes of appropriation of digital tools: the example of managers and recruiters” by Giseline Rondeaux
    - Discussant: Dominique Marechal (Prayon)
4) “The ambivalence of autonomy and flexibility in platform work” by Anastasia Joukovsky
    - Discussant: Martin Willems (United Freelancers – ACV)
    - Discussant: Wouter Zwysen (ETUI)

Participation in national congresses/workshops/symposia

Dessers, E. (2021). Digitalisering in de zorg. Presented at the Digital Experience Event. Empowering Public Workers, Brussels. (professionally oriented)

Brodersen, M. (2021). Guest lecture ‘Making sense of the platform economy in Belgium – The SEAD project’, for 3th BA students Social Sciences, in the course Sociology of Work and Employment, VUB, Brussels, 21 April 2021.

International webinar “Digitalisation and the world of work: the effects on jobs, occupations and workers.” 22 April 2021. (Speakers from the SEAD consortium: Nick Deschacht, Karen Van Aerden. External speakers: Steven Dhondt, Janine Berg and Zachary Kilhoffer)

Martinez, E. & Brodersen, M. (2021). 'Qu’est-ce que l’économie de plateforme? Premiers apports du projet SEAD' at Journée d'étude 'Sécurité et santé dans l’économie de plateforme, Service public fédéral Emploi, Travail et Concertation sociale, Bruxelles, 6 Octobre 2021.

Dessers, E. (2022). Technostress of technopower? Over technologie, arbeidsorganisatie en werkbaar werk. Presented at the Flanders Make event "Slim inzetten van technologieën - een verdere stap naar werkbaar werk", Leuven, 26 april 2022. (professionally oriented)

Dessers, E. (2023). Technology and organizational design for motivational work. Gastcollege prof. Anja Van den Broeck.

Dessers, E., Jacobs, T. & Vierendeels, L. (2023). Webinar Federgon: Proeftuin Industrie 4.0 - Technologie voor werkbaar werk.

Dessers, E. & Moorkamp, M. (2023). Werkbaar werk in het digitale tijdperk: Hoe technologie en arbeidsorganisatie elkaar kunnen versterken. Presented at the Technologie voor Werkbaar Werk event, Gent.

Dessers, E., Habraken, M. & Van Hootegem, G. (2023). Werkbaar werk: Knelpunten in de Vlaamse maakindustrie. Presented at the Technologie voor werkbaar werk. Persconferentie, Pelt, 6 February 2023.

Joukovsky, A. (2023). Guest lecture 'Mobilisations collectives des coursiers et des chauffeurs en Belgique' (dans le cadre du cours de structure de l'entreprise), ULB, Brussels, 21 March 2023.

Dessers, E., Vranken, R. & Heyman, R. (2023). Technologie in functie van werkbaar werk. Presented at Werkbaar Werkt!, Brussels, 29 March 2023.

Vandevenne, E. (2023). Measuring and understanding job quality and its relation to well-being in the Belgian platform economy. Presented at CfP Untangled Final Conference, HIVA – KU Leuven, Leuven, November 2023.

Dessers, E., Vranken, R. & Vannieuwenhuyse, D. (2024). Revolutie op de werkplek. Innovatieve technische oplossingen voor sociaal betrokken werk. Presented at the INDUmation, Kortrijk, 31 January - 2 February 2024. (professionally oriented)

Joukovsky, A. & Vitali, Z. (2024). Guest lecture 'L'économie de plateforme. Dans le prolongement de l'entreprise-réseau' (dans le cadre du cours de structure de l'entreprise), ULB, Brussels, 19 March 2024.

Dessers, E. (2024). Meer robots op het werk?! Hoe ontwikkelen we technologie op mensenmaat? - Webinar Economische Reflecties. Opleiding georganiseerd door Postuniversitair Centrum KU Leuven, 19 Maart 2024.

