



How globalisation, technology and
demographic change are transforming
companies and industries:
Lessons from case studies

Editors:

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Part I: How companies and industries
make sense of globalisation, technology
and demographic change

1. Running on the spot or taking it slowly: How companies and industries make sense of globalisation, technology and demographic change by Ursula Holtgrewe

1.1. Introduction

1.1.1. Outline of this volume

This volume presents eleven case studies, conducted in 2021 and 2022, of companies and (sub-)sectors in manufacturing, financial services, and business services in various countries in the EU and South Africa. Each case study investigates the interplay between globalisation, digitalisation and demographic change, and the impacts of these megatrends on employment, skills, job quality and inequality in the respective field.

The case studies were conducted by partners in the Horizon 2020 research project UNTANGLED,¹ which took a mostly economic view of interconnected trends and their impacts on the economy and the labour market. The present volume contributes a case study approach that aims to shift perspective:

'A case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a 'real life' context' (Simons, 2009, p. 21).

From this viewpoint, cases are not treated as instances where trends materialise and impacts make themselves felt. Cases are 'live' sites of collective and individual agency. Managers, workers and their representatives make sense of both trends and impacts, are affected by them, and utilise them. In doing so, they also shape them – in their own interests, if they can. For example, the German mechanical engineering industry and its associations played a central role in developing the Industry 4.0 discourse in Germany and Europe (Pfeiffer, 2017).

Viewed through public and policy declarations and media reporting, trends often appear as irresistible forces to which companies, workers and societies must simply adapt as fast as possible. Yet in the lived realities of manufacturing goods and providing services, on the one hand changes are often made more slowly and incrementally, and disruptions are avoided rather than celebrated. On the other hand, globalisation means that both competitive pressures

¹ See: www.projectuntangled.eu, funded by the EU's Horizon 2020 programme, Grant No. 101004776 from February 2021 to January 2024.

and options multiply within and between firms. Companies and sectors, each investigated in a particular country and embedded with its production, innovation and employment regime, thus navigate opportunities and pressures with varying speeds and varying scope for choices. The title of this chapter refers to the spectrum of modes of strategic and reactive action observed in the case studies.

Each chapter in this volume follows a common structure: after introducing the case, we explore how globalisation, technological and demographic change respectively play out in the company or sector in question, and then look at the interplay of trends on the ground in the respective field.

We then explore the impacts of these trends on skill demand and supply, the development of employment and job quality, and established and emerging inequalities in the field.

The final section integrates these findings into 'patterns of impacts' and identifies the reasons for case-specific configurations. Chapters are grouped according to manufacturing sectors (Section 2); financial services (Section 3); and globalised business services (Section 4).

The present Chapter 1 compares cases and draws conclusions, first at the sectoral level, then across sectors. The conclusions show that megatrends manifest themselves as soon as they are filtered by institutional regimes of employment, industrial relations, market regulation and industrial and labour market policies, as well as by the actual and expected developments of markets for products and services. Collective actors such as companies, social partners and business associations also play an active and strategic part in shaping these regimes and policies.

Empirically, path dependencies of sectors and national production and employment regimes are rarely disrupted by technology, globalisation or changing workforce demographics, although some erosions are observed, for example in vocational and educational training (VET) systems and social partnership. In some cases, at the company and sectoral level, workplace innovations offer possible pathways for companies and sectors to move towards 'better jobs' that improve both economic performance and job quality.

Despite the ongoing expansion of the service sector, manufacturing (Section 2) remains the focus of studies of technological change, globalisation and also demographic change. It would appear that technological and societal changes are playing out in obvious ways here.

The case studies cover the subsectors of food and machinery in Italy (Chapter 2.1); mechanical engineering in Germany (Chapter 2.2); the biotech sector in Belgium (Chapter 2.3); and an electronics manufacturer in Austria (Chapter 2.4).

More specifically, the Italian study by Chiara Acciarini and Fabrizio Pompei presents three case studies in one, analysing the interplay of digitalisation, globalisation and demographic change in a food manufacturing small or medium enterprise (SME); a manufacturer of food packaging technology (also an SME); and a provider of engineering services for telecommunications and remote sensing and surveying. Across these companies, the use of robotics and digital technologies has not led to job losses. Employment has been sustained or extended, due to the companies' expansion and international export activities, and ongoing innovation. The packaging machine supplier, interestingly, buys in components but does not use automation or robotics technology in actual assembly. This is a labour-intensive production process, integrating both hard-and software into highly customised machinery.

The German case study by Ronald Bachmann and Eduard Storm reports on German mechanical engineering, a sector that is somewhat emblematic of the German production and innovation model and its challenges. It also connects with all other manufacturing sectors in supplying its machinery globally and facing global competitive pressures. The sector consists of large and smaller multinationals and also a wide range of highly specialised SMEs, some of which are known as 'hidden champions' and are often located in rural or semi-urban regions. This sector employed some 969,000 people in Germany in 2021. Digitalisation, known as Industry 4.0, here refers to a large transition as former manufacturers of hardware and physical machines now integrate software, sensors and data flows, aiming to sell services in addition to machines, and to further innovate products. Currently, mostly low- and semi-skilled routine jobs are being substituted by automation (although the share of these jobs is lower than in other industries). Automation affects newcomers to the sector rather than incumbent workers.

The Belgian case study by Mikkel Barslund and Karolien Lenaerts looks at a newly formed sector and its ecosystem in the country: the biotech industry. Having benefited from considerable policy support since the 1990s, the biotech industry has evolved as a research-driven sector and built an ecosystem of university departments, spin-offs, science parks and training facilities that also attract foreign investment. The sector has extended its activities from R&D into production, currently offering 40,000 jobs in Belgium, of which some 30% are medium- to-low-skilled. The sector is thus embedded in global value chains, benefiting from its

central European location and global connections, and having received a recent boost in demand through the COVID-19 pandemic.

The Austrian case study of an electronics manufacturer, TRONIC (a pseudonym), by Ursula Holtgrewe and Martina Lindorfer, introduces a special kind of tech supplier: an SME with some 90 employees, with the production located in Austria, manufacturing ‘conservative’ electronics equipment with stable, long-running technology, but increasingly pursuing the possibilities of the Internet of Things (IoT) technology to add services to its products. Since 2013, the company has transformed itself from a family-owned specialist SME to a tech company (still owned by the family) with a distinctive participatory mode of governance. This has made it a much-cited exemplar of ‘new work’. The company embraces automation and administrative digitalisation, which has been substituting individual tasks, but it has consistently hired new staff in recent years.

All in all, the sample presents SME and specialist manufacturers’ views on globalisation, digitalisation and demographic change, with a focus on technology suppliers rather than users, with the exception of Italy’s pasta manufacturer and the Belgian biotech sector, which develop technology and manufacture end products.

Mass production associated with Taylorism is not present in the sample, and indeed the overall picture echoes ‘flexible specialisation’ (Piore & Sabel, 1984). Nevertheless, we find some precarious employment and dualised labour markets (also along gender lines) in some manufacturing instances.

Financial services (Section 3) are of especial interest since they have been digitising and restructuring for decades, with varying impacts on employment. In Luxembourg and Austria, our teams looked at the banking sector specifically. In South Africa, the insurance sector was investigated with a focus on workplace innovation.

All three case studies thus address the sectoral level and are based on interviews with representatives of employer and sector associations. In Austria and South Africa, teams gained some additional company-specific insights; in Austria interviews were conducted with the works council chairs of two banks. The South African team went on a field visit to an insurance company specialising in data-intensive product innovation.

Banking in Luxembourg (Chapter 3.1), investigated by Adrien Thomas and Patrick Thill, is the most important sector in the country’s economy in terms of its shares in GDP and employment. It developed with considerable political support, using the opportunities in the international

finance system, starting with the emerging Eurodollar markets of the 1960s and 70s and the creation of a favourable tax regime with regulations such as instating strict banking secrecy. Banking regulation has since changed due to pressure from ongoing globalisation and new regulations requirements in the EU and beyond. The sector in Luxembourg employed some 26,317 employees in 2021, and employment has been stable, albeit with a slight decline directly after 2008. Shifts in skill needs and restructuring have led to some job losses, however, which have been addressed in a 'socially sustainable' way, through subsidised early retirement and tripartite retraining initiatives.

The Austrian banking sector (Chapter 3.2), investigated by Ursula Holtgrewe, Martina Lindorfer and Nela Šalamon, notably made a rapid expansion to Eastern and South-Eastern Europe after 1995. Having made a quick recovery from the 2008 crisis, it built up its equity capital upon new regulations and internationalised further up to 2022. As banks have continuously but incrementally been introducing new technologies in customer service and back-offices, they have been closing retail branches for years and continue to do so. Employment has thus decreased in this sector and the skill profile has changed.

Job losses in Luxembourg are handled through social plans, early retirement and working hour reductions, and favourable severance pay and re-training offers. Even though employment has been shrinking, the sector has also been increasingly affected by staff shortages in recent years.

The banking sectors in Austria and Luxembourg are similar, in several dimensions. They have been compared before with a focus on company restructuring and industrial relations (Kirov & Thill, 2015): operating in small countries and coordinated market economies (Hall & Soskice, 2001). They have successfully based the sector's expansion on cross-border and global opportunities with a strong presence of foreign-owned banks (although ownership in Austria became transnational later than in Luxembourg). Banks in both countries are still well-connected with the political sphere and have a comparatively strong social partnership that successfully addresses company restructuring. However, in both countries the social partnership is challenged by transnationalisation.

By contrast, the South African insurance sector (Chapter 3.3), investigated by Zaakhir Asmal, Haroon Bhorat, Lisa-Cheree Martin, and Chris Rooney, looks to global developments but is dominated by national businesses. It still has plenty of space to expand within the country as currently only 19% of South Africans have insurance outside of funeral coverage. In recent years the sector has expanded well above the financial sector at large, with gross earnings growing by 7.8% per year between 2010 and 2020 and an employment growth of 1.5% on average per

year over the same period. The workforce is made up of a large share of graduates, and proportionally more people of White and Asian origin than in the (service) economy at large. In terms of both technological and workplace innovation, it appears to be somewhat polarised. Incumbent insurance companies move slowly and are not overly driven by a cost-cutting or competitiveness logic. However, they also underwrite an emerging sector segment of ‘insurtech’ companies that focus on tech- and data-intensive product and business model innovation.

By definition, business services (Section 4), especially business process outsourcing (BPO) and shared service centres (SSCs), sit at the intersection of globalisation, digitalisation and demographic change. To globalise, digitalise and address changing demographics and their impacts, companies draw on a range of local and global services, for example tech providers, consultancies, B2B platforms and auditors. Business services are therefore already central as an enabler of megatrends. In addition, as companies become more globalised or digital, they relocate and/or outsource their own service functions to save costs and access new markets or new talent. It is thus unsurprising that all business services covered in the case studies have been expanding in the last decade and often before that. The case studies address different types of business services.

In Poland and South Africa, we look at established globalised business services. In the Polish case study (Chapter 4.1) by Zuzanna Kowalik, Piotr Lewandowski, Tomasz Geodecki, and Maciej Grodzicki, the focus is on shared service centres (SSCs); that is, consolidated subsidiaries of multinationals that handle space-independent functions such as back-office, finance, ICT, HR, and legal or sales support on behalf of their parent companies. Business services has been one of Poland's most dynamically growing sectors, with a 6% growth in 2021 alone, employing some 355,300 people in that year. SSCs in Poland have been moving up the value chain, compensating for the ongoing automation of routine tasks with more complex functions. The question is whether they can maintain that process of upgrading, or whether automation or rival locations will overtake them.

The South African business services case study, by Caitlin Allen Whitehead, Zaakhir Asmal, and Haroon Bhorat (Chapter 4.2), focuses on the sector of Global Business Services at large, of which three-quarters are customer contact centres. The study pays particular attention to the joint efforts of the business association, the government and a non-profit training provider to expand the sector and increase South Africa's share in it. The aim is to generate export revenues and, particularly, to provide labour market access and jobs to the country's young, low-skilled and severely underemployed part of the workforce. By promoting ‘inclusive hiring’, the country aims

to combine all three megatrends to create jobs and trajectories of transferable skills – but the case study makes clear that it takes additional efforts to harness these trends in the interest of inclusive growth.

The Irish case study (Chapter 4.3), by Seamus McGuinness, Paul Redmond and Klavs Cipriks, addresses the sub-sector of business services that develops and uses blockchain or distributed ledger technology. Blockchain is a technology not a sector, although it has an emerging structure of business associations, networks and initiatives that work on establishing a sector or organisational field. These actors aim to integrate the field of blockchain technology into the Irish strategy of establishing the country as an attractive destination for investment and the relocation of IT business services with a skilled workforce, attractive tax schemes, and liberal regulation. For now, the field is small in Ireland, with some 100 organisations and 1,400 people working with blockchain directly. The case study introduces a company using blockchain in exporting Irish craft beer, a globally oriented, space-independent provider of both technology and financial services in cryptocurrencies, and an industry association representative which connects several ‘sector’ organisations, of which some aim for positive social impact.

The Belgian case study (Chapter 4.4), by Mikkel Barslund and Karolien Lenaerts, describes a single company case: a regional provider of technical testing, inspection and certification (TIC) services in the Benelux countries that introduced a large digital transformation of the work process, with considerable impact. The company employs some 2,000 people and has recently become part of a European network of similar companies. The change, devised by a previous CEO and CTO in a top-down fashion, aimed to massively bring forward digitalisation for efficiency and competitiveness reasons, and to increase transparency and managerial control over auditing work. However, the disruption also translated into considerable delays, impracticalities, and dissatisfaction among employees and clients. The company - now with the involvement of union representatives and a labour mediation institution - had to develop complementary workplace innovations to mitigate negative impacts. In this way, it is an almost emblematic case study of the impacts of disruptive technological change on knowledge-intensive work in a unionised environment within a ‘coordinated market economy’.

1.1.2. Disentangling trends in the field: actors, strategies, consequences

From a case study perspective, trends and impacts are the aggregate results of collective actors making decisions, investing, recruiting, negotiating, networking with others, and changing their own organisations in the process. The respective contexts and modes of action in which they do

so are shaped by their histories, previous decisions, institutional contexts, available resources, investor expectations and society - as indeed are the actors themselves (Maurice & Sorge, 2000).

Cultural frames, mindsets, or 'economic imaginaries' (Manning, 2022) of models of value creation or of 'the future' (Beckert, 2016) also play a part. Neo-institutionalist theory in particular shows how organisations, in order to function and be recognised in their respective fields of business or interest representation, need to fulfil expectations of modernity, efficiency, professionalism, and dynamism (DiMaggio & Powell, 1991). This can be seen as the institutionalist approach to megatrends. Companies, social partners and sector associations must demonstrate that they are aware and strategically capable of addressing globalisation, technological change and demographic change – as well as manage green transformation. Such expectations apply both to their markets and to the policy and institutional environment.

Fulfilling expectations is not all that organisations do. Christine Oliver makes the point that organisations (like individuals) do this strategically and aim to shape expectations in their own interest (Oliver, 1991). In our sample, for instance, representatives of the emerging Irish blockchain industry (McGuinness, Redmond & Ciprikis, in this volume) aim to position their technologies and services as a vital contribution to economic and social progress and to integrate the sector into the Irish policy strategy of attracting both ICT and business services.

Viewed over time, companies' and sectors' practices and strategies will be path-dependent to some extent, but path changes and disruptions are also possible. The Austrian SME TRONIC, for example, is gradually changing its business model from providing 'conservative', long-lasting components to the integration of IoT technology and the provision of data-driven services (Holtgrewe & Lindorfer, in this volume). The South African industry of Globalised Business Services, with government support and considerable incentives for companies, is aiming to extend the sector's job creation to young people from disadvantaged backgrounds under the heading 'inclusive hiring' (Whitehead, Asmal & Bhorat, in this volume).

In some places, we observe loops of development as companies and sectors come up against the (intended or unintended) consequences of earlier rounds of globalisation, digitalisation or company restructuring. Globalised business services originally located in cities with promising labour markets, nevertheless face staff shortages in the same places (Kowalik, Lewandowski, Geodecki & Grodzicki, in this volume; Whitehead *et al.*, in this volume). Banks that have been shedding jobs and reducing employee benefits for decades are finding that the sector has become less attractive to the younger age cohorts they would now like to hire (Holtgrewe, Lindorfer & Šalamon, in this volume).

Our case studies thus offer a dynamic view into the actual workings of globalisation, digitalisation and demographic change in varied countries and contexts; into the interplay between trends and impacts and, centrally, into alternative and case-specific strategies and practices when navigating these dynamics. They provide answers to ‘how’ questions: how do companies use technologies, navigate globalisation, change business models, and upgrade or downgrade work (or both)? This may mirror the findings of macro analyses (Acciarini & Pompei, in this volume) or it may deviate from them – for reasons that can be explored and explained. We find, for example, that job quality can improve and deteriorate simultaneously. For example, digitalisation in a Belgian business service provider removed discretion (in the sense of autonomy of action) in working but improved work-life-balance (Barslund & Lenaerts, in this volume), and the upgrading of skills often comes with increased pressure at work (Thomas & Thill, in this volume).

In keeping with sound sociological tradition, the comparison of cases allows some inroads into ‘why’ questions as well (Yin, 1994). Comparing the ‘most different’ or ‘most similar’ cases (Strauss & Corbin, 1991) or comparing across the board (Eisenhardt, 1989) allows researchers to develop theories that provide possible reasons for different developments and outcomes. However, with the dimensions and scope of case studies created in this project, such theories are somewhat sketchier than a ‘grounded theory’ (Strauss & Corbin, 1991) that is based on a longer-term mixed method observation of carefully matched cases.

We find evidence for varied patterns of technological change and varied strategies in globalised markets and are confident that we can explain under what preconditions certain changes are more or less likely. We also claim that cases go beyond mere illustrations of, for example, routine-biased technological change (Dosi & Virgillito, 2019) or labour process theory (Huws, 2016), although, for example, both banking and manufacturing sectors provide striking examples of the former, and the ‘testing, inspection and certification’ company case investigated by Barslund and Lenaerts (in this volume) is an example of the latter.

We cannot, however, generalise from the case of TRONIC, an SME company applying ‘new work’ principles in its decision making structure and successfully operating in a globalised market for electronic components (Holtgrewe & Lindorfer, in this volume), that ‘new work’ principles generally improve productivity or competitiveness in a globalised market. This would require larger samples and, possibly, matched cases. The conclusions we draw from a combination of cases, research perspectives and national perspectives show what is possible and what is likely under which conditions.

1.1.3. Methodology: the process

In total, eleven case studies in eight countries (seven EU-countries and South Africa) were conducted in 2021-2022. The (sub-)sectors of case studies (manufacturing, business services and financial services) were pre-defined to cover a reasonable range of globalising industries in the private sector. One case in each sector was specifically selected as a case of 'workplace innovation' (Barslund & Lenaerts, in this volume; Holtgrewe & Lindorfer, in this volume; Whitehead *et al.*, in this volume). Sectors were covered in varied employment regimes (Gallie, 2007). Partners then chose which specific case they were going to explore in their regional context.

For all cases, a generic research and reporting guideline was developed by the editors and discussed with all case study authors. Generic information and consent forms were also drafted. The guideline and the presentation in this report build on the UNTANGLED model of trends and impacts but we left their interrelationships open and approached them inductively, from the case level. This prioritised comparability of outputs over comparable research procedures and allowed case study authors the space to translate interview guidelines and adapt them to the various institutional and sectoral contexts of their cases.

In the context of the UNTANGLED project, with its general focus on economic and policy analysis, case studies needed to be modest in size and the case study selection pragmatic.

Regarding sectors, desk research into recent developments in the sector/country was conducted first. In the field, expert interviews were mostly conducted with representatives of business and professional associations, trade unions and employer associations and some sector experts. In certain sector case studies, evidence from companies is embedded. For example, works councillors who also play a part in the sector's collective bargaining or managers of exemplary companies were interviewed.

Dedicated company case studies involved interviews with both management and workers. In total, 85 interviews with national social partner and industry association representatives, company-level representatives (management, worker representatives) and employees were conducted (see Table 1). Within-case data analysis was conducted by each research team following the reporting guideline. All individual case study reports were then reviewed by the editors and by authors of comparable case studies and revised.

Table 1. Overview of case studies

Case study title and subject	Created by	Country of case	Sector/subsector	Analysed companies (if any)	No. of interview partners	Type of interview partners
Manufacturing:						
'Manufacturing Italy' – machinery manufacturing and food industry	Acciarini, Chiara & Pompei, Fabrizio	Italy	Food manufacturing/machinery manufacturing	3 companies in Umbria: (1) SME, producing pasta, 20 employees, 3.25 M€ operating revenues (2) Manufacturing SME of machine tools, 60 employees, 11 M€ turnover (3) Start-up, supply of geodata-related engineering services, 420 employees, 1 5.14 M€ turnover	7	<ul style="list-style-type: none"> – 3x company directors – 1x researcher – 2x union representatives – 1x policymaker
The German mechanical engineering industry	Bachmann, Ronald & Storm, Eduard RWI	Germany	Mechanical engineering Mechanical engineering in DE employs some 969,000 workers, spread across more than 3,800 businesses.	N/A	5	<ul style="list-style-type: none"> – 1x representative of chamber of commerce and industry – 1x representative of industrial trade union – 2x representatives of mechanical engineering industry association – 1x technology institute executive
The biotech ecosystem in Belgium: from research and development to production	Barslund, Mikkel & Lenaerts, Karolien	Belgium	Biotech sector (subsector of chemical and pharma industry): 40,000 jobs in Belgium, ca. 140 companies	N/A	4	<ul style="list-style-type: none"> - 1x academic expert - 1x trade union representative - 2x biotech sector professionals (1x employee at a large well-known multinational, 1x employee at a start-up)
Innovating workplaces and hierarchies in electronics: the TRONIC case	Holtgrewe, Ursula & Lindorfer, Martina	Austria	Electronic component manufacturing	TRONIC: electronics company, 90 employees, annual turnover of 13 M€	6	<ul style="list-style-type: none"> - 1x executive manager - 1x HR - 2x senior technical professionals - 2x production planner/supervisor

Case study title and subject	Created by	Country of case	Sector/subsector	Analysed companies (if any)	No. of interview partners	Type of interview partners
Finance:						
Impacts of globalisation, technological innovation and changing demographics on the banking sector in Luxembourg	Thomas, Adrien & Thill, Patrick	Luxembourg	Banking and Finance sector 50,997 employees in the finance sector, among which 26,317 worked in banking	N/A	5	3x senior trade union officials senior employers' officials
The banking sector in Austria	Holtgrewe, Ursula; Lindorfer, Martina & Šalamon, Nela	Austria	Banking sector In 2020 in AT: 71,896 workers	N/A	6	<ul style="list-style-type: none"> – 2x senior experts from employee representation – 2x senior experts from employer representation – 2x experienced works counsellors
Technological change and workplace innovation in the insurance sector in South Africa: disruption with the potential for social good in a developing country context?	Asmal, Zaakhir; Bhorat, Haroon; Martin, Lisa-Cheree & Rooney, Chris	South Africa	Insurance sector In 2021, the insurance sector in ZA had a total of 3,603 active employers; gross earnings of an estimated R33.2 billion in 2020 Q4.	N/A	11	<ul style="list-style-type: none"> – 1x executive manager from professional body for insurance industry – 1x executive of representative body of the non-life insurance industry – 1x policy advisor – 1x Insurance Advisors Council director – 7x senior employees of an established insurance company .

Case study title and subject	Created by	Country of case	Sector/subsector	Analysed companies (if any)	No. of interview partners	Type of interview partners
Business service						
The impact of automation on business services centres in Poland	Kowalik, Zuzanna; Lewandowski, Piotr; Geodecki, Tomasz & Grodzicki, Maciej	Poland	Business services sector with a focus on shared services centres (SSCs) In 2021, 355,300 people worked in over 1,600 BSC companies in Poland, accounting for 5.6% of total business sector employment	Firm 1: Insurance, 300 employees Firm 2: Technology, 400 employees Firm 3: Petrochemical, 5,000 employees Firm 4: ICT, 2,000 employees	31	In each company: head of the centre, managers, and regular employees + 1 x HR
Coordination to Support Inclusive Growth in Developing Countries in the Context of Globalisation: The Case of the Business Process Outsourcing Sector in South Africa	Whitzeehead, Caitlin Allen; Asmal, Zaakhir & Borat, HaroonUCT	South Africa	Business Process Outsourcing (BPO) services sector	N/A	5	<ul style="list-style-type: none"> – 1x public entity executive – 3x non-profit company executives – 1x non-profit company skill expert
A case study of the blockchain industry in Ireland	McGuinness, Seamus; Redmond, Paul & Ciprikis, Klavs	Ireland	Blockchain over 100 organisations working with blockchain in Ireland and +/- 1,400 people actively involved in the blockchain scene	N/A	3	<ul style="list-style-type: none"> – 1x employer utilising blockchain technology – 2x engineers in blockchain technology – 3x representatives of a national blockchain consortium
Case study on digital transformation at the company level through the lens of workplace innovation	Barslund, Mikkel & Lenaerts, Karolien	Belgium	Testing, inspection and certification (TIC) sector	Belgian testing, inspection and certification company, 2,000 employees	7	<ul style="list-style-type: none"> – 1x change manager – 1x HR manager – 1x team leader – 2x workers – 2x trade union representatives

1.2. Manufacturing

1.2.1. Megatrends in manufacturing

Globalisation

All companies and sectors in the sample have been expanding their markets internationally and are embedded in global value chains. Hence, many of them are concerned by recent value chain disruptions. China appears as a large and desirable market for both Italian manufacturers and German mechanical engineering companies that generally see their market as global. However, they also voice concerns over China as an emerging competitor, especially to highly specialised SMEs.

In the German case, some relocation of offshored production facilities back to Germany (so-called backshoring) is a possibility in light of the possibilities of Industry 4.0 and the disruptions of the COVID-19 pandemic, plus other geopolitical uncertainties.

Backshoring was already a topic of debate during the 2010s when offshoring activities declined and some disillusionment set in. However, the trend appeared to be limited, although it is positively correlated with Industry 4.0 activities of German manufacturers at large (Dachs, Kinkel & Jäger, 2019; Kinkel, 2018).

The reasons for backshoring are economic, technological, and strategic. Automation may save some labour costs, which reduces the attraction of offshoring activities to lower-wage countries. Technologically, the transmission of process and product data in IoT environments in real time requires some spatial proximity, especially with 5G telecommunications technology.

Finally, the technological transformation, even if it proceeds more incrementally than the Industry 4.0 rhetoric about massive technology-driven transformations has suggested, needs closer cooperation and control within and between companies. Apparently, backshoring is attracting new interest in the European Parliament (Raza, Grumiller, Grohs, Essletzbichler & Pintar, 2021) as well.

The Belgian biotech sector has developed in terms of global value chains from its inception and has extended its activities from R&D into production. This development connects with recent European COVID-19-related concerns over a more resilient distribution of production facilities for critical vaccines and other pharma and medical products, which also entails some backshoring.

The Austrian TRONIC has saved itself some value chain disruption headaches through the COVID-19 pandemic, mostly by sourcing materials and components from Europe and keeping production local, maintaining reliable relations with suppliers and keeping sufficient stocks. According to its management, being a family-owned company with 'patient capital' and the awareness and participation of employees helped to inform these decisions.

Technological change and digitalisation

New and digital technology in the manufacturing of industrial machinery includes the use of robots in production and logistics, also by SMEs, as well as more generic software for enterprise resource planning (ERP), project management, warehouse management, production planning, and so on. Machine learning and big data technology is used in quality control. Robots are increasingly working close to humans (known as cobots) as safety issues are being resolved, and high-precision robots expand possibilities. Robots can make shopfloor work less physically demanding. Sectoral experts also cite additive manufacturing and 'digital twin' technology for development and testing as technologies that are gaining ground in the sector. For the German mechanical engineering sector, the case study authors also recommend more use of business-to-business platforms to share data and extend collaborations.

Belgian biotech companies use digital and automation technologies in both R&D tools and production equipment. Increasingly, big data technology is used in R&D and in quality control. Bio technologies themselves are becoming more complex and contribute to more personalised medicine. Much like the tailored Italian packaging machines, these processes require a more flexible production in smaller batches and complementary technologies.

The use of robots, especially in SMEs, has its limits, however. Space constraints and varying lot sizes, especially where products are customised, complicate the issue of robot efficiency (TRONIC). Indeed, this company is quite aware that automation can be more labour-intensive than expected as robots need to be programmed and set up. With the company's participatory decision making structure, digitalisation projects need to clearly add value to convince everyone involved. Awareness of business development and market needs among employees means that decisions are more informed; this awareness appears to prevent friction in the adoption of the technologies. Interestingly, the Italian packaging machinery manufacturer assembles its digitised products with limited recourse to robotics. It buys in components and assembles both hardware and software in a labour-intensive process, with ample flexibility for customisation.

Industry 4.0 technology is making consequential inroads into both products and business models. Mechanical engineering and electronics companies increasingly build digital functionalities and software into their machines and components. Data and complementary analytics can then be sold to customers as services on top of products (for example, predictive maintenance), and can also be used to improve and innovate products. Indeed, this favours more spatial proximity of production sites for the efficient use of data, and also of the functions of R&D, technical support and data analytics. At TRONIC, sensors and software are also used to save energy in the company building – and the monitoring of energy costs has sparked the idea of implementing an alternating four-day week in production.

In Italy, robot density increased considerably from 2008 to 2017, not least through the support of the government's Industria4.0 plan that offered subsidies and support to SMEs with low digital maturity.

In Germany, case study authors also suggest more government support in introducing and developing Industry 4.0, especially for SMEs that require simpler and more accessible support programmes. They also highlight the importance of improvements in the public digital infrastructure, which in Germany can still entail comparatively slow connection speeds and urban-rural divides in both broadband and mobile connectivity.

Demographic change – ageing, migration, diversity

The countries in which UNTANGLED conducted case studies in manufacturing are all characterised by ageing workforces, also due to pension reforms that increase the retirement age and restrict access to early retirement. Italy has regional disparities and a large share of SMEs in the economy, which pay lower wages than larger firms. The emigration of young graduates is thus exacerbating workforce ageing and staff shortages.

In Germany, the average age of mechanical engineering workers is 44 years. The industry is strongly male-dominated and so far, its attempts to recruit more women have had limited success. While the industry has traditionally relied on apprenticeships and vocational training, this career path has been losing attractiveness in recent years as young people tend to prefer to stay in education or pursue degrees – possibly anticipating increased skill needs in the labour market. As younger and highly skilled workers tend disproportionately to move to urban regions, SMEs located in more rural areas have increasing difficulties to find staff.

The Belgian biotech industry addresses demographic change firstly as a change in market demand, as ageing populations consume more health-related products. The skill needs and

working conditions in the sector attract a global staff. The sector as a whole is gender-balanced, with the possibility of a wider pool of skills and expertise than the more male-dominated sectors, provided working conditions and perspectives remain favourable to women.

The Austrian TRONIC is an example of where a company's reputation as well as the increasing diversity of the workforce mitigate staff shortages. Whereas the production side is carried out almost by exclusively women, and administrative functions are also female-dominated, technical and engineering jobs are male-dominated. On all levels, immigrants are employed.

How trends play out on the ground in manufacturing

Indeed, for manufacturing companies and sectors, the logic as well as the tensions of globalisation, technological and demographic change manifest themselves in interrelated ways. The globalisation of both production and markets has been enabled by digitalisation as it facilitates remote coordination. Supply and value chains have been lengthened and multinationals have also offshored core and essential activities such as R&D or parts of them – known as 'fine slicing' of value chains (Ali-Yrkkö & Rouvinen, 2015; Linares-Navarro, Pedersen & Pla-Barber, 2014) – both through the relocation of business functions and through outsourcing. This has rendered value chains more fragile, as was revealed during the COVID-19 pandemic, with various global logistics bottlenecks and increased geopolitical uncertainty. Both the vulnerabilities of extended value chains and the opportunities of networked production are apparent in the Belgian biotech sector.

Furthermore, emerging industrial strategies related to, for example, sustainability may contribute to the reshaping of value chains and business models. The Italian manufacturer of packaging machinery is already exploring possibilities to refurbish and update machines rather than exchange them, and durable technologies like the products of TRONIC encourage development and design for sustainability and energy saving. Both examples also illustrate green contributions to the servitisation of manufacturing as technology-enabled monitoring of machinery and processes can save energy and materials.

Looking beyond the case studies is the question of to what extent engineering and technology manufacturers can retain control of the new IoT assemblages of products, services and data. The European trade union federation industriAll addressed the political economy of data access and property rights in its policy brief on Artificial Intelligence (industriAll, 2019): sensors and monitoring devices gather data at work, and ownership of this data may be ill-defined between the users and providers of the systems. If tech providers appropriate and monetise this data,

this may lead to a further expansion of digital monopolies – all the more so if the software and IT giants that are strong in Artificial Intelligence also gain ground in IoT.

‘A private capture of machine-generated data in a professional environment would be particularly damaging, because this data embeds the professional experience of workers, so that the data monopolist would de facto capture this experience’ (industriAll, 2019, p. 5).

To enable such data to be used in workers’ or the wider public interest (for example, in assessing sustainability) would require ‘a regime of mandatory nonexclusive licensing of machine-collected data’ (ibid.). However, in our cases, it appears that many mechanical engineering and ICT SMEs and start-ups develop their own software to a large extent.

Currently, as digitalisation and data flows permeate manufacturing processes directly, the possibilities of IoT and telecommunications technology favour more spatial proximity. This may also affect the continuous production flows in the Belgian biotech industry, if such flows are increasingly monitored using big data technologies. In Italy, and probably elsewhere, tech suppliers also need closer feedback loops between R&D and tech support, or between software developers and mechanical engineers as hardware and software components are assembled. Then, strategies of offshoring and automation may become alternatives or sequential steps, as in backshoring. However, jobs being backshored are unlikely to be the same as those that were relocated originally. Whether backshoring - a limited trend apparently related to both technology and the proliferation of crises in the 2020s so far - will gain traction in the following years remains to be seen.

The interplay of demographic changes with technology and globalisation has no clear direction either. On the one hand, ageing workforces are sometimes seen as less adaptable to technological and organisational change. On the other, well-designed robotics may render physically challenging work easier, healthier and safer. This would not just help older workers but also prevent work-related diseases and accidents for all groups of workers. Finally, ageing and shrinking workforces may exert pressure on companies to invest in further labour-saving automation. Alternatively, staffing challenges may again encourage the relocation of jobs to places with more suitable workforces – unless such workforces migrate themselves.

Overall, the manufacturing cases demonstrate how far companies go beyond simply adapting to external megatrends. In Germany, the sector with its industry associations, the union IG Metall and especially its large players, have centrally contributed to the public formulation of these trends under the heading Industry 4.0 (Pfeiffer, 2017).

The Italian companies with pasta, packaging machinery and engineering and remote sensing services for the agrifood sector are also in a way emblematic of Italy's SME-dominated and often flexibly specialised economy. They show that this economy allows for the rapid growth of a tech start-up as well.

The Belgian biotech sector appears to be a textbook case of a research-driven innovative ecosystem that is bringing R&D and manufacturing closer together while still being embedded in global value chains.

The Austrian case is exceptional with its decidedly entrepreneurial participation model. Yet it is an established family-owned manufacturer that incrementally changes its business model, builds its high-tech and 'new work' ecosystems, and is well connected within the regional innovation scene.

1.2.2. Impacts of megatrends on skills, employment, job quality and inequality in manufacturing

Given the interrelations of megatrends, impacts generally result from their interplay and feed back into the way they play out. Institutional regimes of vocational education and training (VET), education and employment actively process the challenges and opportunities of globalisation, technological and demographic change in their path-dependent ways. Companies and sectors combine and utilise the resources and constraints that these regimes provide. They may also depart from them and develop sector- or company-specific strategies.

Skills

Skill development in manufacturing is not easy and no longer appears to fit neatly into the institutionalised patterns of industrial VET, even in Germany. Still, the substitution of workers by technology in manufacturing is mostly affecting the un- and low-skilled, as might be expected (Acemoglu & Restrepo, 2020). Where this group loses jobs, it is also likely to move into lower-paying service sectors, with or without some reskilling.

Skill upgrading means the development of skills that complement digital, robotic and Industry 4.0 technologies and ensure their productive use. This mostly benefits skilled workers. This group needs better know-how in and across processes and data flows, also in the integration of software and hardware.

In the Belgian biotech sector, domain-specific expertise needs integrating with digital and social skills.

Acciarini and Pompei (the Italian case) point out that many hard skills, meaning technical skills, are inevitably company-specific, especially as manufacturers are working on the integration of mechanical and ICT engineering skills. Developing them is helped by better soft skills in problem-solving, collaboration etc. and also by the meta skills of learning and re-learning.

Bachmann and Storm's (German case) interviewees suggest that the need for soft skills might favour women, who so far are underrepresented in the industry and traditionally have social and collaborative skills ascribed to them. However, even women's increasing share of higher-paying non-routine occupations in Germany has not so far brought them proportional pay increases (Bachmann & Gonschor, 2022). This suggests that these skills, in demand as they supposedly are, remain persistently immune to market mechanisms in their gender dimension.

These skill needs are not new and not particular to current technological changes in terms of Industry 4.0 either. The case studies suggest a need for skills in 'job crafting' (Wrzesniewski & Dutton, 2001), in particular but not only in SMEs. In our context, this equals the skills of employees in identifying opportunities in shopfloor technological change and in integrating these opportunities into their tasks and competencies. HR and middle management may not always have the knowledge and capacities to manage such incremental skill adaptations for employees in a timely way. 'Job crafting' is exemplified by the self-directed learning and personal development processes that Austrian TRONIC demands from its workers. As we shall see, this also opens up opportunities to those electronics assembly workers who start with no sector-specific skills in the company. The emphatically meritocratic mentality favoured in this company will not translate easily to other workplaces, either on the company side or for workers. Indeed, Italian unions report that regardless of age, many workers, especially the lower-skilled, are somewhat reluctant to upgrade their skills.

In Germany, the questions if and how to extend skill upgrading to the lower skilled is controversial among social partners. Trade unions demand more efforts and investment by companies and the state, and companies still set their hopes on the external labour market, in spite of the constraints they see there.

For that reason Bachmann and Storm as well as Acciarini and Pompei suggest more and better institutional support for further training and lifelong learning – especially for the low skilled. Acciarini and Pompei point out that managers also require better soft and transversal skills, not least in supporting workers' potential in skill development.

In the Belgian biotech sector, social partners have successfully established joint training facilities and training funds. Such initiatives may also promise ways out of the well-known 'St

Matthew's principle' of investment in training, i.e. 'to those that hath shall be given'. Indeed, this remains an ongoing challenge for labour market policy, social partners and company HR.

Some promising policy suggestions for labour market policy are put forward by Knuth (Knuth, 2021), who argues in the German context that institutional support for up- and re-skilling is currently too based on actual and potential workers' (un-)employment and education status. Labour market policies that give workers more discretion over which pathways to follow and which support to access could render skill development more fluid, timely and adaptable.

Employment

The case studies support the finding that in manufacturing, the substitution of jobs through robotisation has so far been largely compensated by expanding international markets and ongoing innovation growth and the export of the respective industries and companies (Bachmann, Gonschor, Lewandowski & Madoń, 2022). However, this mechanism appears to have retained incumbent workers' jobs rather than creating new employment. The Belgian biotech sector's expansion of both production and R&D also offers employment to the lower-skilled, at generally favourable working conditions and wages.

The lower skilled in both Italy and Germany appear to be at risk, as do those skilled workers who have hardware skills only. This would affect the lower-skilled manufacturing sectors and functions, such as women workers in consumer goods or electronics assembly – unless such workers get the opportunity and manage to upgrade their skills. Indeed, TRONIC is a case in point. The company has a dualised hiring and employment structure: shopfloor operatives are mostly women from varied occupational backgrounds and ages and are hired through staffing agencies first, which gives the company some flexibility in terms of suitability and size of this workforce. After approximately one year the contract is taken over by the company if it suits – and a year is the time a new hire takes to comprehensively learn their jobs. However, the company's fluid organisation and decision making structure opens up opportunities for self-initiated skill upgrading and job crafting, which is especially appreciated by women workers.

In skilled and engineering jobs, companies are already experiencing staff shortages. Competition with other sectors for these workers is likely to increase. However, case study authors and their interviewees are not confident that the companies and sectors in question (apart from the Belgian biotech sector) will be very successful in this competition. Younger highly skilled workers tend to be more attracted by the ICT sector and large companies; they may move to more urban regions or, in the Italian case, emigrate.

TRONIC, however, needs some specialists in Industry 4.0 areas but generally does not complain about difficulties in hiring due to the company's reputation and active social media presence. The fast-growing Italian high-tech start-up draws on a non-obvious pool of technical and soft skills as well: it retains older engineers aged 70+ in roles supporting younger project managers.

Job quality

Job quality in manufacturing is a mixed picture. On the one hand, the technological support of physically hard work can have health benefits and may render remaining manual jobs more feasible and sustainable for older, female or less physically strong workers. On the other hand, digitalisation in the sense of 'looking at screens' for large parts of the working day has its health disadvantages. For now, the interplay of digitalisation, globalisation and demographic change has not always improved employment quality. The remaining low- and semi-skilled jobs in manufacturing can be seasonal (in food and other seasonal industries), fixed-term, or accessible through staffing agencies. In the sample, this mostly affects women workers and those groups whose jobs are at risk from automation anyway. As unskilled or semi-skilled manufacturing jobs still often pay better than comparable or even skilled jobs in services, manufacturing companies face fewer staffing shortages in this labour market segment than elsewhere and have little incentive to improve lower-skilled jobs.

In both the Belgian biotech sector and the Austrian TRONIC, shopfloor workers especially were affected by increased workloads during the COVID-19 pandemic. In the biotech sector, production often runs continuously, requiring shift work. This is well-paid but in the long run, night work especially is known to have negative health impacts. As the sector has been expanding and workforces are expected to age, it may benefit from forward-looking strategies to mitigate such impacts, for example, by offering older workers reskilling and career changes.

More knowledge-intensive and complex manufacturing jobs may be more attractive, learning-friendly and interesting – but there is the downside of work intensification, and cognitive and psychosocial stress. Industry 4.0 means integrating hardware and software technologies in R&D, assembly and tech support. This requires increased collaboration across occupations and technological paradigms. Additionally, implementing an orientation towards IoT in mixed or newly mixing teams of opinionated experts requires a particular set of social skills and quasi-political savvy (i.e. TRONIC). All these demands make for improved job quality as long as work is organised in a learning-friendly and supportive way, and this is not undermined by ongoing

pressure or intrusive monitoring. However, a multiplication of tasks and initiatives where workers are 'empowered', as in the TRONIC case, can also increase the pressure.

Flexible and shorter working hours are one way of addressing these issues and rendering highly productive upskilled work sustainable. The Italian tech company has reduced its working hours. They are the only Italian case to have implemented a performance-based incentive system. TRONIC offers part-time contracts (apart from production) and has introduced its alternating four-day-week in the production department. These initiatives may also contribute to the attractiveness of manufacturing sectors, although shortening working hours in a situation of staff shortages appears paradoxical at first sight – but it may encourage further automation while distributing productivity gains.

Inequality

In manufacturing, those with precarious contracts or non-digital, hardware-only skills and low- or unskilled workers are the groups most at risk of job loss, substitution or reduced prospects. They are the very groups that tend to have less access to training. In both electronics and food, they tend to be women. In supplier-dominated industries, that is, those manufacturing consumer goods, robotisation may also diminish job quality. In these terms, Acciarini and Pompei (in this volume) as well as Italian unionists find a risk of 'divergence between old jobs and new roles', and of further compartmentalisation or segmentation of labour markets.

Even in the participatory TRONIC firm we find legacies of 'old' industrial gender divisions of labour, with women operatives in electronics assembly, hired through different channels and taking part in decision making somewhat tentatively. If individualised performance-based incentives become more common, and women in manufacturing continue to carry larger shares of unpaid care work than their male colleagues, gender pay gaps may also widen. Clearly, this is evidence of persistent inequality and labour market segmentation in manufacturing. Similar inequalities may be reproduced between firms within a sector, as SMEs continue to be able to pay lower wages than larger competitors and may also lack the resources to offer other benefits or invest in higher job quality.

Older workers on the one hand appear to be at risk if they lack the necessary skills but, on the other, are often favoured by longer incumbency in the sector – if companies that are affected by staff shortages and uncertain savings through automation make efforts to retain experienced workers.

Increased workloads during the COVID-19 pandemic were found among production workers as well – and this group could not enjoy the flexibility of working from home. In some cases, this translated into inequalities in the distribution of workloads and a sense of perceived unfairness as, for example, workers without children felt they took on a disproportionate share of that workload.

These mechanisms may contribute to the further polarisation of labour markets and job quality, if the lower-skilled, either with reskilling or without, move into the lower-paying and often more precarious service sectors (Bachmann & Storm, in this volume). How far the need for social and transversal skills opens up new opportunities for disadvantaged groups remains to be determined. So far, in a macro perspective, women workers' wages appear not to have benefited proportionally from demand for their (ascribed) soft skills (Bachmann & Gonschor, 2022).

Nevertheless, the case studies provide some examples of older engineers in Italy and younger semi-skilled women at TRONIC in Austria who are able to utilise and upgrade their skills. These examples rely on fairly specific configurations but suggest that companies with imaginative HR and skills policies can address some staffing shortages.

Another dimension of inequality in manufacturing concerns regional disparities. SMEs especially, also the successful and tech-intensive 'hidden champions', are frequently located in rural or semi-urban regions. There, they contribute to regional development and sometimes to building regional ecosystems of training and R&D. Yet, if they need new skills such as ICT and compete for them with other sectors, they may not be in the most favourable position to attract younger cohorts.

Patterns of impacts and their prerequisites

In the manufacturing case studies, the impacts of megatrends are not entirely negative, and some negative impacts have been compensated by expanding markets and innovations. However, entrenched labour market segmentations and inequalities in employment opportunities and job qualities are far from being disrupted, unsurprisingly. Uses of technology to render work healthier and more interesting, to upgrade skills and build 'learning organisations' (Greenan & Napolitano, 2021; Jaehrling, 2018; Lorenz, 2015), and to render these virtuous circles more inclusive on equal terms requires dedicated and systemic efforts by companies and policies on all levels.

The impacts of globalisation, technological and demographic changes on skills, employment, job quality and inequality are, again, interrelated. Skill and staff shortages in a market context should require improvement in wages and job quality to attract workers – but in empirical organisational contexts, staffing shortages often decrease the quality and attractiveness of jobs through the intensification and expansion of work. Such shortages also appear to converge (as we shall see in other sectors): ICT specialists are sought across the board and the ‘battle for talent’ concentrates on young(ish) highly skilled graduates with some sector-specific expertise. Traditional sources of skilled workers, such as apprenticeships in German-speaking countries, feature less prominently in the case studies although they used to offer good pay and career prospects in skilled manufacturing and engineering sectors. Companies’ anticipation of demographic change and academisation may have led them to lose confidence in traditional training schemes.

Yet skill needs may be more company-specific than this convergence of skill demands suggests, especially as hardware and software, digital and analogue specialists need to collaborate and integrate their domains, and inevitably will have to learn from each other (Acciarini & Pompei, in this volume). This requires and also builds soft and transversal skills. Flexible and even agile organisations such as the Italian Eagle or Austrian TRONIC are finding these skills and learning potential in-house and outside the ‘young graduate’ demographic. Alternatively, skill shortages may drive another round of outsourcing, offshoring or remote collaboration if workers with complementary skills cannot be found in the existing labour market.

1.2.3. Financial services

1.3. Megatrends in financial services

Globalisation

Financial services in general and especially in our cases are still embedded in national economies, and national path-dependencies, histories and regulations continue to play a part. However, they have also been relying on global infrastructures such as the SWIFT data exchange system since well before digitalisation and the internet permeated all segments of society. By channelling money through economies, they are affected by global and regional crises and play a central part in the management of such crises. They are also regulated on the national, European and (partly) global level.

Since the Financial Crises of 2008, the Basel III regulations require banks to increase their shares of equity capital. The US Foreign Account Tax Compliance Act (Facta), and in 2015 the automatic exchange of information between EU member states on savings income, disrupted those bank business models that were based on favourable national tax regimes and strong banking secrecy regimes in Luxembourg and Austria.

Luxembourg banks are thus redirecting their activities to asset management for the very wealthy, also from Russia (albeit less so since 2022), China and Latin America. Indeed, the increase of wealth outside of Europe can be viewed as another impact of globalisation that presents ever-changing opportunities for banks. For Austrian banks, their activities in Central, Eastern and South-Eastern Europe (CESEE) continue to be lucrative, although they have been shown as risky since 2020, during the COVID-19 crisis and the Russian-Ukraine war.

Globalisation also has an impact on the composition of the sector: more local and small banks have left the market post-2008, mergers and acquisitions have occurred, and both larger and foreign-owned banks increasingly dominate the sector, although regional and national retail banks and savings banks are still present in both Luxembourg and Austria. This has sometimes had the effect that after mergers and acquisitions, headquarters are located abroad, and local managers have limited decision making power. Sector representatives in both countries also report increased turnover in management.

Both foreign ownership and management volatility have had a negative impact on social partnership in both countries. Bank owners and newcomer managers tend to be unfamiliar with national industrial relations systems, including the traditions and conventions of cooperation and negotiation on both the sectoral and the company level – or they may simply take a more confrontational position.