Participation in international congresses/workshops/symposia

Smits, I., Franssen, M., Beuker, L., Van Aerden, K., Lamberts, M. & Dessers, E. (2021). Sustainable employment in the age of digitalisation: unpacking the organisational level. Presented at the BEYOND4.0 Conference, Sofia, Bulgaria, 30 September - 1 October 2021.

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5.2 Valorisation

One of the aims of the SEAD project was to translate its findings into (social) policy advice aimed at safeguarding and promoting the sustainability of employment in a context of digitalisation. The research on how digitalisation is impacting the world of work and employment is relevant in ways that transcend a fundamental-research point of view. The results of this research make clear that this process of digitalisation has shaped and is still impacting our labour market and workers in both positive and negative ways. The results and wider implications of the project are therefore of great importance and of interest for different actors, such as trade unions, employer organisations, policy makers, federal or regional public services, companies, sectoral funds,….

During the course of the project, members of the consortium reached out to important stakeholders on a number of instances:

- On Tuesday the 9th of November 2021, SEAD consortium members had a meeting with representatives from both Kabinet Dermagne and Kabinet Vandenbroucke to inform them about our research project and to present the preliminary results concerning the platform economy in Belgium. Following this meeting, a policy brief with main findings on this topic was shared with them on Monday the 10th of January 2022.
- Intervention by Esteban Martinez and Meike Brodersen, 'Qu'est-ce que l'économie de plateforme? Premiers apports du projet SEAD' at Journée d'étude 'Sécurité et santé dans l'économie de plateforme', Service public fédéral Emploi, Travail et Concertation sociale, Bruxelles, 6 October 2021.
- The webinar "Digitalisation and the world of work", organised on 22 April 2022 (see supra)
- Jessie Gevaert and Karen Van Aerden have taken part in the Statbel (FOD ECON) Werkgroep 'Nieuwe statistische behoeften: telewerken & platformeconomie' / Groupe de travail 'Nouveaux besoins statistiques: Télétravail & économie des platformes'. Gathering in reporting period: 18 March 2022; 15 May 2023
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- SEAD policy brief 2024.03 'Enhancing sustainable careers in the digital era'. https://sead.be/wp-content/uploads/2024/04/SEAD-policy-brief-2024.03.pdf
- The concluding symposium "Digitalisation and the world of work", organised on 6 May 2024 (see supra)

Moreover, the SEAD-project led to research insights that contributed to new successful research grants:

- SBO-grant for the WellFiciency-project (Measuring and optimizing operator well-being via dashboards and task allocation while sustaining production efficiency). More information on this project can be found here: https://hiva.kuleuven.be/nl/onderzoek/project-in-de-kijker/WellFiciency
- BELSPO-grant for the SUSHY-project (Towards sustainable hybrid work: the study of hybrid work effects on well-being, productivity and environment). More information on this project can be found here: https://brispo.research.vub.be/en/sushy-towards-sustainable-hybrid-work-the-study-of-hybrid-work-effects-on-well-being-productivity
- ERANET CHANSE-grant for the GIG-OSH-project (New challenges for occupational safety and health in times of the digital transformation in Europe: the role of digital labour platforms). More information on this project can be found here: https://brispo.research.vub.be/en/gig-osh-new-challenges-for-occupational-safety-and-health-in-times-of-the-digital-transformation-in

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Rondeaux G., Focacci, C.N. & Pichault, F. (2024c). The socio-material impact of digitalization: an occupational perspective (forthcoming).

Vandevenne, E., Vanroelen, C., Stas, L. & Gevaert, J. (2024). Measuring and understanding job quality and its relation to well-being in the Belgian platform economy. Towards an empirical assessment (forthcoming).

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Van Aerden, K., Deschacht, N., Détilleux, C., Dessers, E., Smits, I., Pichault, F., Franssen, M., Beuker, L., Martinez, E., Brodersen, M., Joukovsky, A., Gevaert, J. & Vanroelen, C. (2021). SEAD Working Paper 2021.01 Introducing the SEAD project. https://sead.be/wp-content/uploads/2021/07/20210708-SEAD-Working-Paper-2021.1.pdf

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ANNEXES

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