In addition, social partnership and its ability to address sectoral challenges is also contingent on collaboration among actors on each side, within the employers' associations and the unions respectively. Here, banks and insurers benefit from bi-or tripartite initiatives (with state support) in training, job mobility and security (sharing data to prevent insurance fraud in South Africa). Still, in Austria, further sector-wide initiatives with a focus on training and education were suggested by the union but eventually failed as employers preferred to rely on company- or subsector-specific collective agreements.

The South African insurance sector allows insight into the variety and range of configurations that make up financial services. Insurance reaches only a small part of the population in a developing country with high inequality and intersecting divides of income, education and race.

The sector picks up on 'global' trends, ideas and innovations but (apart from some franchises) chiefly operates on the national level, where there is still space for growth.

Technological change – digitalisation

Both banks and insurance companies have long histories of digitalisation, and the impacts of new technologies on employment and job quality have also been studied for decades. Indeed, insurance companies 'invented' actuarial mathematics and the foundations of commercial uses of big data. Nevertheless, in all our cases the financial sector is characterised by rather incremental and slow-moving innovation. The reasons for this are partly functional: the sector's centrality to the economy, its regulation, and its customer focus mean that it sees disruptions as more of a threat than an aspiration.

Furthermore, the long digitalisation history of banks and insurance companies means that they often have old, robust but cumbersome IT systems that have grown over time and are not easy to rebuild, replace or adapt to new processes and products. The sunk cost of these systems complicates decisions about continuing or changing systems.

In the South African case study, some 'cultural' reasons for slow-moving innovations are observed: organisational and cultural inertia, lack of management commitment and interest, and a lack of competitive pressure among incumbent companies. However, new 'insurtech' companies pursue product and also process innovations and are underwritten by the incumbents.

Financial services use digital technologies to reorganise customer service and contact and for internal purposes. Company and sector representatives often explain that in digitalising services, they respond to customer demand - but they clearly contribute to shaping this demand by the pricing of non-digital services, by closing branches or by restricting their opening hours. Whether changes are demand- or supply-driven, job automation in financial services often means a shift to unpaid work in the form of customer self-service, including the use of customers' digital equipment. Online and mobile banking increasingly leads to an integration of communication channels and media ('multichannel management').

Here, some dilemmas become apparent that have been observed in earlier rounds of reorganisation in the service sector (Arzbächer, Holtgrewe & Kerst, 2002): if customer service happens digitally, this limits well-established sales techniques such as the 'cross-selling' of additional products and services in a transaction. While data crime makes customers

vulnerable, increased security requirements render online services more cumbersome, in spite of ever-new banking apps for mobile devices.

Moreover, new providers of financial services such as payment processing, also those related to IT big tech companies such as GooglePay or ApplePay, compete in offering smoother and easier services. In so doing, they are shaping customer expectations and setting de facto standards in the traditional domain of banks. It is indeed the Big Five tech companies rather than new start-up fintech companies that are feared as competitors by banks. Fintechs - similar to the insurance-specific insurtechs - are developing new tech- and data-driven products, business models and process technologies. So far, banks see them as potential partners and collaborators in product and process innovation, as with the South African insurance sector.

Internal tech uses gradually deploy 'new new technologies' (Holtgrewe, 2014) such as artificial intelligence, big data analytics (internal) and cloud systems to support product development and sales, integrate back-office workflows or automate the processing of credit applications. Yet all these functions have already been digitally supported for quite some time so that technological advances may have less impact in the shorter run than expected.

Austrian sector experts were also asked about the likely prospects of distributed ledger (blockchain) technologies in the sector (*cf.* McGuinness *et al.*, in this volume). Again, they confirmed the reticence of Austrian banks: since transfers of money are largely automated already, the value added seems unclear for both banks and customers, and the energy use of most blockchain systems does not currently make the technology more auspicious.

As in globalisation, the regulation of digitalisation is a central issue: from 2016, the European Payment Services Directive 2 (PSD2XS2A) requires banks that offer payment accounts to provide interfaces that give data access to regulated third party providers (Jansen, 2020). In 2022, the EU Digital Operational Resilience Act (DORA) was approved and will enter into force in 2025. The PSD2XS2A gives opportunities to fintech and payment service providers that 'repackage' functions of payment processing, consumer credit etc. into data-driven services. Not being averse to regulation in general, sector representatives insist on such regulations to ensure a level playing field for competitors from other sectors. As data-driven services by big tech companies may be funded less through fees than through a somewhat non-transparent exploitation of the resulting customer data, this may give them a cost advantage over banks.

Demographic change – ageing, migration, diversity

In Luxembourg, the banking sector is highly skilled, with a workforce composed of some 71.7% graduates. Due to the relative size of the sector and its increasing skill needs, its labour market cannot be filled by resident nationals. Immigrants make up nearly a quarter and commuters from neighbouring countries another half of the workforce.

In Austria, the sector has been slowly shrinking since 2009 as routine tasks have been automated or outsourced and branch offices closed down. Although older workers have been offered favourable working hour reduction and early retirement packages, younger cohorts have also lost jobs, with the fewest losses being among young graduates. Due to increasing skill needs, fewer apprenticeships, and pension reforms that are gradually increasing the retirement age in Austria, the average age of employees in the sector is expected to increase further. Currently, perceived trends appear to be overlapping: ongoing job losses combine with staff shortages in ICT and specialist functions such as compliance, modelling and data analytics, and with changing requirements in customer service.

South Africa has a much younger population anyway, with unequally distributed skills and learning opportunities and uneven access to the labour market. The insurance sector has a high proportion of graduates and, related to this, a higher-than average proportion of White and Asian employees, whereas Black Africans are underrepresented. Hence, improving access to and inclusion in the labour market for the disadvantaged young is a policy target in both the insurance sector and outsourced business services (see Asmal *et al.*, in this volume). At the other end of the skills spectrum, for highly skilled young South Africans, emigration (often to English-speaking countries) is an option which may expand with the spread of mobile working opportunities. As older, experienced workers in insurance retire, the sector is thus both at risk of losing their experience-based and sector- or company-specific skills and missing out on younger highly skilled graduates.

Trends on the ground in financial services

In financial services as well as business services (see Section 4), offshoring and outsourcing have been a key outcome of the interplay between globalisation and technological change. This occurred first at national level, with the outsourcing of ancillary activities such as cleaning and catering. Then came certain routine functions; mostly moving workers into less costly collective agreements. As European banks especially extended their activities and/or merged internationally, they also consolidated some space-independent activities in subsidiaries in

lower-cost countries. For Austria, obvious destinations were Poland, Romania and the Czech Republic. Luxembourg relocated some services, such as IT, to India.

This practice has some regulatory constraints. Austrian banks are not allowed to outsource the parts of their core business where bank-typical risks are taken. In both Austria and Luxembourg, customers have to agree to the international sharing of their data even within international banks, which enables consolidated platforms and clouds to be located in lower-cost countries. In Luxembourg, there is a distinct and regulated subsector of service providers to banks within the country: *'professionnels du secteur financier'*.

In Austria, the trade union and Chamber of Labour suggested a similar model of joint ventures among banks with a distinct collective agreement for 'near-bank services', but banks prefer to use company-specific solutions and some joint ventures of smaller banks, for example in IT.

However, in both countries recent 'insourcing' or 'backsourcing' examples are observed that reverse previous offshoring decisions. The reasons are service quality, efficiency or control. As in manufacturing, we cannot really assume that this is part of a larger trend. Certainly, activities that are relocated back will be more highly automated and/or shifted to customer self-service than they used to be.

Interestingly, the South African insurance companies are practically outsourcing their innovation activities to insurtech companies and some fintech frontrunners that develop business models to attract new customers with low-cost yet adaptable offers. Such newcomer companies are underwritten by incumbent companies that apparently aim to limit risk while accessing new bodies of knowledge and testing new markets.

Migration is another pattern resulting from combined globalisation and demographic change. As banks are internationalising, so are their staff, across functions and skill levels. Highly skilled experts in international banks' headquarters are internationally mobile and cooperate internationally. In retail banking, as communication channels and demands of customer advice change and customer self-service is extended, in-person service faces more complex questions and interactions. Service-focused banks are hiring more diverse and multilingual advisors, also with qualifications in other service sectors. In South Africa, the emigration of the highly skilled may eventually become a challenge for the nationally oriented insurance sector. Yet outreach to new, more diverse and poorer customers with new products may similarly provide job opportunities for more diverse groups of workers – unless these services are fully automated.

1.3.1. Skills, employment, job quality and inequality in financial services

Skills

The picture of skills in the financial sector is fairly consistent but complex. In all countries the sector has better educated workers than average, in both the economy as a whole and the service sector, and it has been upgrading skills continuously. Traditionally, banks have offered secure continuous careers that could take employees from entry or apprentice positions into management. Currently, new groups of employees are sought for more volatile careers. Skill gaps mirror those in other sectors: ICT staff are needed most, and those with high, sector-specific skills are also in demand. In the financial sector, this means risk assessment, modelling, data analytics and compliance.

Back-office skills and those needed in branch offices are less sought after, and indeed, automation, customer self-service and branch closures have decreased demand. Customer service workers need higher skills in advising on more complex products and/or in omnichannel management of customer contact. In Luxembourg, the sector's new focus on servicing very rich customers requires both expertise and confident social skills.

Trade unionists point out that the downsizing of in-person service functions may have gone too far to ensure good-quality customer services. If these erode, it puts customer trust at risk. According to sector representatives, this trust is a key asset of banks in the competition with other service providers that offer high-tech and easily accessible financial services. In addition, the downsized teams in branch offices lack the time and capacity to support the learning of new recruits on the job.

In South African insurance companies, both managers and workers require more skills to tackle digitalisation and innovation, also with a focus on new, lower-income customer groups where much potential is seen. Whereas prospects and careers likely diverge between highly skilled experts in the headquarters and back-office and customer service staff, sector experts agree that both groups and indeed all employees need more social and transversal skills in collaboration, problem-solving and 'competence in agility' (KPMG Advisory, 2018).

Increasingly, competition for 'talent', both highly skilled and medium-skilled, occurs between sectors and between existing and new competitors. ICT and data analytics staff are being sought in the ICT sector as well as across the economy, and as with manufacturing, there is concern among banking experts that the sector is not the most attractive in that competition.

Qualified customer advisors and customer service managers are also needed in the service sector at large. Sector-specific experts are few in number and they are also hired by new competitors such as fintechs and insurtechs. Nevertheless, at least in Austria, banks hesitate to offer very high salaries to sought-after experts. Even though existing companies cooperate with fintechs or hold shares in start-ups, the job preferences of experts may well play a part in the division of labour between banks and other tech and service providers in the innovative parts of the sector.

To meet these skill needs, sector-wide initiatives play a key role in Luxembourg and South Africa. In South Africa, sector associations are now offering further training to insurance employees in both digital and sector-specific skills. In Luxembourg, tripartite training initiatives have been set up by social partners and the Ministry of Employment, and a collective agreement on ongoing training has been concluded. The sector's social partners have also revised its list of functions in banking, possibly at the expense of the recognition of skills in more routine functions.

In Austria, banks mostly rely on company-specific agreements and offers of further training, and a few sub-sectors have collective agreements covering training. Rolling out initiatives to the whole sector has been suggested by the trade union, but apparently companies are concerned about their respective competitive advantages.

Overall, Luxembourg banks appear to be more sanguine than Austrian ones about skill updates and skill upgrading within the sector and about the collective benefit of sector-wide initiatives - which may indeed help to mitigate staffing shortages.

Employment

The development of employment varies in each of the case studies.

In Luxembourg, it has remained stable, despite some restructuring and resulting changes in workforce composition. Local banks especially have been reluctant to cut jobs for fear of reputational damage. Otherwise, job losses have been compensated by new hires.

Austria has seen continuous downsizing, and sector experts disagree on whether there has been a recent shift to staff retention or a slowing in the downsizing trend.

In South Africa, the insurance sector has been expanding but anticipates job losses due to advancing digitalisation. New business models targeted at new groups of customers are clearly

more tech- and data-intensive and, if they take off, may require fewer but likely higher-skilled employees.

In the coordinated market economies of Luxembourg and Austria, the impacts of job losses have been mitigated through social partnership: social plans have been agreed, early or partial retirement schemes used and statutory benefits topped up by employers. In Austria the focus has been on re-training whereas in Luxembourg, more emphasis has been placed on skill development within the sector.

In South Africa, with its younger population and expanding insurance sector, the inclusion of less educated groups into 'good jobs' is pursued in the insurance sector as well as in business services. Regional disparities play a part, and digitalised, spatially flexible work may increase possibilities here – especially if the skilled urban young decide to leave the country to pursue their careers.

The previous rounds of well-published job losses and restructuring initiatives may also contribute to staff shortages in Austria and Luxembourg: as the sector no longer reliably offers secure high-quality employment and starting wages are not that high, young skilled jobseekers may find other industries more attractive than banking.

Job quality

In terms of job security, changes in the banking sector have been significant and consistent in recent decades across countries: the sector no longer promises a job for life with favourable benefits and prospects.

'Since the early 1990s however, the job profile has shifted considerably from an emphasis on highly sophisticated customer consultancy towards target-defined sales work that lacks the former prestige and status.' (Kirov & Thill, 2015, p. 8).

Clearly, work has been intensified with tighter performance monitoring, especially in sales functions. Digitally supported product development and algorithm-based recommendations require customer advisors to make sense of and explain such products in customer interaction. Working hours in customer advice roles became more flexible, even before COVID-19: many banks now ask customers to make appointments for personal advice and in return offer appointments outside their regular opening hours.

In both banking cases, impacts on employee health have been noted, with decreasing job satisfaction and increased incidence of burnout and other stress-related conditions. Some

banks address increasing pressure and stress with dedicated projects that involve works councils or union representatives to improve prevention or work organisation.

In all cases, the COVID-19 pandemic has resulted in an expansion and some institutionalisation of options to work from home. This option is favoured by the majority of employees, especially those who commute longer distances, as is often the case in Luxembourg. In both Luxembourg and Vienna, some banks have consequently downsized and rebuilt their office spaces with non-assigned desks and more space for team meetings and informal conversations.

Nevertheless, homeworking has the now familiar downside of reduced job quality. Peer learning and quality assurance become more difficult, and boundaries blur between work and private life, with invisibly increased working hours. More flexibility with regard to childcare or other interests and obligations is also possible, but for women this may increase their 'double shifts' if it is not matched by men's increased participation in care and housework.

In Austria, in particular, interviewees also report a cultural change in the expectations of younger age cohorts: in light of staffing shortages, job candidates confidently demand a work-life balance, provisions for working from home and sometimes long part-time work in the range of 30+ hours. In addition, employee turnover is increasing. Whereas previously workers in banking changed jobs mostly for career advancement within the sector, more are now leaving the sector altogether. The traditional loyalty of bank employees to their company or profession appears to have dissipated in the light of changing working conditions, decreasing security, job losses and increased pressure on remaining staff. It remains to be seen whether the much-publicised new confidence of young employee groups with favourable labour market options triggers sustainable changes in the labour market, or whether these changes are absorbed in companies' renewed cost-cutting pressures induced by inflation, technological investments, or economic crises.

Inequality

On the one hand, the banking sector is known for high wage gaps, especially between high-level executives and 'regular' employees. On the other, it has traditionally offered favourable salaries and benefits due to the strong social partnership in both Austria and Luxembourg. Here, outsourcing or relocation of back-office and service functions with resulting job losses have exerted pressure on medium-skilled employees – who also make up the traditional organisational basis for trade unions in the sector.

While the sector has almost even male and female employee groups and women are apparently advancing into management positions, gender pay gaps and unequal career options persist. In Austria specifically, part-time work is still concentrated among women. Apparently, some banks, motivated both by equal opportunities principles and staff shortages, aim to set targets and improve the transparency of HR processes to recruit more women into management positions.

The South African insurance sector has also offered traditional middle-class occupations and working conditions to well-educated employees. It has proved less accessible to educationally disadvantaged and African groups in the labour market, although these groups are the target market for new insurance products. Still, it appears that increasing diversity and equal opportunities in the sector require dedicated efforts – also with a view to contributing to the financial inclusion of marginalised and poorer people.

Patterns of impacts and their prerequisites

While employment figures and trends vary in the sector, skill structures and automation patterns appear to converge. Yet the degree to which routine tasks can be automated, or automation itself generates complementary tasks, is uncertain. Such tasks, again, may be highly standardised, bridging gaps in automation and creating the predictable environments that favour machines. Alternatively, they may amount to more complex, digitally supported jobs.

At present, we are seeing both actual downsizing (Austria) and anticipated automation (Luxembourg and South Africa) on the one hand, and skill shortages on the other. These are mainly found among highly skilled jobs in both ICT and sector-specific functions.

Automation risks may also exacerbate staff shortages if potential employees are aware of the sector's downsizing and choose other industries and jobs to work in. Sector-wide skills initiatives in Luxembourg and South Africa may address that challenge, and in Luxembourg especially, skill upgrading within the sector plays a part. In the Austrian sector, such initiatives, also in collaboration with universities and universities of applied science, chiefly occur at the company level – possibly a classical problem of collective action that misses some of the potential benefits of sector-wide efforts.

1.4. Business services

1.4.1. Megatrends in business services

Globalisation

All business services in the case studies emerge as ‘winners’ of globalisation. This happens in two ways: through the relocation of work – thereby creating jobs and export revenues, and through increased demand for business services.

Business services enable further globalisation through, for example, managing data flows, enforcing standards, and introducing innovative technologies. For this very reason, they are also aware that globalisation is ongoing and that new competitors emerge. In large and established business services, the positions and the approaches of the Polish and South African sectors are different.

South Africa started out in the 2000s as an offshoring and offshore-outsourcing destination of call and contact centres from mostly English-speaking countries (Benner, 2006; Manning, 2022). It also participated in the formation of the sector by developing a set of national standards to improve quality and service delivery for business process outsourcing (BPO) service providers and contact centres (adopted in 2008), which then fed into the global ISO Contact Centre standards ISO 18295-1 and ISO 18295-2. Contact centres still make up three-quarters of the sector, and clearly have seen some automation, increased customer self-service, and the addition of digital channels of communication (*cf. Whitehead et al. in this volume*).

The sector aims for further expansion and increasing shares of offshored work and value creation – with a view to a wider regional distribution of jobs also enhanced by working from home (WFH) possibilities, and better labour market access especially for the young and disadvantaged part of the workforce. Manning (2022) argues that this entails a shift from a mainstream theory of value creation through scalable standardised services to a niche strategy of ‘impact sourcing’ that emphasises distinctive regional features. The sector also explores ways to integrate business services in other African countries into its value chains, through subcontracting or other intermediary functions.

Poland was able to welcome a wider range of ‘nearshored’ services in recent years, due to its highly skilled workforce, spatial and cultural proximity to Western Europe, and EU membership. The case study focuses on ‘shared services centres’, that is, consolidated units of multinational companies that provide back office, ICT or customer services for the company. As multinationals

gained experience in the remote coordination of work and business functions while retaining control over these services, the shared service centres investigated by Kowalik *et al.* were well-placed to take over more complex and higher-value-added functions. So far, this appears to be a success story, but relocating work clearly means that it can be relocated again, and competitors further East or South may well follow similar strategies.

The Irish case is also based on the history of a country that has been attracting foreign investment and relocated jobs in business services and ICT since the 1990s, with considerable government engagement focused on attractive regulation. It bridges technology and business services that fit into a liberal market economy within the EU. With its innovative technology focus, the blockchain 'sector' is global from the start and almost by definition. Indeed, the tech and service provider introduced in the case study is a virtual, globally hiring company that is incorporated in Ireland due to the country's favourable institutional environment. The blockchain user company shows an interesting combination of a global and local outlook: the products it is trading still have a small-business local and 'craft' image that is appreciated by an almost-global, urban and youngish hipster culture of affluent, somewhat nostalgic and (more or less) sustainable consumption. This culture is less locally embedded than it looks. Blockchain is used to coordinate supply chains and to distribute detailed product information to retailers, and to that very customer group. This approach makes even more sense when supply chains are extended further – although, for current blockchain technologies, energy use may constrain the expansion of the technology.

The Belgian provider of testing, inspection and certification (TIC) services is, for now, less global, and its international expansion has been limited by its complex and varied services. Nevertheless, it is an enabler of globalisation as the international trade of products, components and services has multiplied the needs to ensure compliance with standards and certifications, both as a customer requirement and a regulatory requirement for market access.

Indeed, both manufacturing companies and European financial services in our case studies note compliance and regulation as an expanding field of activity and skill needs. Auditing and certification services are thus increasingly complex and hard to manage. The need to contain complexity and retain management control may be one of the reasons why the disruptive and far-reaching digitalisation of our case study company's core activity of auditing and the associated administration and management tasks appeared so urgent.

Technological change – digitalisation

Business services crucially depend on digitalisation. ICT services are a substantial part of the sector, both as specialist services and as a part of shared service centres. As the more standardised and circumscribed services have already been outsourced or offshored on a larger scale, more specialised or complex services may also face automation. This is a concern in the Polish industry especially, where, so far, shared service centres successfully add more complex tasks and functions to their portfolio and appear to embrace automation and ongoing change. On the one hand, they use varied process automation technologies such as Robot Process Automation, Artificial Intelligence, and Intelligent Process Automation (Mamica, 2021). On the other, they find that these comprehensive approaches require high investments with uncertain gains and improvements. In highly automated processes, workers also point out the need to frequently recheck the output of bots and algorithms.

Companies devolve some automation of routine tasks to ‘citizen developers’, that is, employees outside IT who create macros or bots to (partly) automate their own tasks. Improvement and transformation teams outside dedicated departments are also being used – reminiscent of manufacturer TRONIC’s bottom-up approach to automation (Holtgrewe & Lindorfer, in this volume).

Blockchain or distributed ledger technologies are process technologies in their own right. They are expected to ensure the integrity of transactions and processes, transparency, safety and security of operations. In the user case of the Irish case study, they are used to manage both supply chains and product information, and the technology itself was sourced from a Microsoft subsidiary. A representative of the tech and service providing company emphasises that blockchain functionalities can be delivered outside of the traditional banking system or other standardised systems of data exchange in logistics or data transfer. There are also ‘good cause’ uses of blockchain technology to provide financial or information services to marginalised people or people at risk who are not served by conventional institutions (for example, financial services for homeless people).

A contrasting example of process automation is found in the Belgian case study, where the planning, inspecting and reporting work of auditors was digitalised and massively standardised; pen and paper were replaced with apps on tablets or mobile phones. This turned out to be a lengthier, costlier and more cumbersome process than expected. The heterogeneity of services and auditing situations limited standardisation, and neither service quality nor job quality was improved, in the view of workers.

In the South African case study, technological change is mostly addressed as a question of skills and infrastructure. Currently, the globalised business services sector there mainly specialises in customer contact. The immediate process changes appear to affect omni-channel services; that is, handling customer contact through telephone, e-mail and, increasingly, chat functions. The substitution of labour by chatbots and voice recognition technology is not perceived as much of an issue. This is surprising since the skill level in the sector appears to be on the low side, and policy strategies aim to further improve opportunities for labour market entrants. In light of the overall picture of dynamic digitalisation emerging from the business services case studies, further expansion of the sector in South Africa will be contingent on a scenario of slow-moving automation of business services in the country and across its client countries and/or on specialisation in old and new services where interaction with customers (or patients, students, or other recipients of service or advice) needs to take place in real time.

That being said, the improvement of digital skills is part of the strategy as they are recognised as critical skills in the future. Improvements in digital infrastructure outside of larger cities are crucial for decentralising jobs and providing labour market access to inhabitants of remote regions. If working from home possibilities expand, as they are expected to do, this will require massive investment into the 'last mile' of digital infrastructures.

With varied social processes of automation in the case studies, starting points (if these can be identified) make a difference. In the Belgian case, fairly autonomous, mobile professional work on clients' sites was digitalised, with some discretion and planning autonomy removed and travel times monitored.

In Polish shared service centres, already digitalised and remotely delivered tasks with high shares of routine and already-standardised work can and need to be automated further. There appears to be space for incremental on-the-job innovation as well as large systems design, and workers consider themselves both accustomed to automation processes and in a way 'winners' from these developments, although there are some concerns over further automation.

Demographic change – ageing, migration, diversity

Globalising and digitalising business services form a sector that looks to a younger workforce, with the exception of the Belgian case. The technology-intensive segments in Poland and Ireland require graduates, and in both countries the availability of well-educated younger workers has been part of the sectors' attractiveness to foreign investment. Nevertheless, companies in these countries also encounter skill and staff shortages as demand for ICT skills is rising across many

sectors in the economy. The immigration of highly skilled workers helps fill positions in both countries. In Ireland, with its high-tech blockchain industry, virtual collaboration and remote working also substitute physical immigration, and it remains to be seen how the technological possibilities play out in accessing potentially global labour markets.

The South African business service industry operates in a different context. The industry hires mostly young workers (87%), two-thirds of whom are women. Young people are expected to bring (some) digital skills and affinity to the job as well as an attitude of enthusiasm and openness. Black Africans, generally disadvantaged in the labour market (see above, Asmal *et al.*, in this volume), make up slightly over half of new hires in recent years; Coloured people a quarter; Asians 13%; and White people 3%. Compared with the insurance sector, this amounts to a younger, more diverse workforce already. It also points to a segmented labour market in which lower-skilled 'new jobs' go to disadvantaged (younger) groups faster than the higher-skilled ones in established industries such as insurance.

The large companies and number of jobs in globalised business services both contribute to demographic changes and are affected by them. In both South Africa and Poland, these services are concentrated in a few large cities: Warsaw, Kracow and Wroclaw in Poland, and Johannesburg, Kapstadt and Durban in South Africa. It is there that office space, digital infrastructure (especially in South Africa) and a large labour market are found, and the cities are easy to reach for clients. If the sector continues to expand, it is likely to attract mobile young people and thus contribute to urbanisation and age divides between cities and countries. Emerging staff shortages (Poland) and the aspiration to more inclusive labour markets (South Africa) are reasons to relocate companies to other second or third-tier cities or regions or to decentralise jobs with WFH opportunities or satellite offices. However, this requires considerable investment in both infrastructure and – likely - management practices.

Trends on the ground in business services

Unsurprisingly, in business services, we cannot really untangle the mechanisms of globalisation and digitalisation. The interplay of both has created and developed the sector and contributes to its further global relocation and automation of tasks which is, again, supported by other business services. Business services are the outcome of interrelated megatrends already: a combination of globalising economies and digital possibilities (plus liberalisation policies in many markets), enabling the outsourcing and relocation of these services. Consequently, the

sector represents a case of the well-used Red Queen theory – a literary reference to Lewis Carroll's *Through the Looking-Glass*:

'Now, here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that,' says the Red Queen to the story's heroine Alice, who expects running to get her to another place.' (Carroll, 1871).

Or, as one of Kowalik *et al.*'s Polish interviewees (in this volume) puts it, the sector faces the alternative of becoming the Detroit or the Silicon Valley of business services, depending on its innovativeness, skill and human capital base, and its capabilities to attract and retain further labour and expertise.

Yet not all case studies converge on this narrative since neither globalisation nor digitalisation are unified processes, and they interact with specific sectoral and local configurations. These interactions take the shape of loops rather than cascades of trends and impacts. This means that increasingly, digitalisation and globalisation address already-digitalised and already-transnational processes – and their impacts.

With the focus of each case study, we are seeing sectors within countries and companies on particular pathways: upgrading within value chains in Poland, fitting a new complex of 'born global' technology into an established national strategy of attracting investment in Ireland; improving labour market access for disadvantaged young people through incentivising an expanding sector to hire more inclusively and create transferable skills in South Africa. The Belgian case illustrates an attempt at disruptive digitalisation in an unlikely place of professional and unionised work – and the resulting frictions and needs for complementary adaptations in the workplace.

1.4.2. Impacts: skills, employment, job quality and inequality in business services

Skills

Overall, in all case studies, the need for more ICT skills is noted, as well as varying degrees of transversal skills such as problem-solving, creativity, critical thinking and customer interaction. This does not distinguish business services from other sectors investigated, and indeed, competition for these skills in varied combinations with more sector-specific ones extends across sectors. Yet there are interesting variations in the logic of 'more and better' skill provision.

Companies in global business services – either voluntarily or compelled by their specialisms – rely on ongoing on-the-job training unless they need specialists in particular areas. In Polish shared service centres, as more complex tasks are coming in, this does not mean the skill and

educational requirements of new hires are increasing proportionately. 'A BA and a good attitude' are often deemed sufficient for entry positions, but the attitude entails creativity and openness to new challenges as skill updates every three to four years are routinely expected. Some self-learning outside working hours is routinely expected. Yet, possibly, companies need to invest more in providing training opportunities, especially as staff retention becomes more of an issue.

Irish blockchain companies also train technology-specific skills internally as such skills are rare in the labour market. In both cases, interviewees and case study authors see room for improvement in the education system and a role for it in delivering more specific skills. This entails less provision of specifically dedicated degrees than the provision of modular courses or micro-credentials to render training more agile.

Given the role of policy initiatives in developing and supporting new and expanding sectors, this might be complemented by joint initiatives in ongoing training, such as educational leave and sabbatical provisions. On the sectoral level, this happens in South Africa. However, the globalised business services (sub-)sectors in all countries except Belgium have a weaker social partnership than financial services or manufacturing, and so may have difficulty in aligning collective interests in skill upgrading.

In South Africa, with the high hopes of employment creation by globalised business services, the strategy of businesses, business associations and the state allows for a 'demand-led skills pipeline' in which work-readiness skills are provided by a non-profit organisation. Continuous training of employees is also necessary as the digital skills generally ascribed to young people will not be sufficient for more complex tasks. Pathways for specialisation and careers in, for example, finance, accounting, data analytics or organisational transformation are needed. In addition, skills acquired in business services are considered highly transferable to local companies and industries.

By contrast, the Belgian auditors and their unions interpreted the standardisation of their tasks as a deskilling process, as online checklists and templates guide their work. Consequently, in internal training, technology use took up a larger space than the standards and procedures of auditing. Workers and unions saw this as a new priority of efficiency over service quality that undermined the professional identities of auditors. A range of support functions, 'superusers' and helplines were introduced to provide support and smooth workflows, but auditors and other workers in the company rarely noted skill gains in learning to use the technology.

Employment

In all three cases of business service sub-sectors, employment continues to expand, although in Poland this expansion is perceived to take place on shaky ground. The same reasoning may apply in other places: spatially mobile industries may relocate again, the availability of skilled workforces may reach limits and turn into staffing shortages, or ongoing automation may affect the very functions that have been considered promising for expanding outsourced or offshored services.

The Belgian company case study is the only one noting some job loss: auditing reports were generated automatically, and typists were dismissed rather than finding possible transfers for them, even though a need for more administrative support emerged in the process.

In Polish and Irish business services, mostly graduates are hired. ICT-based functions are male-dominated, with some 20% being women in the Irish blockchain industry and 28% in Polish ICT SSCs.

Elsewhere, women's share is above 50%, up to almost two-thirds in South Africa, but we have no information about their distribution across the hierarchy. Teams are multinational and/or ethnically diverse everywhere, as immigrants join the sector in Poland and Ireland, and in South Africa, the share of Black Africans represents half of the sector's employees. The Irish blockchain tech provider directly accesses a global expert labour market by offering comprehensively remote working.

A key issue for globalised business services is labour turnover. This is felt in Poland and South Africa, especially among recent hires, and it suggests challenges in job quality (see below).

Under the heading 'inclusive hiring', the South African government sets incentives for the hiring of young South African citizens (aged 18 to 35 years) from poor households and communities with low or no (formal) employment rates. The initiative appears to be taken up as 22% of new hires met those criteria in the second quarter of 2022. Yet this suggests that the skill requirements in the sector are comparatively low, which makes labour market access easier but job quality harder to achieve (see below).

Other targets in the South African strategy look at indirect employment effects of the sector on an inclusive economy: business services are encouraged to collaborate with African-owned companies and start-ups both within their core business and in sourcing ancillary services such as cleaning, catering or security. In these space-dependent services, more Black African entrepreneurs are likely to be found than in the globalised business services themselves.

Job quality

Job quality in the business services investigated here is varied. It is worth noting that apart from the Belgian case, trade union representation plays no part in the case studies in Ireland and Poland, and unions in South Africa do not appear to be very present in shaping the sector either.

In the generally lower-skilled South-African case there are some concerns over job quality as tasks are likely highly standardised. Indeed, the outsourcing and offshoring of customer contact services have not appeared to improve job quality, compared with companies' inhouse contact centres. Clients exert direct pressure on cost and on the regimentation of work in outsourced operations (Batt, Holman & Holtgrewe, 2009), which may get in the way of learning and skill upgrading initiatives.

It is possible that developing specialisations in functions or sectors that are less sensitive to automation helps companies build expertise and render tasks more complex. For example, Manning (2022) reports that besides customer contact centres, outsourced legal services are also expanding in South Africa.

One specific job quality issue mentioned in South Africa is the availability of safe transport to work, especially when services work for the US market and employees demand night shifts. Workers' homes (especially those of people from poorer backgrounds) and workplaces may be far apart, and travel may take workers through unsafe and violent areas. Apart from travel times, this is another reason to discuss whether remote work could improve job access in remote and rural regions if workers with suitable skills can be found or developed there. However, working from home may not be the best solution in light of potential workers' living conditions in rural areas, and internet connectivity also appears to be an issue in the more remote regions. This would suggest that companies and policy initiatives should explore the possibility of decentralised shared workspaces over working from home, which would also allow for easier knowledge exchange and peer learning among colleagues.

In Poland, despite the general development of task complexity in the sector, repetitive work still exists. However, overall job quality in SSCs is deemed to be higher than in local jobs, wages are higher as well, and have increased in recent years. This again requires that SSCs increase their productivity and value-added. Involving workers themselves as 'citizen developers' in the automation of their jobs may add learning opportunities and a sense of involvement as long as the jobs themselves are not perceived to be at risk. Polish interviewees and case study authors also see greater agility and a more positive attitude to change in the workforce than among their

colleagues from Western Europe – for good reasons as in these countries jobs were lost and relocated as the business services sector in Poland expanded.

Remote working appears to be common in the Irish blockchain industry. In Poland, its introduction during the COVID-19 pandemic demonstrated that complex tasks can often be performed remotely. It remains unclear for now whether this contributes to a decentralisation of work or enables the further relocation of jobs.

In Belgium, auditors' work is mobile in the sense that most of it takes place on clients' sites. Centralised and tech-supported travel planning at first promised more efficiency and management control but then required considerable rescheduling by planners and auditors as the digital tools underestimated travel times. In the Belgian case study, auditors and unions perceived some deskilling, devaluation of professional work and loss of autonomy, for example over scheduling appointments and travel.

Not all impacts on job quality were negative, however. Report writing was automated as auditors filled in their forms and task sheets online, and reports were generated and delivered to customers in (almost) real-time. This saved the work of writing and typing up reports and reduced the amount of work that auditors took home but came at the expense of some typists' jobs. Thus, some auditors noted improvements in their work-life balance. After changes in management, some improvements were also made in work organisation: planners were assigned to particular auditors, and the planning of appointments was done with more feedback loops.

Inequality

From a 'critical' and labour-process-oriented West European and also US-based perspective on the offshoring and outsourcing of services, globalising business services make use of inequalities in wage and cost levels both within and between countries and sectors, as jobs in industries of origin are relocated and/or moved to less regulated and organised sectors and regions (Doellgast, 2018; Drahokoupil, 2015; Huws, 2014). Indeed, trade union presence in business services is comparatively low, and even in the Belgian case the union representatives in the company were sidelined during the technological transformation.

Yet from the view of actors and observers located in Europe's New Member States or emerging economies, global business services provide gains in terms of employment, export revenues and job quality (for example, Mamica 2021). Indeed, jobs in the sector may be better in terms of pay

and job quality than those available locally, although the labour turnover in these sectors suggests that employees are aware of room for improvement and do seek out better jobs.

Gender divisions of labour in our cases mirror those in the sectors for which services are provided: women are found in greater concentrations in admin, financial, HR as well as customer services, and men tend to be found in ICT and other technical functions. ICT companies say they would like to hire more women.

We have no evidence of how gender inequalities play out through the hierarchy or in terms of turnover, pay gaps and so on. In the Irish blockchain industry, there is a dedicated initiative connecting women in the sector and promoting both women's perspectives and the general uses of blockchain technologies for social impact.

Efforts to harness the sector to create more inclusive employment are seen in South Africa. Here, the creation of jobs for low-skilled groups may trade off against developing sustainable and good-quality employment. Yet, if low-skilled workers achieve transferable skills this may increase their labour market options. More jobs may also be created indirectly when business service companies are encouraged and subsidised to procure downstream services from African-owned companies.

The spatial concentration of business services contributes to spatial inequalities. Digitalisation, especially post-COVID-19, promises greater spatial flexibility of working. However, the promise of working from home to economically advance remote and disadvantaged regions has been a subject of debate from around the year 2000 in the context of the 'knowledge society', and such promises have rarely materialised. Other recent research (Dhondt *et al.*, 2022) suggests that successful tech-based regional development initiatives require more of a focus on entrepreneurship, knowledge spillover and regional network-building than on digital infrastructures.

Patterns of impacts and their prerequisites

As the very formation of business services is based on interrelated trends, impacts are also interrelated. Cases have very varied skill bases, but all sector representatives suggest more public investment in education and training systems to provide targeted skill sets to potential workers in their domain.

The division of labour between the education system and companies themselves appears somewhat contested: the dynamics of the sector require ongoing learning for incumbent workers as well as new recruits. In addition, the newness of the industry in Ireland, tightening

regional labour markets in spatially concentrated clusters in Poland, and the inclusive hiring strategies in South Africa all require companies to take over parts of initial and ongoing training. This may become even more important as companies take over more complex tasks and aim to add higher value. We are already observing some back-and-forth movement as companies' and countries' industrial strategies learn from previous offshoring experiences and address their impacts.

Employment prospects are uncertain: traditional tasks taken over by business services may be substitutable by technology such as (partly) customer contact or back-office work, but other functions fill gaps in automation, are complemented by new technologies, or result from their implementation or from further globalisation. Testing, inspection and certification is an example of a service likely to further enable the management and regulation of megatrends. The much-demanded functions in data analytics are likely to expand in similar ways, as data-based value creation is being explored across sectors.

There are varied scenarios: further automation may lead to some backshoring of jobs to keep data-intensive services closer to headquarters, or to further use offshored and/or outsourced services where lower cost or higher flexibility allows for more experimentation or a redistribution of risk. Staff shortages may increasingly drive the direction of automation, either directly through labour-saving technology, or indirectly, to design more standardised jobs that can be filled by lower-skilled workers.

In sum, interrelated trends and institutional processes that address globalisation and digitalisation, changing price structures of other production factors besides labour (such as the availability of cheap or renewable energy sources for energy-intensive clouds or AI applications), and changing markets will likely continue to affect and change companies' 'make or buy' and location decisions in services.

1.5. Conclusions: varieties of megatrends

We have seen how megatrends assume different forms in different contexts, as they are filtered through institutional regimes of employment, industrial relations, market regulation and industrial and labour market policies, as well as through the actual and expected developments of markets for specific products and services.

While addressing megatrends, collective actors such as companies, social partners and business associations also play an active and strategic part in the shaping of these regimes and policies. Hence, their perceptions of megatrends and their impacts make a difference. Which pathways

of globalisation emerge, which technologies are implemented and how, which workforces are sought after (and where they are found) are factors that are all contingent upon companies', business associations' and social partners' decisions, strategies, and modes of cooperation – and of course, upon the histories of previous decisions and actions and their intended and unintended consequences. Path dependencies of sectors and national production and employment regimes are rarely disrupted, although we find some erosions, especially in the coordinated market economies of continental Europe, for example in VET systems, industrial relations or working conditions.

Although this chapter explores possible conclusions that extend across sectors and companies, it is organised along the familiar structure of megatrends and impacts, with some integration of related subjects. As should be clear by now, this terminology suggests a linearity of causes and effects that readers need to take with a pinch of salt to be able to focus on interrelated and sometimes self-reflexive developments.

1.5.1. 'Doing' globalisation and digitalisation

Globalisation means that actual and potential social, economic and organisational relations are expanding. Upon closer inspection, this expansion is an outcome of the interplay between previous rounds of globalisation and technological change, especially digitalisation. Product, service and labour markets as well as competition are growing, extending and changing. This happens not just by region, but also centrally by sector, and by types of customers, business models or employees.

Manufacturers aim to sell data-based services and generally use data-based tools to improve processes and quality. Incumbent banks and insurances try to retain social capital and the trust of customers in the face of automation, self-service and emerging tech-based competitors. Business service providers aim to develop and attract higher value-added and specialised business functions from their clients or parent companies.

The specialist blockchain industry in Ireland, by contrast, creates business models and services that sometimes circumvent banks as traditional intermediaries and are expected to work without established trust between providers and clients – although they find that building policymakers' and the general public's trust in their potential and benefits is necessary to position themselves as a promising sector.

Global value chains come into the picture as a key intersecting point of globalisation and digitalisation (Drahokoupil, 2015; Holtgrewe & Schörpf, 2017). Companies and entire sectors

have been restructuring for decades, redefining the 'core' and periphery of their products and services, and outsourcing and offshoring functions. This is no longer restricted to ancillary or operative functions, as R&D functions can be outsourced or relocated as well – in the South African insurance case, for example.

Interestingly, the Belgian biotech sector started out as an R&D hub but is now expanding its production activities. New sectors and subsectors such as global business services are an outcome of company strategies (in close connection with national industrial policies) that utilise and 'do' globalisation and digitalisation. This extension and expansion broadens companies' options to expand further, but also entails difficult choices, new risks, and new competitors.

In banking and manufacturing, we are also seeing some 'backsourcing' or 'backshoring' of services for reasons of both technology and management control. Security and quality of services play a part among banks, as well as automation-plus-self-service possibilities in customer service.

In manufacturing, Industry 4.0 needs to specifically integrate hardware and software, and IoT networks require spatial proximity to process data and steer processes in real time. Robots and existing machinery may also require closer on-site collaboration between R&D and operations, or hardware and software engineering.

The large US-based technology players (Alphabet, Amazon, Apple, Meta, Microsoft) and IBM, SAP or Salesforce with their diversified and multi-purpose products and platforms become service providers and competitors across sectors. This is most notable among banks that are concerned about Big Tech's access to customers and their capability to cherry-pick tech- and data-intensive payment and intermediation services. Big Tech and other providers of business service platforms and software play similar roles across sectors, and in manufacturing, tech providers with both ICT and manufacturing roots compete with innovative start-ups or in-house tech innovations. With general-purpose technologies and tools, competition for data, social capital and labour extends beyond sectors. The ownership (both legal and metaphorical) of data, customer relations, and indeed, of technological pathways becomes contested as well.

With the multiplying interconnections between sectors and regions, the timelines of change are becoming more complex and less predictable, especially in functions that are already digitised and where new technologies have been implemented for a while.

The outlooks of established entities and challengers (Fligstein, 2002) then diverge, for both structural and discursive reasons. The old, large and secure computer systems of banks and insurance companies as well as their intermediary function in the monetary system slow down digitalisation – for good reasons. This technologically embedded risk aversion adds to banks' scepticism of technologies that come with more disruptive claims such as blockchain.

Manufacturing SMEs were also found to carefully assess the business case for further automation initiatives and to favour incremental solutions. Trade-offs between risk and efficiency or productivity gains and the timing of potentially disruptive choices need to be assessed at a time of economic uncertainty.

Practical experience feeds into these tentative approaches in manufacturing and financial services: introducing robots into manufacturing or apps and database systems in auditing can turn out to be more difficult and/or labour-intensive than is often anticipated. This appears to happen especially where manufacturing takes place in the flexible specialisation mode with customised products or varying lot sizes (as is the case in Italy and Austria). The Belgian TIC service provider is an example of planned disruption going (partly) wrong for similar reasons: top-down digitalisation of the on-site professional work of auditors, expected to be feasible within months, took years and required considerable adaptations to auditors' actual work scope and schedules and to divisions of labour with support staff.

Whereas the term megatrends suggests external and irresistible forces, when seen through the lens of case studies methodology these megatrends appear both more embedded in society and practice than expected, and more riddled with tensions and contradictions within and between different trends.

Cultures and histories of digitalisation in relation to sectoral and company cultures also play a part in these processes. Representatives of Polish shared service centres as well as the Austrian manufacturer TRONIC emphasise their and their employees' capability to embrace change and agility, and to retain competitive advantages through ongoing skill development and/or the flexible adaption of workforces. However, they are aware that these advantages may not be sustainable in the long run.

From this perspective it appears quite likely that developments will remain non-linear and continue in ambiguous or paradoxical movements. Technologies such as artificial intelligence or blockchain still require implementation in actual contexts of work and operations. Most likely this is going to take some labour-intensive accommodation and adaptation that is not always factored in when planning change. Divisions of labour between sectors will be (re)navigated

and (re)negotiated as companies decide strategically where and how to build their capacities and where to buy services.

In addition, new global and technological orientations influence all sectors. The banking sector is using the acronym ESG for 'environmental, social, governance' agendas of sustainability, societal impact and governance. However, these are on the manufacturing agenda as well in terms of the circular economy, resource-saving refurbishment and the upgrading of machinery or design of products for low energy consumption. Financial services launch 'good cause' initiatives by providing financial access and inclusion to marginalised groups who may also become customers, and business services explore possibilities of 'inclusive hiring' and building of skills for disadvantaged people in the labour market.

All of this suggests that macro-level predictions of, for example, employment gains or losses in light of automation are not getting any easier. As digital and other technologies are implemented in highly diverse work contexts, and the 'low-hanging fruits' of automation have been plucked for decades, the possible human-machine interfaces are multiplying and diversifying, and the same applies for options to reshape divisions of labour. The modelling of trends and impacts may thus benefit from research into 'real life' contexts in which technologies are used and globalisation happens to mutually refine and sharpen insights into the questions of how changes happen and are made sense of.

1.5.2. Demographic change and employment

Demographic change is mostly a contextual factor for the cases considered in this volume. Yet it influences the composition of actual and potential workforces, in conjunction with institutions and policies that shape gendered divisions of labour, conditions of retirement, general education and VET, and immigration. Globalisation means that companies can choose locations. This decision is often made according to the availability of promising low-cost or highly skilled workforces. In addition, people move within and between countries, often to improve their education, labour market, or other options.

Together with migration, regional disparities show up as an issue. Technology-driven changes such as infrastructures for remote working are sometimes flagged as solutions to provide disadvantaged regions and populations with access to labour markets and opportunities, but so far, globalised and globalising business services still tend to concentrate in urban areas, and platform-based remote working is mostly known for its poor working conditions and wages rather than for equal opportunities (Wood, Graham, Lehdonvirta & Hjorth, 2019).

Job losses are found partly in manufacturing, and chiefly in banking, mainly due to company restructuring, relocation of functions (offshoring) the recomposition of workforces, and to a lesser extent directly to the automation or substitution of jobs. The most striking cases of job losses in the sample are those from the banking sector in Austria and Luxembourg which, however, have been mitigated by social partner and state initiatives. This has resulted in some skill upgrading as lower-skilled groups left the sector. However, some frictions have been noted in retail banking, insurance or back-office functions: as experienced workers leave the sectors due to job loss or retirement, knowledge learned on the job is also lost. Automation or streamlining of processes may then leave workers and teams without the resources and contextual know-how that are still needed to make necessary adaptations.

1.5.3. Skills, job quality and inequality

Staff and skill shortages are the most common demographic and labour market challenges in our case studies, and we have also shown that such shortages apply across sectors. In almost every case, highly skilled ICT experts, especially in promising technologies, and experts in data analytics are sought after. Companies' recruitment targets appear to converge on high potential, highly skilled young graduates, ideally with some initial experience.

Sector representatives are concerned about their respective sectors' position in the intersectoral competition for talent and frequently assume that the ICT sector offers more attractive jobs to this group than other industries. Sector-specific expertise in the disciplines of engineering, biotech or financial services is also needed, mostly but not only for the university graduate level.

In German mechanical engineering and Austrian banks, well-established training pathways below university degree level, starting with apprenticeships and institutionalised further training, appear to be eroding. There may have been a dialectic of supply and demand (Elsholz, Jaich & Neu, 2018): companies expected automation and skills upgrading to substitute apprenticeships and felt that school leavers were lacking the necessary skills. Hence, they may have underinvested in apprenticeships. Meanwhile, young school leavers - who have become aware of these trends in recent years - have lost interest in apprenticeships and decided in favour of college- or university-based education.

Partly, companies, unions and sector representatives look to the state, universities and universities of applied science, and to NGOs to provide some of the skills, knowledge and R&D needed. Some public-private innovations in VET and further training are found in the case

studies: dual degrees, modular courses and other collaborations between companies and universities are gaining ground, such as science parks and support of spin-offs or training opportunities by business associations.

In financial services especially and in some business services, but also in the Belgian biotech industry, company-specific and sector-specific initiatives play a part. Belgian social partners and South African industry associations are running joint training facilities. However, the Austrian banks example shows that competition among employers for skilled employees may get in the way of coordinated sector-level actions. This suggests that initiatives addressing newer skills and those in newer sectors such as business services may be shifting onto the company level, with limited involvement by sectoral social partners.

The role of social partners - apart from in Belgium - appears to be more in mitigating job losses and providing re-training than in shaping new and emerging sectors. The shift of training to the company level presents a strategic challenge to both social partners and to policies that aim to improve and accelerate suitable training provision to workers and jobseekers.

Some gaps are being filled by the immigration of highly skilled experts or foreign students who remain in attractive locations and find appropriate jobs after graduating in some countries. Immigration is also seen in countries that used to be known for emigration, such as Ireland and Poland. Globalised and globalising services have increasingly international workforces. Italian manufacturers and South African insurers note the downside as students or graduates in these countries with high youth unemployment emigrate.

All in all, it seems that with the specific dynamics of technological change, company- or sector-specific training cannot be neglected. Companies upgrade their products and services, integrate new technologies, and new business models around ICT or specialised and upgraded services emerge.

Companies are discovering that ideally matched staff are becoming harder to find, and that implementing technological change requires some local adaptation and cross-disciplinary collaboration, accommodation and learning anyway. Hence, both specific and cross-cutting training and learning will be needed on all skill levels. This requires some capacity on the part of companies to provide that training, through 'learning by doing' or separate training modules.

Overly lean models of organisation, in the face of ongoing changes and further staff shortages, reduce the time and space available for such training and thus put companies' resilience and innovative capabilities at risk. The same applies to training offers delivered remotely, in small

modules and standardised formats, if such formats are implemented for cost-saving reasons only. Whereas digitally delivered training may improve accessibility and efficiency, developing creative, problem-solving and collaborating skills requires opportunities to apply and share them, both online and in-person.

Some companies find skills and learning potential in unlikely places: the Italian high-tech start-up has engineers aged 70+ in project management support functions. The Austrian TRONIC firm supports individual skill upgrading initiatives of former shopfloor operatives. In Poland, workers in shared services are encouraged to enrich their jobs as ‘citizen developers’ who automate their routine tasks.

In services, cross-sectoral recruitment also plays a part: to fill gaps in customer advice in retail banking, an Austrian bank trains people from other service sectors who are hired for their interpersonal and sales skills. Italian manufacturing also offers on-the-job training and skill upgrading opportunities to unskilled youth. The South African strategy of ‘inclusive hiring’ marginalised people for globalised business services also promises gains in transferable customer service skills to this group, with wider impacts on local economies. There is thus clearly space for more imaginative HR policies, hiring and training people from other sectors or upgrading the skills of unskilled workers.

Job quality and skill development are closely related but skill levels do not determine job quality. The higher-skilled are likelier to encounter more interesting and learning-friendly jobs, possibly with options to work from home or flexibly. The Belgian TIC case shows that they are not immune to negative impacts of automation, however. Here, the digitalisation of auditing work brought less discretion, tighter monitoring and various frictions in the work process of auditors.

Generally, the well-known downsides of digitally enhanced flexibility are often work intensification and stress. In financial and business services especially, tight monitoring and permanent performance assessment contribute to that stress. With more working from home, this may entail longer working hours, even more monitoring of work, and less separation of work and leisure – but on the other hand some flexibility to attend to family or other obligations in the daytime. However, in those manufacturing cases where the COVID-19 pandemic contributed to increased workloads, stress was also perceived – without the option to work from home.

In the light of staff shortages and increased experience with mobile working, we see some flexibilisation of working hours in favour of workers. Younger employees, also men, may be able

to negotiate contracts for 'long part-time' at 30+ hours or four-day weeks. Two companies, Austrian TRONIC (in production) and Italian Eagle, have introduced general or alternating four-day weeks and report good results. Works councillors in banks also suggest shortened work hours to render the sector more attractive to employees – in a way reinventing the sector's tradition of offering favourable working conditions in a more flexible way.

The globally comparative perspective of our case studies also shows that job quality is relative: in Eastern Europe or the global South, work in globalised business services may be more attractive and pay better than local jobs. In Poland especially, this allows employees to embrace technological and permanent change in a more confident way than their Western European colleagues. The women at TRONIC also said that they appreciated the challenges and successes of personal and technical skill development.

Overall, job quality in the remaining low- and semi-skilled jobs in manufacturing is not improving – with some exceptions. The Belgian biotech sector, with its combination of expansion, ecosystem-building, policy support and attraction of production shows that good-quality production jobs can be created in Europe.

Otherwise, jobs are found to be seasonal (in food and other seasonal industries), fixed-term, or only accessible through staffing agencies. In the sample, this mostly affects female workers and those groups whose jobs are considered to be at risk from automation. As manufacturing still pays better wages for unskilled or semi-skilled industry jobs than services, companies may not have much incentive to improve job quality – but some do so and mobilise skill reserves and human capital in the process.

The inclusive hiring case in South Africa, in the context of ongoing automation and some relocation of services, leaves some questions with regard to job quality: will these services succeed in training up low-skilled young people fast enough to ensure good job quality and sustainable careers?

Social partnership is another aspect of job quality. Here, we are seeing some dualisation: in the globalising business services, trade unions play no visible part in our cases. In manufacturing they are present, but more so in large companies than in SMEs or start-up companies. Even in the aspirational workplace innovation example TRONIC in Austria, union involvement is reduced to the company's adherence to the sectoral collective agreement.

Banks are comparatively well-organised, but the internationalisation of companies and their management has not improved relations between management and union representatives. Trade union representatives note that hierarchical and cultural distance appear to be increasing. At the level of companies and sectors, new lines of inequality are not easy to observe as automation affects tasks rather than jobs. Staff shortages require a more ad hoc bundling of tasks, new areas of expertise and specialisation have emerged, and careers have become less predictable. Theoretically, shortages of staff and skills should improve the situation of workers in the labour market, but the companies in our cases appear to address the changing labour market situation in ad hoc ways, adapting working time and working-from-home arrangements or incentives in individual negotiation with new recruits. This suggests new inequalities between existing workers at risk of automation and the sought-after new hires, in terms of salaries, labour market options and negotiating power.

Conversely, in banking especially, revised benefits and bargaining concessions affect workers with longer tenure less than new hires. That being said, lower-skilled staff face higher risks from automation, poor-quality jobs and disadvantageous career changes.

Across all the sectors we examined, established gendered divisions of labour persist. In admin, HR, back-office work and some customer services, the majority of workers are women. The same applies to traditional female fields of employment in manufacturing. ICT and engineering remain male-dominated to varying but considerable degrees, also in business services. Financial services are mixed gender with gaps in women's representation in management, but companies are taking initiatives to implement equal opportunities through more transparent hiring and promotion rules.

Yet we also see some scattered new opportunities for traditionally disadvantaged groups of workers: women in electronics manufacturing who upgrade their skills and functions, aspiring skilled women in banking who benefit from more transparent promotion procedures, and admin workers in business services who get to develop their IT developing skills. All of these occur in an individualised, meritocratic pattern rather than a pattern of collective efforts at equal opportunities for groups of workers.

We lack the data to explore the aggregate outcomes of such initiatives, but the findings suggest that in response to labour market changes and staffing shortages, improvements in job quality are increasingly the subject of individualised bargaining between companies and particular workers whose bargaining power is increasing.

1.6. Workplace innovations – ways to reconfigure trends and impacts

Three case studies, one in each sector, were selected under the heading Workplace Innovation. This was Austrian TRONIC in manufacturing (Holtgrewe *et al.* in this volume), the South African insurance sector (Asmal *et al.*, in this volume), and the Belgian TIC company (Barslund & Lenaerts, in this volume). For the purpose of this comparison, we also include the South African business services sector (Whitehead *et al.*, in this volume) with its policy initiative of ‘inclusive hiring’ as a dedicated attempt to render an expanding labour market more inclusive.

In this context, workplace innovation means planned process innovations in work organisation, worker participation and decision making, and/or recruitment and training. Workplace innovations are expected to contribute to both economic performance and job quality. Whereas the European approach to Workplace Innovation as promoted, for example, by the EUWIN platform² requires a strategy and a component of worker participation in the process, the cases in this study are more varied. They do not allow for much generalisation but exemplify some possible pathways of companies’ and sectors’ transformation in favour of ‘better jobs’.

In two of the four cases, the Austrian TRONIC and the South African business services, this entails a proactive embracing of the megatrends we have explored, with an emphasis on digitalisation at TRONIC and on all three in South Africa. This is not entirely a matter of choice: both the company and the sector aim to prevent being locked into unfavourable megatrend configurations.

TRONIC avoided becoming an ‘extended workbench’ to large manufacturers, and South African business services understand the risk of entering a ‘race to the bottom’ in terms of cost and job quality among countries providing generic business services. Addressing these pressures, actors aim to achieve more desirable impacts through joint decision making and building ecosystems of technology (TRONIC), multi-actor collaboration and standard setting (South African business services), skill development, training and consulting (both).

They also aim for some visibility of the respective initiatives for clients, investors and the wider public, which may add a unique selling proposition to their products or services (Manning, 2022). However, we cannot be sure that the South African effort succeeds in opening up sustainable careers and transferable skills to the disadvantaged young that need them. For this,

² See: <https://workplaceinnovation.eu/euwin/>

skill building, upgrading and specialisation in services need to happen at a faster rate than the automation and/or substitution of speech-based customer service by customer self-service.

In terms of worker participation, both cases vary. While being a central component of TRONIC, even there it involves shop-floor operatives to a limited extent. In South African business services, there appears to be no participation of workers or their representatives in decisions on training and career development, job quality, or decentralisation of workplaces.

Seen together, both cases suggest that the participation of low-skilled groups of actual or potential employees requires dedicated and sustained efforts. Participatory formats of decision making offer opportunities, but it will take a step further for disadvantaged groups of workers to make use of them on an equal footing. For example, the clearly ambitious aim of improving the access of rural or small-town disadvantaged youth to the business services labour market in South Africa might benefit from including these groups' views on what they would require to successfully take and retain such jobs. With regard to transport, digital infrastructure, workspaces etc., this may not just raise interest and awareness of possibilities but input by potential workers may also help direct investments where they make most sense. There is evidence from low-paid sectors in Europe that the participation of low-skilled workers can be achieved (Holtgrewe, Markova & Ravn, 2015), but this area of workplace innovation clearly needs further research that includes the Global South.

By contrast, the Belgian TIC case represents a cautionary tale of workplace innovation by necessity. First, a bundle of disruptive process innovations was introduced to digitalise professional work in a top-down way that overrode worker participation and co-determination by worker representatives. Then, workers and managers discovered that disrupted workflows and decreased job satisfaction required complementary or, rather, repair-oriented workplace innovations and adaptations to make the innovations work. This case exemplifies a digital re-organisation where skilled and professional work faces increased standardisation and regimentation, resulting in physical and psychosocial health hazards. Ursula Huws describes this pattern as 'logged labour':

... 'knowledge work that is 'logged in the sense of being chopped up into standardised units; logged in the sense of being connected online, and logged in the sense of being recorded for future analysis. [...] Each unit of production is nested into a larger hierarchy of electronically-managed coordination.' (Huws, 2016).

In this case standardisation of work does not work as expected: there is more variety and there are more physical and logistical prerequisites related to auditing processes than can be

standardised. Consequently, possibilities for human intervention and the adaptation of schedules and entries needed to be re-introduced into the socio-technical system. In addition, social dialogue on the company level also needs some repair work.

In the South African insurance sector, the first impression is that of a certain slowness among established companies to adopt workplace innovation, despite the emerging challenges and opportunities of demographic change, digital possibilities, and underserved markets.

Looking closer, product and process innovations are mostly found in smaller specialised insurtech companies that receive investment and underwriting from incumbents. It appears that dedicated workplace innovations are closely aligned with product innovations in these companies, as in the case of Discovery Insure. This is a company that successfully integrates incentives for risk-mitigating behaviour into its products based on behavioural economics, effectively nudging customers to look after their health or drive more safely. It extends this logic to its own employees under the concept of 'shared value', which seeks gains in both company productivity and the well-being of customers and workers, with some positive externalities for the wider public.

Both the Belgian TIC and the South African insurance cases demonstrate how workplace innovation can occur as an afterthought and a necessity rather than an original objective, and add to our understanding of how technological and social innovations interrelate.

Outside of the dedicated workplace innovation cases, we also find some elements of workplace innovation in the case studies that were not dedicated to the subject: in an Austrian bank, work processes were reviewed and adapted to better support the psychosocial health of employees (Holtgrewe, Lindorfer & Šalamon, in this volume).

'Citizen developers' automate routine tasks in Polish shared service centres (Kowalik *et al.*, in this volume) – and hopefully gain more interesting tasks and workplace discretion in the process. The four-day week was not just introduced in production by TRONIC but also in the Italian tech start-up Eagle (Acciarini & Pompei, in this volume). Institutional innovations, such as the development of new training offers in collaboration with companies and training or educational institutions figure across sectors. The South African insurance sector, with its exploration of new products and markets, may also find that new employee groups can contribute to these product innovations.

In sum, the workplace innovations found in the case studies - be they large or small, ad hoc or systemic - contribute to the insight that the megatrends explored in this volume both drive and

require innovations themselves. Innovations do not evolve naturally, through market forces or engineering prowess alone. They require individual and collective collaboration, sensemaking, creativity and problem-solving capabilities. At the organisational level, they require resources, not least time and space, open-mindedness, and a longer-term or sustainability perspective.

The finding that much technological innovation in the companies and sectors investigated happens in an incremental way suggests that ‘walking slowly if in a hurry’ is a viable option in many cases. If new technologies require some time to be embedded in actual work contexts and to accommodate existing and new work processes and modes of collaboration, this process can also allow for the time to take workers’ experience and knowledge into account. This may avoid costly mistakes, inefficiencies and conflicts, improve working conditions and job quality, and set virtuous circles of skill upgrading and utilisation in motion.

To cultivate these capabilities, companies, institutions, and society inevitably need to reinvent themselves in the process of innovating. This is the case either through strategy and deliberation or through necessity due to unintended consequences. The workplace innovation cases demonstrate that companies and collective actors in sectors are capable of reconfiguring trends and impacts. They *can* recombine them in ways that are (more) inclusive and positive – and they prove that there are good reasons to do so proactively.

Part II: Case studies

2. Manufacturing

2.1. Manufacturing Italy by Chiara Accerini and Fabrizio Pompei

2.1.1. Introduction³

The Italian manufacturing industry has recently experienced important changes in investments in tangible and intangible capital, in the composition of employment and in workers' skill reconfiguration. As in other developed countries, the wave of so-called fourth industrial revolution technologies (4IRTs) is among the most important drivers of these transformations in Italy. These developments, along with other secular trends such as globalisation and demographic changes, are attracting increasing attention from scholars.

Notably, the implications of 4IRTs for employment represent a source of debate. Some authors, focusing on vulnerability of jobs to automation, warn that 47% of all workers in the US and around 54% in Europe might be at risk of becoming redundant during the next one or two decades (Frey & Osborne, 2017; Bowles, 2014). Others pursue a task-based approach and argue that, within an occupation, many workers are specialised in cognitive and manual non-routine tasks that cannot be performed by machines (Brynjolfsson *et al.* 2018). Adopting this approach, only 9% of jobs in 21 OECD countries are at risk. The rationale is that a sizable share of tasks cannot be automated easily (see also Arntz *et al.* 2016).

In theory, automation could substitute workers in a range of specific tasks and reduce employment (displacement effect). The efficiency gains of automated equipment and robots, however, generate productivity effects and prompt compensation mechanisms, through price reductions, input-output linkages, and final demand effects. Such impacts may, in favourable cases, even expand employment and counterbalance initial job destruction through a reinstatement effect (Acemoglu & Restrepo, 2019).

The effects of displacement and productivity may balance each other out differently, depending on the industry and the specific technological context that shapes the sources and nature of the innovation. According to the taxonomy proposed by Pavitt (1984) and recently revised by Bogliacino and Pianta (2016), supplier-dominated sectors such as the food, textile and apparel, wood and furniture industries mainly use technologies embodied in machinery and new

³We thank the following interviewees: Michele Carloni, Paolo Carnazza, Leonardo Faccendini, Fulvio Fammoni, Cinzia Maiolini, Livio Romano and Giovacchino Rosati, for participating in this study. Usual disclaimers apply.

equipment (e.g., automatic packaging machines, robots, 3D printing). The sources of knowledge inputs necessary to produce the technologies above are frequently external to these traditional industries, residing instead in specialised suppliers, that is, Pavitt's category that includes the manufacturing of machinery and equipment as the main industry. The vast literature dealing with innovation and employment (see Van Roy *et al.* 2018 for a recent review) suggests that productivity outcomes are tied to displacement effects and job destruction in supplier-dominated industries that introduce automated technologies as process innovations. In contrast, the link between productivity effects and job creation should prevail among specialised-supplier sectors, such as manufacturing of machinery and equipment, where automation technologies appear to be product innovations.

However, these outcomes might not be given when we consider the interplay between 4IRTs and globalisation or 4IRTs and demographic change. For example, Artuc *et al.* (2018) argue that in the medium term, as robotics and automation deepen, robotised sectors acquire a comparative advantage in international markets and expand their supply, which reflects the increasing labour demand for tasks performed by human labour. In a recent review on demographic and technological changes, Jimeno (2019) points out that population ageing is an incentive for automation, as Acemoglu and Restrepo (2018) stress, because machines could more easily replace the skills of middle-aged workers. Nonetheless, over the long-term, population ageing and the decline of a highly educated young population may negatively affect innovation and the ability to create modern and more efficient robots and automation (Jimeno, 2019).

Based on these considerations, this case study entails a qualitative investigation of the potentially different effects that 4IRTs, combined with globalisation and demographic change, exert on employment, skill reconfiguration and wage inequality in the food industry and manufacturing of machinery in Italy. The latter are two representative industries of supplier-dominated and specialised-supplier technological regimes, respectively, according to Pavitt's taxonomy (1984). A central hypothesis in this analysis is that by distinguishing industries, as Pavitt suggested, we better understand the impact of 4IRTs on employment. Indeed, the technological transformation in supplier-dominated industries (e.g., food industry) mainly emerges as a potential labour-saving innovation, while in specialised-supplier sectors that produce machine tools, technological progress is essentially a product innovation. We conducted semi-structured interviews with managers and directors of two representative companies operating in these industries, plus a company that develops artificial intelligence

and software (WebGIS) for the agrifood industry, among other economic activities. Next, we integrate this information by interviewing an official of the Italian Ministry of Economic Development (MISE, its acronym in Italian), a researcher from the Research Department of Confederation of Italian Industries (Confindustria) and the labour unions represented by the Italian General Confederation of Labour (CGIL).

The outline of this research paper is as follows. Section 2.4.2 addresses a detailed description of the cases analysed (industries and companies) and discusses the research methodology. Section 2.4.3 presents the main findings from the interviews, and Section 2.4.4 discusses the impacts of secular trends (technology, globalisation and demographic change) on the world of labour according to the interviewees. Finally, Section 2.4.5 concludes.

The ‘story of the case’

After Germany, Italy is the second largest manufacturing country in the European Union,⁴ and food and machinery manufacturing emerge as important pillars of the so called ‘Made in Italy’ (Carcano & Loiacono, 2019). In this section, we first describe the size of these two industries as an introduction to our case study. Next, we briefly introduce the companies interviewed and place them in a broader context depicting the evolution of the megatrends. We conclude the section by presenting the methodology used to investigate the two industries and the representative companies therein.

What is the case, and what is its context?

Figure 1 offers some information about the incidence of Italian enterprises, value added and employees on the total EU-28 enterprises, value added and employees, in the food, beverages and tobacco industries, and in machinery manufacturing (C10-12 and C28, respectively, according to the NACE rev.2 taxonomy). To obtain an overview, we compare Italy at this stage with the other large economies of the former EU-28 (Germany, France, Spain and the UK), plus other EU member countries included in the UNTANGLED Project. According to Eurostat business statistics, in 2018 there were approximately 268,000 enterprises in the food industry in the EU-28, and almost 20% were located in Italy and France. That Italy is no longer the leader,

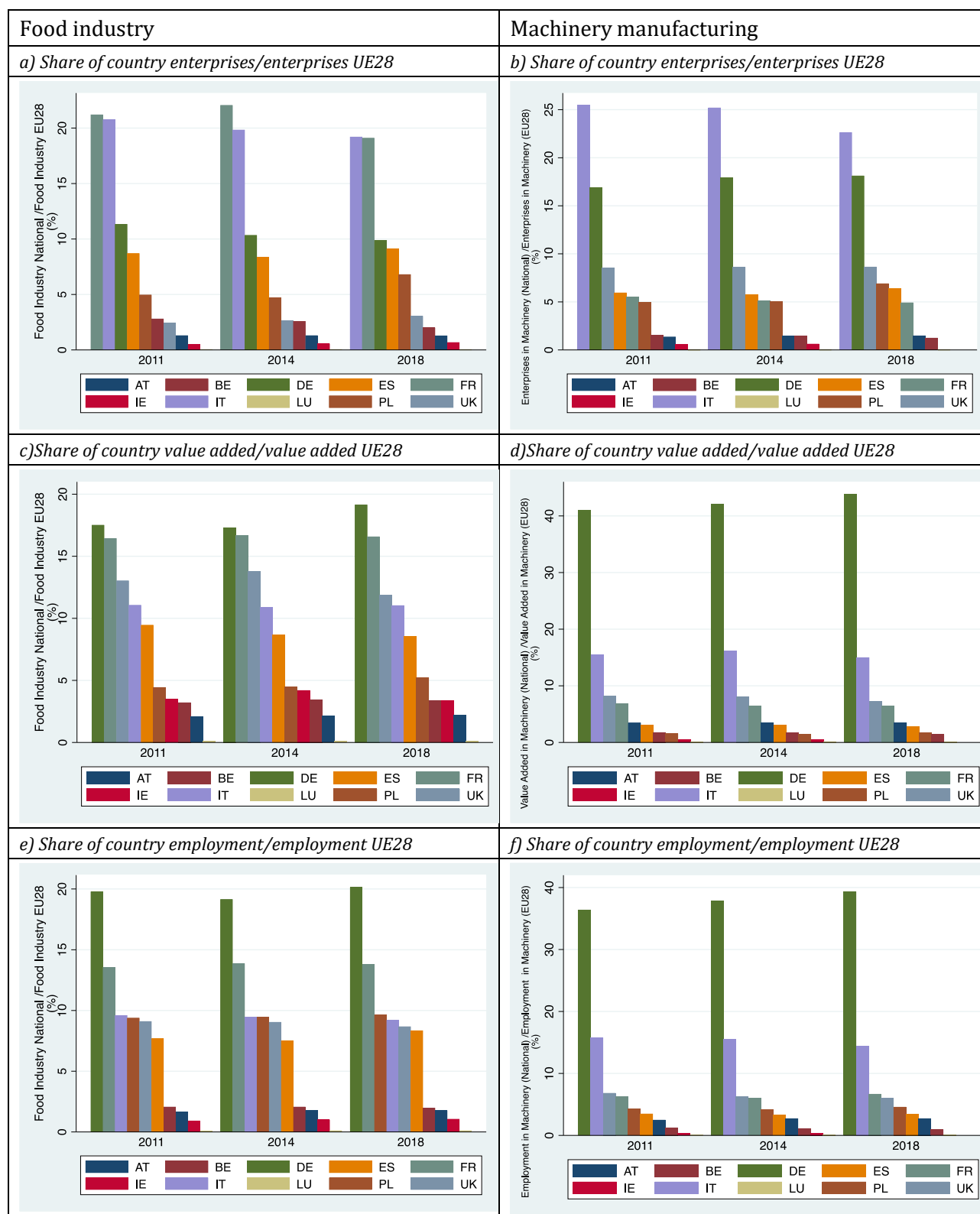
⁴ According to Eurostat, in 2020 Germany contributed for 29% of the total value of sold industrial production in the EU-28 and Italy was placed second with 18% out of the total. In the same year, food, beverages and tobacco was still the most important industry in the EU-28 in terms of share of the total value of sold industrial production (17%) while machinery manufacturing ranked fourth (10%), after automotive (15%) and metal (13%) industries (see updated Eurostat statistics online https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Industrial_production_statistics).

if we consider the incidence of employees and value added (Figure 1, Panels *c* and *e*), signals that the food sector comprises an excessive number of small and medium-sized enterprises (SMEs). This pattern is similar to the machine tools industry (Figure 1, Panels *b*, *d* and *f*). In 2018, Italy, the second most important machine tool industry after Germany, accounted for more than 20% of the total 87,000 enterprises, approximately 15% of the total 3.25 million employees and 15% of the total 247 billion euros of value added in the EU-28. These figures indicate that both the food and machine tool industries contribute to making Italy the third most important economy in the EU-27, after Germany and France, and explain why we chose them as case studies.

The descriptive statistics presented in this section will be integrated with the opinions of professionals and information provided by companies operating in these industries. Thus, the case study develops through three interviews conducted with representatives of MISE, Confindustria, and CGIL.

For companies in the food industry, we analysed the case of Antico Pastificio Umbro S.r.l., a small manufacturer of traditional pasta that recently introduced Internet of Things technology (IoT). Umbra Packaging S.r.l. represents the machine tools industry; it is active in automated packaging machines for pet food, flours and other granular food products. Eagleprojects S.p.A. is an innovative start-up working on artificial intelligence that, among other activities, sells engineering services to the agrifood industry. The three firms are headquartered in the Umbria region (central Italy).

Figure 1. Relevance of national industries on the aggregate EU-28 (selected countries)



Source Own elaborations from Eurostat data

How does it fit into the triangle of technological change/globalisation/demographic change?

Like the rest of the manufacturing firms in the EU, the companies operating in the Italian food industry and machinery manufacturing have been influenced by secular trends and several shocks in recent years. After the 2008 global financial crisis, Italian manufacturing coped with specific shocks, such as the sovereign debt crisis in 2011 (Romano, 2021), and international upheavals, including the rising wave of populism and trade conflicts intensifying in 2016, the outbreak of the COVID-19 pandemic in 2020–2021 (Razin, 2021) and the Russia-Ukraine war in 2022 (OECD, 2022). At the time of writing, it is difficult to say how the last two shocks will further weaken trade globalisation and alter the paths of technological transformation and demographic change. The picture we provide about technology, globalisation and the demographic characteristics of workers relies on information between 2008 and 2018. This is because there is a lack of data available for the most recent years and it would be difficult to infer any long-term projection about the evolution of the last global crises owing to the uncertainty characterising the pandemic and war events (OECD, 2022).

In the charts below, we compare the Italian industries with the corresponding activities of the two most important peers that emerged from the previous section - Germany and France.

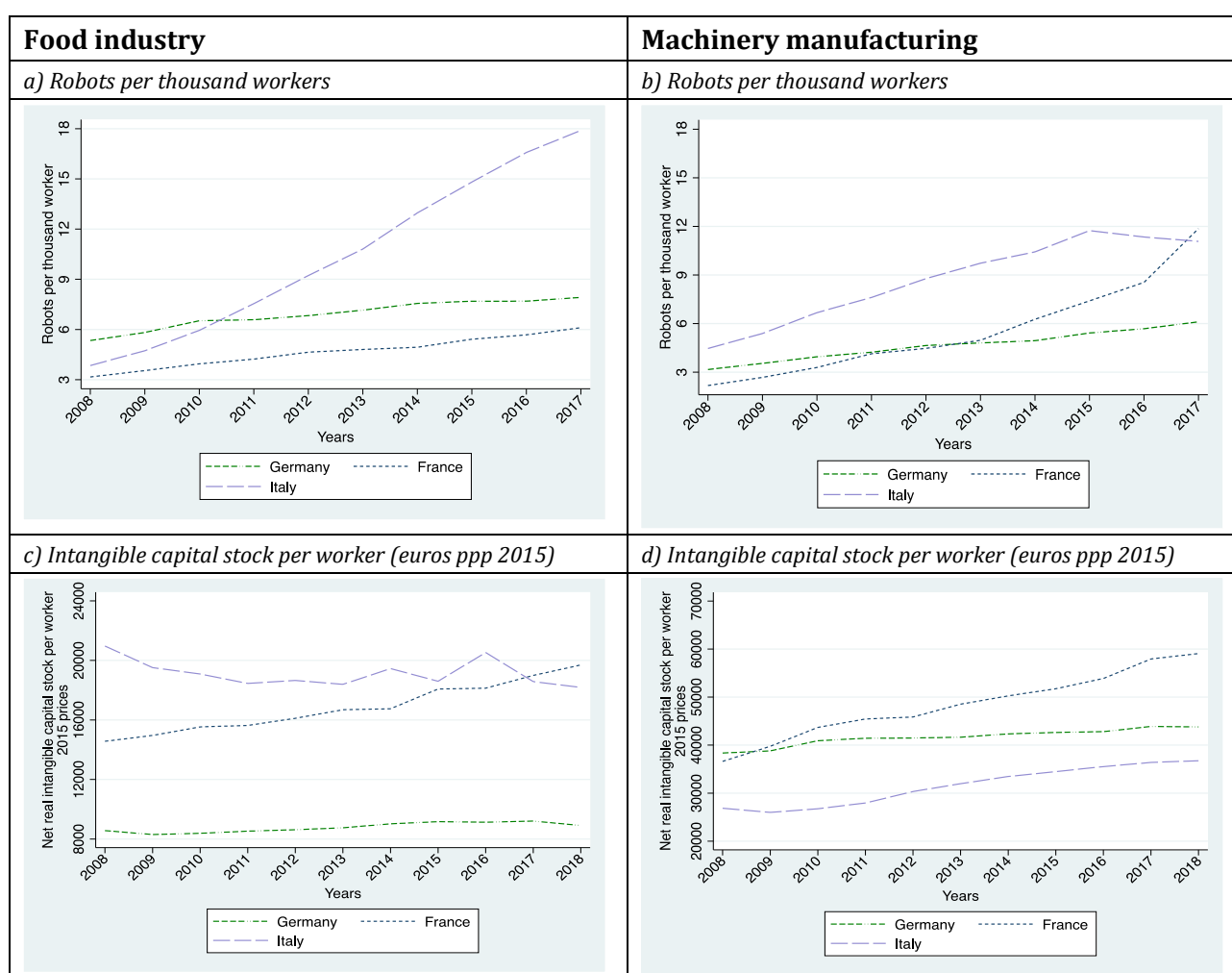
Figure 2 reports trends in 4IRTs in the area of robotisation (Panels *a* and *b*) and knowledge economy indicators suggested by Corrado *et al.* (2005; 2009) and included in the EU-KLEMS Project and database (Stehrer, 2021; Luiss Lab, 2022). The latter refers to the intangible capital stock per worker (Figure 2, Panels *c* and *d*) and encompasses investments in database and software, scientific and non-scientific R&D (such as industrial design), patents, brands, market research/advertising, managing consulting and training.

The growth of robot density in the two industries of interest was significant in Italy compared to that observed in Germany and France between 2008 and 2017 (Figure 2, Panels *a* and *b*). The original mix of tax incentives and amortisation possibilities (the so-called *iperammortamento*) that the Italian Ministry of Economic Development launched within its *Industria 4.0* Plan, unlike traditional funding implemented in Germany and France, may have partially contributed to this result (Buhr & Stehnen, 2018). It is also worth noting that for Germany and Italy, robot density remains higher in the food industry than in machinery manufacturing. This is consistent with the distinction we made between supplier-dominated industries (e.g., food industry) and specialised suppliers (machine tools), where process innovation (capital-intensive production) and product innovation (labour-intensive production) respectively play a prominent role. These

findings are also in line with broader evidence of the whole EU-28, where between 1995 and 2015, the industry's share of robot stock for the food industry notably increased, while that for machinery manufacturing shrunk (Klenert *et al.*, 2020, see Figure 1).

For the intangible capital stock per worker (Figure 2, Panels *c* and *d*), the Italian food industry maintained higher levels than machinery manufacturing, even though the former stayed constant over the period of interest. The intangible capital stock employed in the machine tools industry increased in Italy and started to catch up to the higher levels observed in Germany and France.

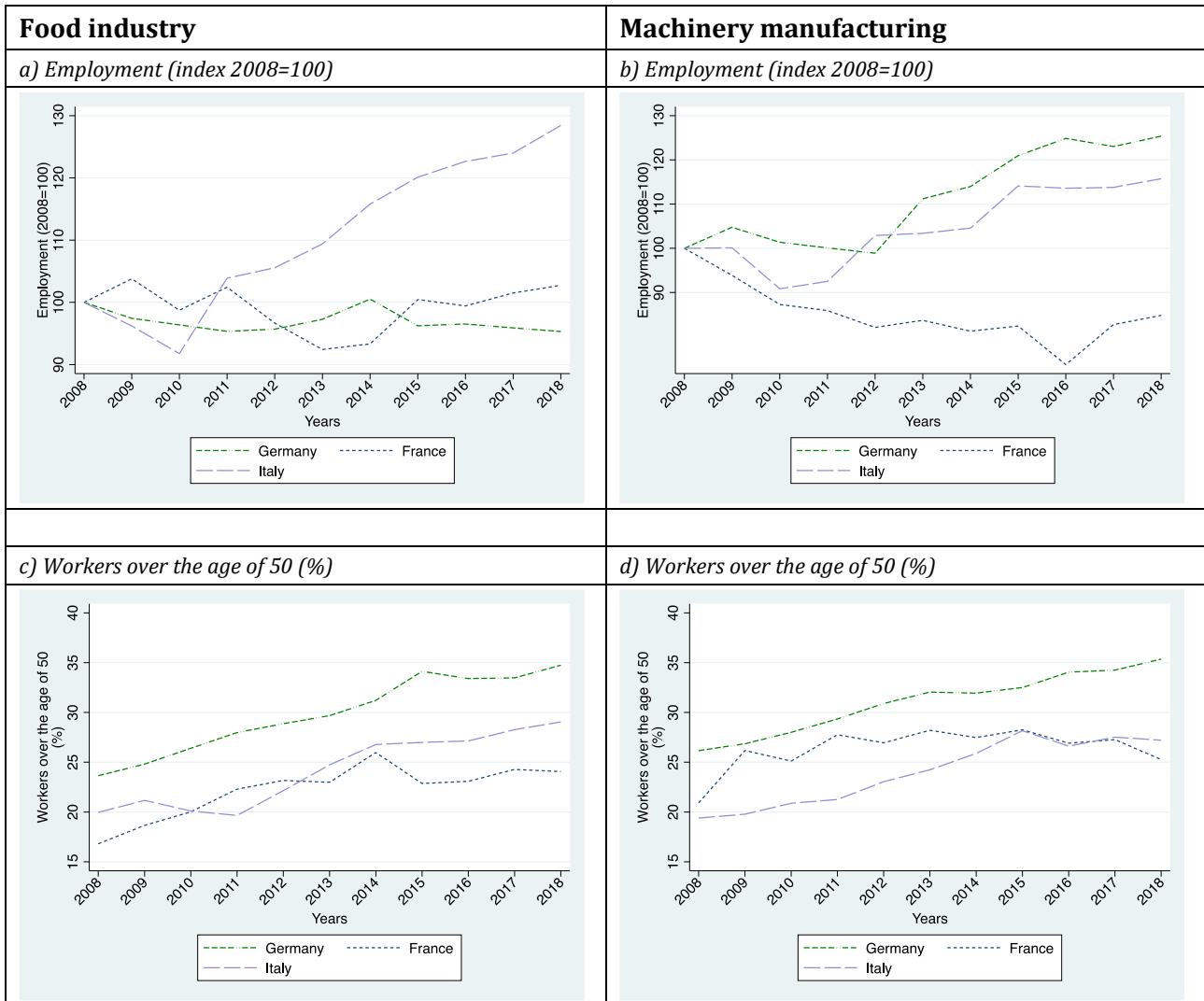
Figure 2. Technological changes in food industry and machinery manufacturing



Source Own elaborations from EU-KLEMS (February 2022 release) and IFR data.

Interestingly, the pervasiveness of 4IRTs in the food industry and machinery manufacturing has not been accompanied by a reduction in employment (at least for Italy and Germany, see Figure 3 , Panels *a* and *b*).

Figure 3. Employment and demographic changes in food Industry and machinery manufacturing



Source Own elaborations from Eurostat (Labour Force Survey) data

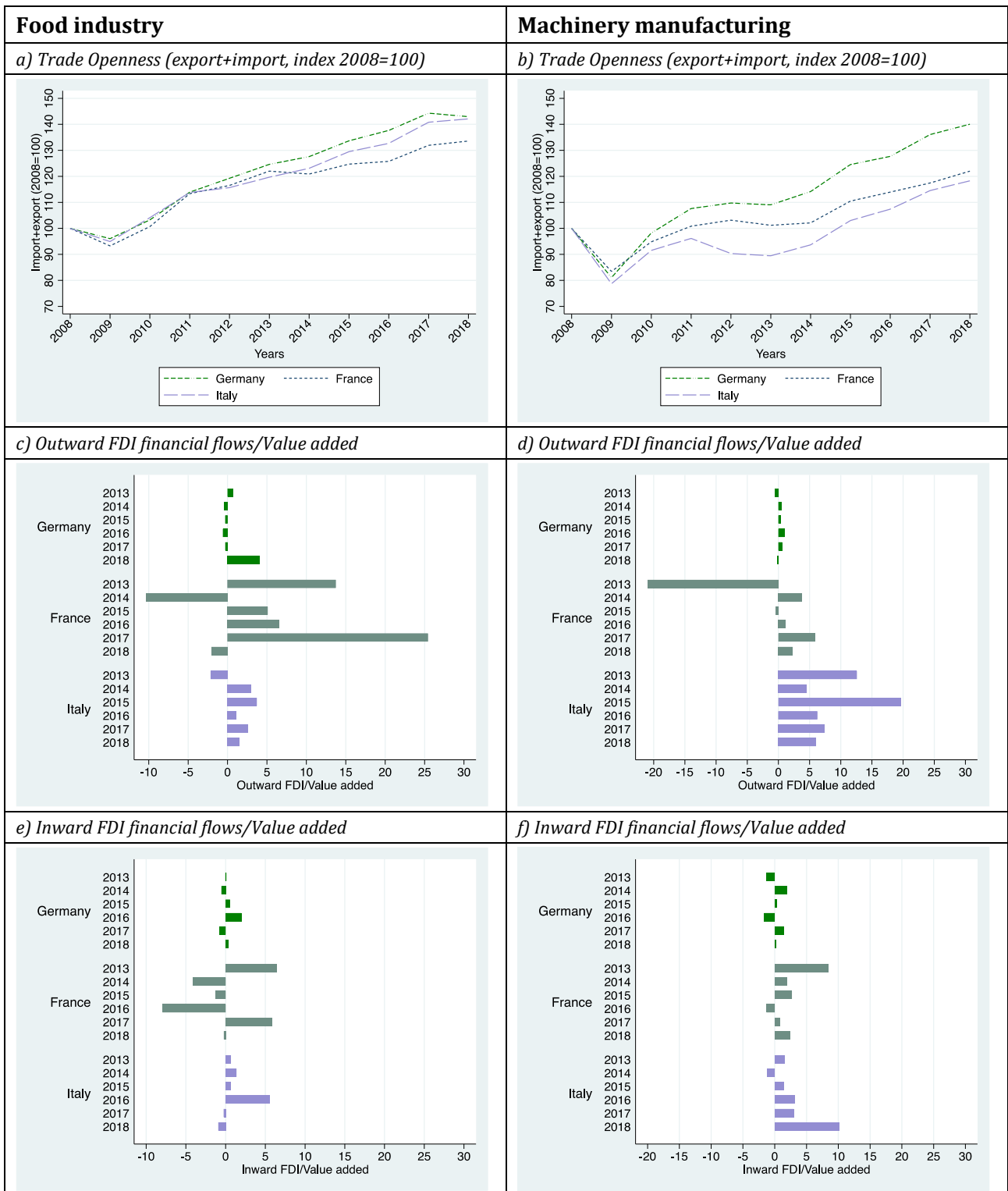
The case of Italy is surprising, as employment seems to have kept pace with robotisation in both the food and machine tools industries. However, there was an upwards shift in the growth rate of the share of older workers (aged 50 or more) in total employment, which occurred just after 2011 in Italian industries (Figure 3, Panels *c* and *d*). This may suggest an alternative explanation to that based on the productivity and reinstatement effects of robots discussed in the introduction; that is, the launch of Fornero law in Italy in 2012. According to some scholars, this reform, by increasing the retirement age and imposing restrictions on early retirement plans, locked older employees into the workplace and negatively affected productivity (Gabriele *et al.*, 2018). A similar pattern, in which increasing robot density is accompanied by increasing employment and an increasing share of older workers, is also observable in Germany in machinery manufacturing (Figure 3, Panels *b* and *d*). Indeed, the explanation based on

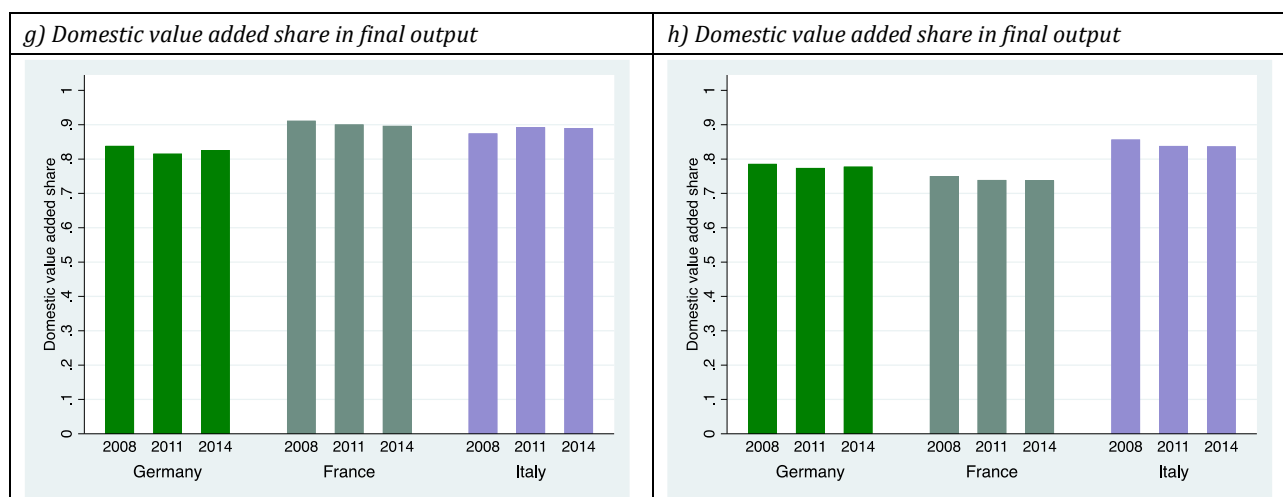
institutional changes may apply to the German case as well as the pension reforms launched in the 2000s gradually increased the normal retirement age (Fehr *et al.*, 2012).

We cannot ignore the increasing evidence supporting the view that robots, and more generally the implementation of 4IRTs, have not harmed employment levels. For example, Stehrer (2022) found insignificant or even positive impact of the accumulation of ICT, software and database capital assets on labour demand across EU country-industries. Despite several caveats, i.e., robot adoption and employment tend to go together because of other factors such as resilience, competitiveness and innovative capacity of specific national industries, Klenert *et al.* (2020) also found a positive correlation between robot exposure and total employment in the EU-28 between 1995 and 2015. Likewise, Dauth *et al.* (2021) and Dottori (2021) found that robot exposure tends to favour incumbents and older workers in manufacturing sectors in Germany and Italy, respectively. Bachmann *et al.* (2022), by extending the analysis to 16 EU countries, found similar results for older workers that also apply to Italy, where higher robot exposure seems to have reduced the probability of job separation. These authors also found that in countries with average initial labour costs (or slightly above average labour costs, such as the Italian case), high robot adoption is not harmful to either non-routine or routine workers, especially in countries where expanding industries and globalisation are playing important roles.

To explore this aspect, Figure 4 shows variables describing different dimensions of globalisation. First, we compare the trade openness between the two industries in terms of index figures reporting the movements of the sum of imports and exports over time (Figure 4, Panels *a* and *b*). Trade openness for the Italian food industry in 2018 was 40% higher than that registered in 2008, while in the Italian machine tools industry, trade openness grew by only 20% over the same period. Thus, greater international trade expansion may provide an additional explanation, along with those based on institutional changes (tax incentives for 4IRT implementation and pension reforms), for increasing robot density associated with employment growth in the Italian food industry.

Figure 4. Globalisation in food industry and machinery manufacturing





Note: indexes are calculated for export and import measured at their current prices. Domestic value added share in final output indicates the geographical origin of the final output of food and machinery industries based on WIOD tables (2016 release) and on the methodology suggested by Timmer *et al.* (2015).

Source Own elaborations from Eurostat, OECD and WIOD data

Second, the internationalisation of the two industries described by inward and outward foreign direct investments (FDI) seems to have favoured most machinery manufacturing in Italy (Figure 4, Panels *c*, *d*, *e* and *f*). Indeed, for the years available (from 2013 to 2018), the multinational enterprise activity in this industry was more important than that in the food industry in Italy; however, it was also more important than inward and outward FDI observed for machine tool producers in Germany and France.

Third, the integration in the global value chains (GVC) of the industries of interest seems to have played a minor role. Panels *g* and *h* of Figure 4 report the world origin of the final output calculated according to the methodology suggested by Timmer *et al.* (2015). The share of domestic value added in total output remained higher in Italy than in its peer countries, signalling a slightly lower integration of these two specific industries in GVCs across the world. More specifically, in the Italian food industry, almost 90% of total output in 2014 was produced internally,⁵ whereas in Germany in the same year, this share was 80%. Italian machine manufacturing appears slightly more integrated with GVCs, even though in 2014 the share of final output produced internally was slightly above 80%, while in both Germany and France, it was below this value.

2.1.2. Methodology

We interviewed professionals and managers/directors of companies in the referenced industries. All the interviews were completed by mid-February 2022; thus, there is no mention from the people interviewed about the extraordinary situation caused by Russia's invasion of

⁵ Unfortunately, 2014 is the most updated information provided by the WIOD 2016 release.

Ukraine or reflections on the global economy. Two of the researchers from the University of Perugia held a series of semi-structured interviews every month for approximately four months. Altogether, we conducted three interviews with Antico Pastificio Umbro S.r.l., Umbra Packaging S.r.l., and Eagle Project S.p.A. managers/directors. Additionally, we interviewed a researcher from the Research Department of Confederation of Italian Industries (Confindustria), two representatives of the Italian General Confederation of Labour (CGIL). We also conducted an interview with an official employed at the MISE to consider the policy-maker's point of view. The interviews lasted from 40 to 60 minutes and were recorded and transcribed verbatim. In these semi-structured one-on-one interviews, we followed a storytelling approach (Czarniawska, 2004); in particular, interviewees were able to freely discuss their experiences by responding to broad questions such as 'Which kind of advanced technologies has your company adopted?' or 'Have you had the chance to expand your business geographically?' or 'What is your workforce made up of?' Furthermore, we focused on questions related to the main effects of technological development, globalisation, and demography on the creation, quality and security of jobs and on capital-labour substitution. Specific questions about potential workforce automation included: 'Did the advent of new technologies lead your company to dismiss more employees?' and 'How did your employees react to the introduction of advanced technologies in the company?' Data analysis followed an inductive process through which we built more abstract units of information from the data observed. After preliminary analyses that focused on the companies, we combined this information with that provided by professionals and proceeded in three stages: (1) carrying out an analysis of perceptions about how megatrends (i.e., globalisation, demographic change, and technology transformation) affect machinery manufacturing and the food industry, (2) understanding the specific effects of these transformations on the nature of work, and (3) categorising these macro effects in terms of skills, employment, job quality and inequality. Details about the findings of our qualitative investigation are reported below.

2.1.3. Case study findings

The companies

Antico Pastificio Umbro S.r.l.

Antico Pastificio Umbro S.r.l. has been in Foligno, Umbria (Italy) since 1994. Even though this company was born as a small artisanal pasta factory, it has suddenly started to invest in innovative design and develop new products such as ready meals and couscous. In 2020,

13,615 euros were spent on industrial patents and intellectual property rights. With 3.25 million euros of operating revenue in 2020 and 9.63% of EBITDA on sales in the same year, the company is directly active in international markets with 40–45% of the export share (this share reaches 70% if we also consider products indirectly exported by some Italian customers). The company normally has 20 employees and its workforce reaches 40 employees during the business peaks. 70% of its employees are women, the average age is 38–40 years, and the majority of employees attained a high school diploma; only 2 of them graduated. 50% of the workforce consists of temporary employees used normally as buffer to cope with demand peaks (*e.g.*, Christmas and Easter festivities). Due to the small size and absence of unions, the company does not implement firm-level bargaining or formal incentive pay schemes; it only complies with industry-level collective bargaining.

Umbra Packaging S.r.l.

Umbra Packaging S.r.l. has been headquartered in Bastia, Umbria (Italy) since 1995. The core business of the company is the manufacturing of pet food packaging machines, packaging machines for flour and granular products (milk and yeast powder), robotic palletisers and bundling machines. With 11 million euros of turnover and 60 employees in 2021, this company is a medium-sized enterprise that recently opened a subsidiary in Brazil. In 2020, a total of 197,466 euros were spent on research and development activities, and 964,613 euros were spent on concessions, licences, trademarks, and similar rights. Most of the employees are men, with only 10% women; furthermore, approximately 50% of the workers are graduates, most of whom are software engineers and mechanical engineers. Only 5% of employees are under temporary contracts, which is used as a screening device to improve the labour quality. This company uses a reward system according to industry-level collective bargaining, but like the previous firm, it does not implement formal incentive pay schemes through firm-level collective bargaining. However, informal wage premia are individually paid to some workers at the end of the year based on the subjective and discretionary evaluation of the company director.

Eagleprojects S.p.A.

Eagleprojects S.p.A. was founded in 2016 as an innovative start-up in Perugia, Umbria (Italy), and is engaged in the supply of computer-related engineering services by focusing on design (development of mobile networks and fibre optic infrastructures on behalf of field operators), software development (implementation of WebGIS dedicated to fibre optic design), detail surveying (carried out using drones and terrestrial mobile mapping with laser scanners) and R&D on virtual reality and artificial intelligence. The most common software developed and

detail surveys are useful to collect geographic data and to map and measure specific areas (e.g., lengths of houses or dimensions of roads). With several subsidiaries active in Italy (e.g., Naples, Ancona, Bologna) and 15.14 million euros of turnover recorded in 2020, the company has spent more than 2.3 million euros on industrial patents and intellectual property rights. The major source of value creation comes from the use of intangible fixed assets, and approximately 99% of revenues derive from Italian customers, that is, big corporations operating in public utilities (e.g., Enel, A2A, Acea, Open Fibre). Recently, they have also developed new software products for customers operating in the agrifood industry. Eagleprojects S.p.A. employs approximately 420 people and more than 100 collaborators; 80% of whom are scientific graduates (e.g., engineers, architects, physicians, agronomists). In terms of contract types, 33% of the 420 employees are under temporary contracts, while 10% are employed as apprentices. Thanks to its size, Eagleprojects S.p.A. has a human resource office with four persons dedicated to recruitment. It is also a company with a clear structure articulated on four tiers: (1) top managers, (2) project managers, (3) team leaders, and (4) teams. However, the work organisation in teams entails rotation across different projects of both shop floor workers and project managers (or team leaders). Thus, there is not a rigid vertical hierarchical structure. The overall proportion of women employed in the company is 30%, which increases to 43% if we only consider the team leader groups. According to the interviewee, women are more frequently in the role of team leader because they have better soft skills and relational capital. The average age in the company is 36 for women and 37 for men. For work conditions and rewards, the company implements both industry- and firm-level bargaining. Within firm-level bargaining, formal incentive pay schemes are implemented and address (1) collective basic premia conditional on firm-level targets and paid to all workers; (2) team-level premia conditional on specific projects, and (3) individual premia.

Globalisation

In line with data on globalisation discussed in Section 2.4.2, the professionals interviewed talked about a greater international expansion of both the Italian food and machine tools industry in recent years. In particular, for the machine tool industry at the country level,

‘The investments and the production establishment in China are encouraged since robotics is considered a crucial sector even though the Chinese technological market is rather underdeveloped.’ (interview with Confindustria).

This opinion was confirmed by the three companies analysed that practised different modes of internationalisation. In fact, most international companies prefer to directly produce in China

to better respond to their customised needs. China is one of the most relevant targets for Eagleprojects S.p.A. in relation to a project based on the development of cricket proteins as food of the future. In addition to China, Eagleprojects S.p.A. is present in Athens and Germany, where ambitious plans for business growth are being considered. Umbra Packaging S.r.l. exports to almost every European country (e.g., Denmark, Serbia, Lithuania) with 92% of the overall turnover exported. Additionally, the company has had a presence in South America since 2013, where a subsidiary has been opened *'to provide direct technical assistance to customers'*. This expansion through export and investments abroad allowed the company to triple its revenues in ten years (from 4 million euros in 2012 to 11 million euros in 2021). In the case of Antico Pastificio Umbro S.r.l., 70% of the products are

'allocated to foreign countries like United States, Germany, Sweden, Holland, and Eastern Europe. Moreover, most of the offering distributed in Italy is allocated to tourists'

According to most of the interviewees, despite the need and the willpower to grow through partnerships and mergers and acquisitions, the major challenge is represented by the entrepreneurial mind-set that could limit business expansion. For instance, one of the interviewees from Antico Pastificio Umbro S.r.l. reported that the partnership with a supplier was crucial to developing software in a customised way that enables integration across different business areas.

Technology use

In most cases, the use of technology has been encouraged by the Italian government with the adoption of measures useful to support the digital transformation of production processes, the official from MISE said. For instance, Antico Pastificio Umbro S.r.l. benefited from the incentives related to Industry 4.0 to *'integrate and interconnect different production phases'* (from the interview with Antico Pastificio Umbro S.r.l.). Thanks to the use of interconnected digital devices, *remote collaboration and assistance* could be implemented in this company to provide real-time support. When companies operating in the food industry such as this one do not have enough resources and competencies, *specialised suppliers and external professionals and consultants* are helpful in developing customised software and services to meet demand. Furthermore, Eagleprojects S.p.A. adopted augmented reality to offer remote technical assistance and training through a special glasses kit. Interestingly, this company not only develops software incorporating artificial intelligence and sells it to other firms, but it also internally uses this software to keep its personnel from being overworked with bureaucratic and routine tasks. In contrast, Umbra Packaging S.r.l. has not adopted any of the Industry 4.0 Plan measures in its

production, with the exception of the digitalisation of warehouse management. The core business of this firm relies on R&D activities and industrial design, assembly, testing and trade of packaging machines. Although the production of the majority of mechanical components is outsourced, this company still develops the software and other crucial mechanical parts of the sophisticated packaging machines in-house. Ultimately, it realises internally customised machines that combine mechanical and digital devices in a context shaped by labour-intensive production processes.

‘The paradox, at least for the Italian SMEs operating in machinery manufacturing, is that these companies produce automation and interconnected sophisticated machines by only relying on skilled labour.’ General manager of Umbria Packaging.

In any case, these machines end up costing less, as a whole, than the workforce employed in supplier-dominated industries such as the food industry.

In more general terms, however, there are potential drawbacks to be considered. In fact,

‘most of the Industry 4.0 measures have been addressed to small and medium enterprises (SMEs) as well as to organisations characterised by a low level of digital maturity’, according to the representatives from Confindustria.

One of the respondents from CGIL revealed that the major critical issue in the Italian context is the low level of diffusion of technological infrastructure, which is essential to accelerating the adoption of new technologies.

‘The lack of sufficient resources characterising specific contexts like SMEs and the lower educational level of managers could hinder the innovation progress.’ (Interview with CGIL).

In addition, *‘cultural obstacles, and the lack of complementary skills’* are potentially detrimental to innovation’. (interview with Confindustria).

Labour and demographic change

Although some studies (e.g., Frey & Osborne, 2017; International Labour Organization, 2016) suggested large numbers of jobs at risk of automation, our case studies revealed that the advent of digital transformation has not reduced the level of employment. This is in line with descriptive evidence and literature focusing on the EU countries discussed in Section 2.4.1. Most of the workers benefited from advanced technologies, and they increased their job productivity (interviews from Eagleprojects S.p.A., Umbra Packaging S.r.l., and Antico Pastificio Umbro S.r.l.). Undoubtedly, the most striking case is Eagleprojects S.p.A., which started with two persons employed in 2016 (the current top managers) and reached more than 500 employed persons in 2022 (420 employees and approximately 100 collaborators). This rapid growth was not

caused by a direct expansion of international markets but rather by continuous product innovation and differentiation in software and drone technology, products acquired by large Italian corporations that, in turn, provide their services to the public utility sector (Acea & Enel, among others). Interestingly, the software incorporating artificial intelligence and machine learning are not only products to sell in the market but are also process innovations to use internally, which saves routine work for engineers and allows them to concentrate on more cognitively complex tasks. In particular, new technologies help reduce the number of mistakes due to human errors. However, in these cases, it is crucial to determine the level of wages, according to one of the respondents from CGIL. In addition, *'Italy should avoid the risk of supporting divergences like the gender gap or the job quality.'* (Interview with CGIL). Although numerous opportunities are associated with the use of technology, *'Only 10% of the employees feel confident about the new machineries.'* (Interview with Antico Pastificio Umbro S.r.l.).

In some cases, *'There are difficulties in finding the right talents like software developers since they look for the best companies.'* (Interview with Eagleprojects S.p.A.).

According to Umbra Packaging S.r.l., software and mechanical engineers cannot be easily found in the market since they are typically scarce and most of them are already employed. One of the respondents from CGIL confirmed that not only the ability of companies and individuals to leverage innovations is disappointing, but also the development of updated competencies, such as digital competencies, represents one of the major obstacles. In general, employees are reluctant to change, *'without any differences based on their age'* (interview with Antico Pastificio Umbro S.r.l.), even though older people (over 50) tend to be less adaptive to new technologies. In some cases, schools and universities do not adequately prepare younger workers to navigate the innovative context created by the advent of rapid transformations. In addition, *'it is more difficult to reskill and upskill individuals with a low level of education'*, according to Eagleprojects S.p.A. Overall, there is a need to reinforce investments in training to spread the development of new competencies and to identify career paths for people who lost their job due to automation. However, these training activities should not be strictly associated with one type of technology that might also quickly become obsolete (from the interview with CGIL).

Likewise, *'it is necessary to understand which type of institution can feasibly implement this training in the near future'*, according to one representative from CGIL.

In the case of Eagleprojects S.p.A., approximately 400,000 euros have been allocated to 'training on the job' programmes, and most of the activities are addressed to software developers.

Interrelated changes

Overall, technology adoption and business expansion have gone hand in hand, acting as an accelerator of growth. When companies decide to expand on the international scale, *'the use of technology favours a major control on production quality'* (interview with Confindustria). According to Umbra Packaging S.r.l., advanced technologies can support the monitoring of remote processes by allowing employees to control specific activities from Italy to Brazil. Furthermore, the interplay between producing more sophisticated automation technologies and the expansion of exports allowed Umbra Packaging S.r.l. to double the number of packaging machines sold and the number of workers employed in ten years, while over the same period, its revenues triplicated. This is thanks to the higher value added of machine tools that have incorporated more sophisticated software programs over the years. In the case of Antico Pastificio Umbro S.r.l., the use of technology has been incentivised by the increasing demand in international markets. This explains why this company did not dismiss workers despite introducing more automation technologies and IoT.

According to the manager from Eagleprojects S.p.A., the acquisition, interpretation, and monitoring of a large amount of data increase the possibility that advanced technologies improve by learning from past experiences and failures.

For instance, *'Smart sensors can accumulate information and knowledge useful to adapt themselves to existing and new conditions.'* (Interview with Eagleprojects S.p.A.).

According to representatives from both Confindustria and MISE, companies can decide to adopt innovative strategies to preserve their market share or simply survive in the market. On the one hand, *'the introduction of technology has simplified the execution of manual and repetitive works'* (interview with Antico Pastificio Umbro S.r.l.); for instance, thanks to the use of machine learning, Eagleprojects S.p.A. has automatised numerous routine activities and processes.

On the other hand, *'Jobs are becoming more complex and sophisticated since individuals need to deepen their knowledge about processes and products to effectively integrate new technologies with the existing structure.'* (Interview with CGIL).

Regardless, the innovation effects should be mediated by managerial experience, according to the respondent from Confindustria. In this sense, *'the development of managerial capabilities combining economics and IT knowledge'* (i.e., hybrid skills) is pivotal. According to the MISE official, a crucial question for the future will be how to support the generation and accumulation of managerial capabilities through training of managers.

'Undoubtedly, it remains a controversial issue how to support the creation of managerial knowledge and competencies, especially whether they rely on transversal and soft skills.'
(MISE official).

This interviewee also pointed out that the question of managerial capabilities is strictly complementary to the question of the growth of firm size, as in many firms that are too small, the diffusion of managerial capabilities is questioned. In addition, despite the advances deriving from the digital era, population ageing could make it difficult for individuals to adapt to technology, according to the respondent from Confindustria.

2.1.4. Impacts

The opinions of the interviewees about how the megatrends in technological transformation, globalisation and demographic changes are conditioning employment, skill reconfiguration and inequalities in the industries of interest are summarised in this section. Moreover, the qualitative study conducted offers a new practical explanation of how enterprises react to these transformations and of how policy makers can manage these megatrends towards shared prosperity.

Skills

The *skills gap* continues to be high since specific competencies (especially software and mechanical engineering) are not easily found in the market. Therefore, firms are unable to fully exploit advanced technologies due to the lack of complementary skills of workers that would enhance human-machine integration. However, all the interviewed companies acknowledged that, independent of the education and training systems, it is impossible to find personnel in the labour market with the competencies that exactly complement the firms' needs. This means that *on-the-job training* and accumulation of firm-specific knowledge remain crucial.

In supplier-dominated sectors, such as the food industry, the introduction of sophisticated and interconnected equipment increases the need for external competencies, which are crucial for the adaptation and maintenance of these automation technologies.

While institutions and companies need to invest in *education and training* to raise the opportunities to reskill or upskill workers, potential constraints can be related to the presence of limited resources to devote to these systems.

On the other hand, since business processes are more complex, information is widespread, new technologies are emerging, and *managerial competencies* can be helpful in supporting and

mediating innovation effects. Specifically, evolving markets need hybrid managerial skills that are able to combine economic, social, and information technology aspects.

The question of transversal competencies and soft skills is thus emerging not only for employees but also for managers, calling for specific training programmes dedicated to these occupations. Indeed, specific soft skills are required from managers (especially those employed in the food industry) because, as reported above, they cope at the same time with the implementation of 4IRTs in the presence of incumbent (older) workers who require reskilling and upskilling. The question of managerial skills and capabilities is intertwined with the issue of a firm's size and the problem of traditional family ownership in Italy. Without incentives to increase firm size, serious barriers remain to the diffusion and accumulation of managerial capabilities within industries.

Employment

Our case studies emphasise some important aspects related to employment. Overall, all three companies interviewed used or produced new technologies and 4IRTs without dismissing workers. At least two of the three companies even notably increased the number of employed persons. Automation technology and artificial intelligence allow companies to reallocate incumbent workers to other tasks. In some cases, this was also accompanied by a reduction of weekly working hours (from 40 to 38 hours in the innovative company producing software).

There is, however, a necessity to reduce the divergence between old jobs and new roles. According to union representatives, this divergence may negatively affect job quality and pay gaps, as reported in the following sections.

In most cases, incumbent employees have adapted to new technologies. In fact, automation has not substituted for existing workers; rather, it has enhanced overall productivity. Even in the case of the most dynamic company, i.e., that producing software and machine learning, older engineers aged 70 and above with valuable competencies and expertise continue to work by supporting younger project managers.

However, according to the interviewed professionals (especially the trade union representatives), the older employees must cope with increasing difficulties in adapting to the new job market in the future. In some cases, *cultural barriers* exist, and they make it difficult for companies and individuals to leverage advanced technologies. For this reason, it is highly encouraged to plan dedicated training paths for those individuals who lose their jobs or are at risk of automation. Moreover, customised training programmes should be designed to include

marginalised people who have been left without adequate access to education and skill-development opportunities.

It is crucial to give employees the opportunity to learn and grow. In fact, organisations can improve their retention rate of the workforce by focusing on dedicated and comprehensive career development.

Job quality

Undoubtedly, job quality is mainly influenced by structural aspects, such as the specific industry and firm size; however, in more traditional activities dominated by small firms, the interplay of technological transformation and expansion of international markets may also improve some aspects of job quality. For example, the introduction of robots and interconnected equipment in the food industry reduced the necessity to resort to physical strength (e.g., lifting heavy flour sacks in the pasta industry) and notably improved the quality of manual labour. However, at least for this company, the percentage of seasonal workers remains very high, and this temporary employment negatively reflects on the welfare of workers. Temporary contracts, involuntary part-time positions, precarious and compartmentalised jobs induced by the introduction of robots and 4IRTs are the biggest concern for union representatives, who have called for workers' representation in the firm's decision making to manage these side effects of robotisation on the quality of labour.

In contrast, in both the medium-sized and large firms interviewed, temporary jobs are not structural, and they are normally used as screening devices for new hiring. In these contexts, project and team working is the dominant form of organising labour within the firm. The existence of a knowledge-based mode of working is particularly suitable for a 'spaghetti organisation' that encourages not only flexibility across various teams but also communication and innovation. The opportunity to exchange knowledge within the company is crucial to developing best practices, stimulating creativity, and fully capturing value from new technologies. This is what happens in the firm that produces packaging machines, where the two groups of software and mechanical engineers meet each other whenever there is a new project to develop. Cross-fertilisation of new ideas and rotation of personnel across different teams/projects is also the rule for the company developing software, drone technology and artificial intelligence. Thus, the increasing number of work projects and work organisation in teams contribute to creating a stimulating and motivating workplace, which in turn favours job satisfaction, as signalled by the very low worker turnover (less than 3% in recent years). Only

in this largest firm is effort and motivation from employees stimulated by a formal and articulated incentive pay scheme, where both collective and individual wage premia are paid to the workers.

This allows us to conclude that the recently launched policy measures in Italy that address tax breaks and fiscal incentives to implement more structured incentive pay systems for small and medium-sized firms should be strengthened.

Inequality

Our respondents highlighted the extent of various inequalities within and between organisations. According to the union representatives, the low quality of some jobs (temporary and compartmentalised jobs) is caused by task reconfiguration and reduction of annual working hours that follow intensive robotisation in supplier-dominated sectors. This negatively affects the labour incomes of some occupations and widens the pay gap within firms. Depending on education and field of studies, the introduction of 4IRTs is expected to accentuate the segregation of particular categories of workers (*e.g.*, women, migrants) in low-paid occupations and tasks, aggravating within-firm wage inequality as well.⁶

Unions also point out that despite the introduction of 4IRTs, boosted by fiscal incentives, SMEs will continue to pay lower wages in Italy than large firms. This contributes to maintaining an important between-firm wage gap. Since SMEs account for more than 96% of total enterprises, especially in the food industry and machinery manufacturing, they also contribute to a generalised low wage economy that is forcing an important fraction of young Italians with tertiary education to go abroad to pursue careers.

This inequality of opportunities for a well-educated workforce in Italy is also a major issue for the official of MISE, who associates this phenomenon with the low level of education and poor managerial capabilities of entrepreneurs. In their view, the majority of them in Italy are still unable to leverage the human capital of the workforce.

⁶ This view finds partial confirmation in the study of Perugini and Pompei (2022). The authors hypothesised that also for better paid jobs, the task reconfiguration caused by the intensive investments in intangibles such as database and software, determines excessive flexibility and unpredictability of working time particularly penalising women.

2.1.5. Conclusions

Our qualitative study dealt with the effect of megatrends (i.e., technological transformation, globalisation, and demographics) on skills reconfiguration, employment and inequality in companies in two Italian manufacturing industries.

We focused in particular on the food industry and machinery manufacturing, as they are representatives of supplier-dominated and specialised supplier sectors respectively, according to Pavitt's taxonomy (1984). This distinction is useful to clarify the potential heterogeneous impacts of megatrends on labour, depending on the different sources and roles that innovation plays in Pavitt's technological regimes.

The case study is based on six semi-structured interviews addressing managers/directors of companies and representatives of trade unions, employer associations and an official of the ministry responsible for industrial policy. This information has been integrated with descriptive statistics at the country-industry level, stressing the importance of the Italian food industry and machinery manufacturing in the EU and providing a picture of how megatrends affect these industries.

Both the facts reported by companies and the opinions expressed by professionals confirm what quantitative studies have been revealing in recent years about the impact of automation technology on employment in EU countries. Thus far, if the technological transformation is accompanied by expanding international markets (food and packaging machine producers) or continuous product innovation and differentiation (software producers), its impact is not so harmful to employment. This is also what some econometric analyses, performed within the Untangled project and focusing across a larger sample of EU countries, have found. For example, Bachmann *et al.* (2022) observe that in countries with slightly above average labour costs (such as the Italian case), high robot adoption is not harmful to either non-routine or routine workers, especially where expanding industries and globalisation are playing important roles. Stehrer (2022) found insignificant or even positive impact of the accumulation of ICT, software and database capital assets on labour demand. These studies confirm the evidence we find for companies active in supplier dominated industries (food industry) and the comments of the interviewed experts: introducing IoT and other automation technologies should be strategies adopted by expanding firms in particular.

What is surprising, and by no means expected,⁷ is that the company that produces highly automated packaging machines and operates in a specialised supplier industry (according to Pavitt's taxonomy), does not use robots or automation technology, with the exception of the digitalisation of warehouse management. This company produces automation technology by means of high labour-intensive processes. By outsourcing the production of components and retaining R&D, industrial design, assembling and testing functions, this medium-sized company combines software and mechanical parts of sophisticated packaging machines exclusively using human labour. This is, of course, the result of producing only in a made-to-order manner, where it is crucial to carry out low volumes of highly customised machines. However, many Italian SMEs in this industry adopt a make-to-order policy. We speculate that international market expansion and product innovation (new customised machines) fuel a sort of compensation mechanism. According to this compensation mechanism, however, the machine tool industry absorbs young people in transition from education to work rather than re-hiring dismissed workers from other industries, even though young labour market entrants are endowed with only basic skills. Differently from other manufacturing industries (such as the automotive industry) where process and not product innovations play a key role, in the machinery manufacturing the young labour force continue to be employed and are not displaced to the service sectors.

From our investigation, the issue concerning which skills may support the processes described above is complex and multifaceted. The problem of skill shortages was underscored by all persons interviewed. Companies using automation technologies face difficulties in finding personnel that easily adapt to the new machines, while for companies producing automation technologies it is difficult to recruit software engineers and developers. However, all interviewees acknowledged that even when a workforce with adequate education in the appropriate fields of study was available, it is impossible to find the right hard skills that a company needs for its organisation in the job market. Thus, *training on the job* and tenure always play a crucial role in the accumulation of firm-specific knowledge by new entrants. This also holds for companies operating in high-technology and 'creative destruction' environments, normally characterised by higher worker turnover, such as software and AI developers. Furthermore, the accumulation of firm-specific knowledge requires an adequate level of soft skills. In particular, the company operating in the food industry implicitly referred to a lack of

⁷ This is because, according to the IFR statistics, robot adoption in the Italian machinery manufacturing almost doubled between 2008 and 2017 (see Figure 2, Panel *b*).

ICT-complementary soft skills among its employees, such as autonomy, coordination and collaborative behaviour. The absence of these soft skills adds to low motivation and negative reactions towards the introduction of automation technology. This is not dependent on the age of workers, the entrepreneur said, as these personal traits are evenly spread across both old and young workers. The problem of soft skills calls for rethinking the functions of the current education, training and lifelong learning systems.

Regarding age, both Italian manufacturing industries analysed here experienced an increasing share of older workers (aged 50 or more). It is difficult to say at this stage whether this is the main cause for the increasing robot adoption observed in recent years, as this demographic trend was concomitant with an expansion of the international markets that may have played a more important role in robot diffusion. What is surprising is that even more dynamic companies, such as those developing software and artificial intelligence, are not dismissing older workers because of obsolete competencies. Indeed, in this company, engineers who are 70 years old use cognitive and problem-solving abilities to support the coordination tasks performed by younger project managers.

The within-firm wage inequality among workers with similar qualifications has been acknowledged by the company producing software and AI, as a result of introducing a formal incentive pay scheme. According to the entrepreneur this form of inequality is not a problem because it is driven by a meritocratic principle where commitment, effort and productivity of workers is rewarded accordingly. However, in their empirical analysis conducted for the UNTANGLED project, Perugini and Pompei (2022) found that this 'meritocratic principle' may be corrupted when we consider the gender dimension and wage inequalities emerging between male and female workers that apply for incentive pay and bonuses, especially in companies with high investments in intangible capital. This is because these intangibles may require relevant changes of the business models and work organisation of companies, as they push towards increasing flexibilisation and unpredictability of working time. As gendered asymmetries in household workloads persist, female workers are less likely to reach the targets to be eligible for bonuses and incentive pay, hence falling behind their male counterparts with reference to the variable part of their remuneration. In addition, the awareness of this disadvantage will render companies and functions implementing incentive pay schemes less attractive for high-potential female workers or decrease their bargaining strength, while increasing the probability of statistical discrimination by employers.

In more general terms, although the diffusion of 4IRTs across firms is not shrinking employment, inequalities in working conditions and wages will persist or even be aggravated in the future, the union representatives said. This is in part because intensive robotisation reallocates tasks and reduces hours worked annually only for some occupations that in turn generate precarious, compartmentalised and low-paid jobs. In addition, a majority of unstructured and undercapitalised SMEs, despite introducing automation technologies thanks to government fiscal incentives, will continue to pay lower wages than large firms. This dualism fuels a persistent between-firm wage inequality. According to unions, to avoid these structural problems, it is necessary to create institutions for territorial-level governance (industrial district-level) of these clusters of small firms. These institutions might favour the extension of firm-level collective bargaining to small and medium-sized units and establish policies for codetermination arrangements and worker participation in high-level company decision making.

2.2. The German mechanical engineering industry by *Ronald Bachmann and Eduard Storm*

2.2.1. Introduction

This case study investigates developments and challenges in German mechanical engineering in the light of the three mega trends technological change, globalisation, and demographic change. Mechanical engineering represents an interesting example for this report for two reasons. First, this industry is of great importance for the German economy and reflects the seal of quality ‘Made in Germany’ perhaps more than any other industry. Therefore, it serves as a good example for Germany’s structural challenges in the 21st century. Second, mechanical engineering is usually associated with hardware, evoking images of large machines and robots. However, even this well-established industry cannot escape the rising prevalence of digitalisation and, alongside this development, greater emphasis on software. The industry therefore serves as a reminder that the digital era is omnipresent and in fact has only got started.

The goal of this study is to explore specific aspects of the impact of the three mega trends on the mechanical engineering industry in Germany, with a particular emphasis on the effects of technological change. We are particularly interested in the type of technologies most prevalent in the industry, the effects on production processes, and the ensuing consequences for workers in terms of employment opportunities and quality of work. We also explore the policy implications of our findings.

In order to answer our research questions, we conducted five interviews with experts from the industry with different areas of expertise, specifically employer and employee representatives as well as technology experts. The overarching result from our interviews is that digitalisation will be *the* major technological driver of the next ten years. Digitalisation highlights the rising importance of data, causing a shift away from machines towards services. Rising levels of interconnectivity and smart automation (*Industry 4.0*) in the modern factory make this transition possible as an ever-increasing number of data is being fed back into the production process. Especially advancements in Machine Learning (ML) will accelerate digitalisation over the next decade, as automated systems become more effective the more data becomes available ('Big Data'). This implies a shift from hardware to software (e.g. in the context of predictive maintenance) which will lead to the emergence of new tasks requiring new competences and a new organisation of work. Consequently, mechanical engineering companies must change their entire business model in order to adapt to the digital era.

The German manufacturing industry

Germany is renowned for its industrial sector, an important reason for its strong position in global manufacturing business. A key sector within this broad industry is mechanical engineering (see below for details). Producing machines for firms across all major industries, mechanical engineering is a key contributor to aggregate value added. Because of its central role in nearly all of Germany's manufacturing supply chains, mechanical engineering is also one of the most complex industries, comprising subsectors such as production engineering, mobile machines, and power stations. This diversity has helped firms to succeed and attain market-leading positions in specific markets.

The importance of technological change, globalisation and demographic change

In the past, globalisation has benefitted mechanical engineers, allowing German firms to expand their businesses into a broader market. In the present however, globalisation poses various challenges. On the one hand, China's strategic plan *Made in China 2025* symbolises its push for a more sophisticated manufacturing sector (USDOC, 2017). On the other hand, recent COVID-induced supply chain disruptions may prompt firms to bring production closer to home. Considering the high cost of labour in Germany, alongside rising political instability in foreign markets, these external factors may incentivise firms to invest in more digital technologies. This transition, however, implies that the modern mechanical engineer must acquire more digital

skills. Considering Germany's ageing society and subsequent staff shortages, demographic change complicates the ongoing structural transformation in mechanical engineering.

Global supply chains will also be affected by technological advancements towards greater use of services. This development may imply that spatial proximity becomes more important, e.g., for knowledge-sharing between R&D and tech support, which may cause the return of previously offshored production steps and thus a slowdown in globalisation. Trade-offs with respect to technological change and globalisation are thus likely (Autor, Dorn & Hanson, 2015). On the one hand, less open economies may hamper welfare gains. On the other hand, trade-induced losses may be outweighed by more efficient production at home. This more efficient production at home may also contribute to facilitating Germany's demographic transition, as more efficient production means lower labour demand.

Key impacts of technological change and ways these are being addressed or shaped

Consistent with existing literature, our case study shows that with ongoing technological change, the two key skills that will gain traction in mechanical engineering are software skills and social skills. Both will likely lead to compositional changes in employment in the manufacturing industry. On the one hand, greater need for software skills will cause an increase in the demand for data scientists, as well as for general IT skills in all occupations. On the other hand, stronger emphasis on social skills may attract more women into mechanical engineering due to their perceived comparative advantage in social skills (Cortes, Jaimovich & Siu, 2021). Empirical evidence shows that the future appears ambiguous with respect to manufacturing employment. On the one hand, technological progress will likely cause more displacement of lesser-skilled routine workers. This mechanism increases polarisation in the labour market, e.g. if low-skilled workers move to less productive (and hence lower-paying) sectors. On the other hand, digital technologies may automate some tasks that are currently performed by high-skilled workers performing non-routine cognitive tasks, such as technicians. At the same time, digital technologies complement tasks of other workers, such as software programmers. This mechanism therefore has an ambiguous effect on polarisation. The net effect of the two mechanisms will depend on the relative size of substitution and complementarity potentials among skilled workers, as well as the upskilling potential of the existing workforce.

2.2.2. Methodology

We interviewed five experts associated with mechanical engineering in Germany, each with a unique perspective and area of expertise to provide different perspectives on the German manufacturing industry.⁸ First, we talked to an employee of the German chamber of commerce and industry (IHK) who is assisting small- and mid-sized enterprises (SMEs) with the implementation of new technologies and local policy. Second, we interviewed a representative from IG Metall, one of Germany's largest unions, on demographic change, industrial policy, and workers' perspectives. Third, we spoke with the head of the education division of the mechanical engineering industry association (VDMA) with a focus on trends in employment and skills. Fourth, we talked to the head of future business division at VDMA about key technologies and their impact in the industry. Fifth, we concluded our interviews with the head of the production systems institute at the Karlsruhe Institute of Technology (KIT), once more exploring the impact of key technologies in mechanical engineering. All interviews were conducted via videoconference from April 11th until April 22nd, 2022.

2.2.3. Trends

Mechanical engineering in Germany

Mechanical engineering is one of Germany's most important industries, generating 271 billion euros in revenue as of 2020, which amounts to 13% of the total manufacturing industry and 6% of GDP. Its importance for the German labour market is further reflected in the fact that it employs some 969,000 employees, spread out across more than 3,800 businesses (Destatis, 2021). From a geographical perspective, firms in mechanical engineering are generally scattered across Germany. A few large, multinational corporations such as Siemens and ThyssenKrupp are known beyond German borders. Yet, the pervasive nature of German mechanical engineering is largely due to its many SMEs. Sometimes referred to as 'hidden champions' (Simon, 1990), these SMEs are often unknown to the general public, yet are worldwide leaders in their respective markets and often clustered in certain regions, e.g., in North Rhine-Westphalia and Baden-Württemberg. In recent years, however, hidden champions have been facing rising competitive pressure, largely attributed to the triangle of mega trends. Especially China has emerged as a key competitor in mechanical engineering in recent years. While the country has been a promising market for German firms in the past, its

⁸ The interviews were conducted using an interview guideline, the content of the interviews was summarised and then used as a basis of the report.

industrial development now is making it more difficult for the hidden champions to compete at a greater scale.

On top of these global trends, Germany has one of the oldest societies in the world (OECD 2022a), exacerbating the challenges in mechanical engineering and hurting recruitment efforts. As of 2018, Pfeiffer (2020) documents the average employee in mechanical engineering was 44 years old and disproportionately skilled compared to the German average. A majority of workers has completed vocational education (62% vs. 56% national average) and only few workers have no completed vocational education (2% vs. 9%). Almost 25% of employees in mechanical engineering are 55 years or older and will thus enter retirement by the early 2030's, reinforcing skill shortages even further. In terms of its composition, the workforce is largely male as only 14% of employees are women (compared to a national female employment share of 46%). Even among comparable industries such as automotive (19% female) or chemistry (28%), mechanical engineering is unusually male-dominated.

Technology use

Over the last decade, mechanical engineering has experienced technological innovations that have been characterised by an increased use of software, in addition to the traditional use of hardware. This development has especially been driven by greater interconnectivity and implementation of smart forms of automation. Often, these features are summarised under the umbrella term *Industry 4.0* (Schwab, 2015). While workers in traditional factories must monitor and equip machines manually, smart factories display improved communication between machines and humans, but also among machines.

This enhanced level of automation is enabled by enhanced availability of Big Data and rising popularity of machine learning (ML) methods. While 'Big Data' is a term used to describe large data sets, ML is a specific application of Artificial Intelligence (AI), a broad concept referring to algorithms that are able to find solutions to specific problems on their own, as opposed to traditional rules-based algorithms. ML relies on statistical modelling to detect patterns in the data and becomes more useful the more data is being generated. In practice, ML applications are especially prominent in quality control and robotics.

An example of quality control pointed out in the interviews is the recognition of anomalies via 'digital twins', a technology that has gained popularity in production development. Using modern sensors, this technology uses digital replicas of physical objects and enables cost-efficient inspection of technical features before the object is physically created, but also for

(potentially time-consuming or risky) trials during the lifetime of the object. Being a data-driven representation, the quality of digital twins depends heavily on a firm's digital infrastructure and improves with advancements in Big Data.

Likewise, high-precision robots have gained traction in manufacturing. For instance, factories use smart robots in assembly lines to improve efficiency of production. Increasingly, they also use collaborative robots ('cobots'), which work alongside humans. For instance, cobots can be deployed as robotic arms to facilitate repetitive production steps that follow human instructions.

Other technologies are currently in use, but their potentials are not fully captured in German manufacturing yet. A notable example identified by our interviewees are platform economies. These platforms represent digital marketplaces and enable more efficient relationships with business partners. Most readers are familiar with this concept in the context of Business-to-Consumer (B2C) relationships, such as Amazon or eBay. In the context of business-to-business (B2B) relationships, firms sell machines to other firms. By providing better access to data of both suppliers and customers, platforms can improve added value in various ways. On the one hand, B2B platforms reduce transaction costs as interactions between firms are automated. On the other hand, B2B platforms support innovation as improved data exchange supports the development of new products and services. However, this only seems possible in business relationships with a relatively high level of trust.

Germany as a whole is a laggard in the implementation of platforms, falling behind other industrial economies such as China and the US (EFI, 2022). Some reasons for this technological gap affect all economic sectors, such as relatively strict data privacy laws. Others are specific to mechanical engineering, such as outdated practices and a diverse industry structure. With respect to outdated practices, according to the interviewed experts, mechanical engineers often underestimate that added value is increasingly generated with software, rather than hardware. This problem is especially common among SMEs and erodes their still-existent comparative advantage in technical skills. With respect to diversity, specialised firms have very specific needs that prevent them from taking advantage of network effects of platforms. Therefore, combining the existing close and trust-based business relationships with the opportunities offered by the platform economy seems a major challenge for the German manufacturing industry.

Other technologies are at even earlier stages, yet, considered key disruptors of the future. Prominent examples that were highlighted by our interviewees include additive manufacturing and quantum technologies.

Additive manufacturing technologies are also known as 3D-printing and represent production techniques that create three-dimensional objects. This technology has many potential uses, including the creation of tools and prototypes. One of the key advantages of additive manufacturing lies in cost savings because of reductions in the use of rare and expensive metals. Another advantage, if 3D-printing is used to relocate manufacturing, lies in a reduced risk of bottlenecks as firms are less prone to external shocks, such as export controls or political instability.

Quantum technologies are even more explorative and are based on properties of quantum mechanics. One of the key applications of this technology is quantum computing, expected to not only allow faster calculation of computational problems, but also performing complex calculations that are technically unfeasible with conventional computers.

Globalisation

The role of globalisation for Germany's mechanical engineering is characterised by a tug of war between its location in global value chains and location decisions of domestic players, as pointed out by several interviewees. On the one hand, the sector as a whole sells to global markets and has contributed significantly to Germany's role as former 'export champion'. On the other hand, much of production still takes place in Germany (especially that of SMEs). This can imply synergies in production because communication is much easier when most production stages occur in one place; but it can also imply disadvantages.

These disadvantages arise first because a high-wage country such as Germany has difficulties in competing with a low-wage country such as China. Second, with respect to technological know-how and compared to other countries, mechanical engineering is a laggard with respect to digital technologies, as outlined in Section 2.5.3. While domestic engineering companies still benefit from the seal of quality 'Made in Germany', their implied quality advantages are eroding due to insufficient adaption to digitalisation (EFI, 2022).

These concerns are pronounced among SMEs, including the 'hidden champions', specialised firms with usually one or two establishments in Germany. They face capital and knowledge limitations that prevent them from scaling up to alleviate cost disadvantages. Large corporations, in turn, such as Siemens and ThyssenKrupp, are in a more advantageous position as they can more easily bear potentially high fixed costs of introducing a new technology. Moreover, these multinational firms operate worldwide, enabling the acquisition of technological know-how from abroad. In contrast, the concentration of SMEs in the domestic

economy makes it more difficult for them to benefit from technological advances occurring outside the domestic economy.

Demographic change

The global challenges for mechanical engineering are reinforced by Germany's overarching demographic problems. To illustrate this problem, consider the age-dependency-ratio, defined as the ratio of the number of older dependents (people older than 64 years) to the number of persons in working age (people aged 15-64). In the year 2000, Germany's age-dependency-ratio was close to 0.25, implying four people in the working-age population were providing for one older dependent (OECD, 2022b). By 2020, Germany's age-dependency-ratio rose to more than 0.36, implying that only three people in the working-age population were providing for one older dependent. Compared to the OECD-average age-dependency-ratio of 0.30, Germany thus stands out as a disproportionately ageing country. Current OECD projections suggest these patterns will worsen further during the next decades, posing not only present but also future demographic challenges for Germany.

In mechanical engineering, one out of four workers is 55 years or older. They will thus enter retirement by the early 2030s and contribute to the rise of the projected age-dependency-ratio. This development has already led to staff shortages, which will likely be exacerbated over the next decade. A key problem are recruitment challenges as mechanical engineering companies find it difficult to recruit young workers to replace present and future retirees. These challenges have several reasons.

First, our interviewees attribute recruitment challenges to the declining popularity of vocational education. Many apprentice positions in mechanical engineering are unfilled nowadays because of relatively low interest among labour-market entrants, contributing to the ongoing decline of apprenticeships. These trends likewise reflect the rising share of pupils who prefer college education over vocational education. Second, caused by the shift towards digital technologies, many mechanical engineering companies aim to hire a rising number of data scientists. Technological change thus puts them in competition with software companies as well as other sectors increasingly looking to use data analytics. ICT companies are often considered to be more attractive employers because they provide better pay and more attractive non-pecuniary job elements such as flatter hierarchies. Third, many firms in mechanical engineering are located in towns or small cities. As skilled workers tend to cluster in large metropolitan areas, more rural areas face severe recruiting challenges.

One solution is closer cooperation with local schools and (applied) universities. According to the interviewed experts, some regions do indeed benefit from these collaborations, such as Ostwestfalen-Lippe in North Rhine-Westphalia. However, these benefits are not omnipresent. Some regions simply have limited access to regional education institutions. Others may have access in principle, but either face competition from other firms or lack local infrastructure, e.g., freeway access or public transportation.

Interrelated changes

Two examples highlight the interdependency of the megatrends outlined in this section. First, technological innovations alongside globalisation have generally benefitted urban areas, thereby widening the rural-urban divide. Second, all mega trends tend to produce winners and losers. However, considering climate change and scarce natural resources, companies need to cooperate to aim for the transition towards a circular economy. We now discuss each of these issues in the context of mechanical engineering.

First, the rural-urban divide has been developing for several decades. In recent years it has been accelerating. Between 1960-1990 the share of people living in urban areas in Germany increased from 71.5% to 73%. In contrast, between 1990-2020 the share increased from 73% to 77.5% (World Bank, 2022). Using this trend as a measure for the rural-urban divide, the pace of urbanisation increased by a factor of three in the young 21st century compared to the mid- and late 20th century. Technological change and globalisation have contributed to this development by shifting better-paying and higher-skilled jobs to large cities. Many structurally weak regions therefore are characterised by an older population. As a result, the rural-urban divide mirrors a young-old divide. While there are still many hidden champions in some rural areas, even these highly successful companies are already experiencing a lack of young, well-educated workers.

Second, several of our interviewees pointed out that mechanical engineering plays a key role in advancements towards a circular economy. The circular economy summarises an economic model of production and consumption in which resources are recycled and refurbished as often and as long as possible in order to decouple economic growth from natural resources. In the context of mechanical engineering, for instance, a more ecological system entails less frequent purchase of machines and instead refurbishing of old machines. Consequently, the industry would become less dependent on imports, especially materials from abroad. This paradigm change highlights the shift from hardware towards software and services as the production of

new machines will become less lucrative. Instead, value added will increasingly be generated with data and services to optimise the use of scarce resources. At this point, however, it seems unclear how fast a (more) circular economy will be realised, and which role German mechanical engineering will play in this context.

2.2.4. Impacts

Skills

The triangle comprising technological change, globalisation, and demographic change involves widespread consequences for the workplace. The overarching takeaway is the need to keep skills up to date. This implies a greater emphasis on lifelong learning in response to technological innovations. On the one hand, this requires all workers to be more ready to adapt and to learn more independently. On the other hand, lifelong learning has varied consequences for the type of training workers receive depending on their skill type.

Our experts identified two key skills that will become increasingly important in mechanical engineering. First, all our interviewees highlighted the importance of software skills as a result of technological progress in the *Industry 4.0* context and closer cooperation between production stages and business divisions (also between software and hardware divisions). Specific technologies such as 5G telecommunications and ‘digital twins’ (see Section 2.5.3) will reinforce the need for software skills. While 5G will deepen the interconnectivity in smart factories and thus generate more data to be communicated and analysed, widespread implementation of digital twins will require more programmers in product development. Combined, these two examples highlight the shift in mechanical engineering towards software and services as driver of value added. Generally, beyond an increased need for specific software skills, a more systemic understanding of digitised production processes on the shopfloor is required.

The second key skill our experts identified are social skills. In light of closer collaboration between divisions, workers must be able to communicate effectively. This trend could help recruit more women to alleviate the disproportionate employment of men in mechanical engineering. A growing strand of economic literature suggests women have a comparative advantage in social skills and therefore enter high-paying occupations more frequently (Cortes, Jaimovich & Siu, 2021). Our interviews gave us the impression that women have better communication skills and can therefore transfer knowledge better than men. However, Bachmann and Gonschor (2022) show that for women to enter higher-paying occupations does not necessarily mean that they earn higher wages.

The interviews revealed to us that skilled workers are the primary beneficiaries of training programs aimed at upskilling. These training programmes are motivated by a more integrated production process as Big Data feeds more information from previous and subsequent production steps into a worker's tasks. Enhanced data flows consequently require tighter inter-divisional cooperation and for workers to develop stronger process know-how. The fact that 70% of firms invest in further training highlights the importance of this business reorganisation.

In contrast to skilled labour, workers with basic or no education are typically no beneficiaries of training programs. Instead of upskilling, they are more likely to receive reskilling measures. This difference is largely motivated by an anticipated increase in automation in mechanical engineering, which will continue the replacement of simple production tasks by machines. Especially progress in high-precision robotics will accelerate this process as machines will perform an increasing number of manual tasks that require basic hand-eye coordination. Some of the experts therefore paint a bleak picture for the future of low-skilled workers in mechanical engineering as firms see little value in training measures for this group. Unsurprisingly, representatives of employers and employees do not agree on this issue. The academic literature has shown that re-training can help workers to adapt to technological change (Battisti *et al.*, 2022). Therefore, this topic needs to move higher up on the agenda of policymakers and economic stakeholders.

The disparate effects of technological change on workers with different skill levels create challenges for both companies and policymakers as different workers have different needs. One of our key takeaways from the interviews is that the rising competition for data scientists against tech companies represents an uphill battle for most mechanical engineering companies, leaving internal training measures as the more promising strategy. Especially modular training and e-learning concepts can help engage workers in lifelong learning. In contrast to traditional programmes and workshops, these concepts provide more flexibility and practicability. On the one hand, traditional workshops require workers to be away from work for an extended period, entailing high opportunity costs of foregone production. On the other hand, these workshops may have limited applicability to firm-specific needs. Another key takeaway is that public support schemes should primarily be designed for retraining programmes of less-skilled workers.

From a broader education perspective, policymakers should aim to incorporate acquisition of more technical knowledge in school curricula. Our interviewees partly attribute the ongoing decline in the popularity of vocational education to weak emphasis on technical skills in schools.

To date, the German education system designates no specific subject for these purposes in its curriculum. Inclusion of technical skills, however, may help generate more interest in career paths that are compatible with the needs of mechanical engineering.

Employment

A large economic literature has documented employment polarisation in response to automation (Autor & Dorn, 2013; Bachmann, Cim & Green, 2019; Dauth, Findeisen, Südekum & Woessner, 2021). This line of research shows that workers who primarily performed repetitive tasks have been displaced by computers and robots. Workers who primarily perform cognitive tasks, on the other hand, have benefitted from automation as these technologies increase their productivity. The result is a loss of many middle-income jobs performing routine tasks, such as those that used to be common in traditional factories.

Our interviewee's assessments suggest this polarisation will continue and primarily hurt less-skilled workers. Once state-of-the-art robots will become affordable industry-wide, simple tasks will likely be fully automated, displacing the remaining less-skilled workers. However, some skilled workers, e.g., traditional mechanical engineers specialised in hardware-related tasks, may likewise be prone to displacement. As software-related tasks keep gaining traction, those who cannot adapt to the digital world will likely be left behind. The shift towards servitised manufacturing alongside competitive pressure from globalisation will make it unprofitable to hold onto well-paying jobs whose contributions to value added keep declining.

According to our interview experts, skilled workers involved in product development and services will be the primary beneficiaries from digitalisation. The key impacts on employment are thus a shift towards workers who deal with the hardware (i.e. conceptualise, build and maintain the hardware) and at the same time possess software skills, and a shift towards data scientists, with overall unclear effects on the size of the workforce in mechanical engineering. While this trend implies labour flows from other industries towards mechanical engineering, the competitive disadvantages against IT companies laid out above suggest that these are limited. In contrast, trends in demographic change as laid out in Section 2.5.3 will cause substantial labour market exits due to entry into retirement of many workers in upcoming years.

The net effect of these trends on employment is likely to be negative. The effect on individual workers and their careers within and between sectors is ambiguous and an important question for subsequent empirical research. The existing economic literature offers two possible scenarios. On the one hand, an upskilling scenario allows all individual workers to achieve the

required skills. On the other hand, a polarisation scenario only enables some high-skilled workers to acquire new skills with the remaining workers falling behind. Our impression from the interviews is that firms are actively educating their workforce. However, for some worker groups they may have limited incentives to train existing workers and may resort to hiring new workers instead, especially with respect to acquiring software skills. Unions resist this scenario and emphasise more skill upgrading due to uncertain outcomes for the existing workforce. In addition, current skill shortages pose serious challenges to recruitment and thus may require more emphasis on training measures out of need.

Job quality

In the interviews, two components of job quality were particularly present: first, the changing nature of work organisation with a focus on implications for division of labour; second, health concerns, encompassing both mental and physical health.

We begin with a discussion on work organisation. Greater interconnectivity in smart factories implies the production process has become more intertwined and warrants workers to develop strong process know-how. This business reorganisation facilitates collaboration between humans but also between humans and machines. For instance, software programmers develop assistance systems operated with AI algorithms. These systems analyse data that can be used to either assist other workers in decision making ('humans-in-the-loop') or to provide instructions for further proceeding. Stronger emphasis on process know-how therefore implies that workers need a better understanding of preceding and ensuing production steps to perform their tasks.

The key challenge we identify from rising skill requirements on work organisation is the need for both stronger process know-how and greater domain expertise. The need for process know-how resulting from an intertwined production process requires workers to develop more *breadth* of learning, i.e., more tasks. At the same time, the need for software skills resulting from digitalisation likewise requires more *depth* of learning, i.e., greater understanding of specialised tasks. Managing these two requirements will be a challenge for firms and workers alike.

The second important aspect of quality of work are health effects associated with rising automation in modern factories. With respect to physical health, automation technologies are generally perceived positively as they perform unpopular tasks. Notable examples are unhygienic activities and physically demanding tasks involving the lifting of heavy objects. For

instance, some pilot projects use cobots that sort dirty clothes in laundries. This unpleasant task used to be performed by humans but will likely be fully automated within a few years.

With respect to mental health, the net effect is more ambiguous. On the one hand, automation of unpopular tasks leads to higher job satisfaction. On the other hand, automation also removes repetitive tasks, which may have provided workers with a period of reduced cognitive stress during their workday. While employers view advances in automation positively, employees consider the job implications more sceptically. Spending more time on cognitively demanding tasks contributes to increased fatigue and may possibly cause a higher incidence of stress-induced health problems in the future.

Another mental health aspect that receives little attention in conventional labour market data is the omnipresent use of technology in the workplace such as laptops and tablets. From our interviews we got the impression that some less-skilled workers may be intimidated by this development, seeing it as a constant reminder of their own possible displacement. A related concern is the prevalence of performance monitoring. The rise of Big Data has allowed employers to further optimise the production process and identify inefficiencies. The downside of this development is lack of transparency in spite of the established co-determination rights of works councils over performance monitoring in Germany. While the prevalence of robots is tangible, data is intangible. Consequently, some workers are intimidated by the actual or potential constant supervision enabled by Big Data.

Policy implications

In Section 2.2.3 we discussed the interdependency of the mega trends and highlighted a widening rural-urban divide. What can be done to address the rural-urban divide and especially support SMEs? The answer to this question also depends on policymakers' stance on the trade-off of technological sovereignty versus international cooperation. The liberalisation of national economies after World War II has given rise to globalisation, thereby interconnecting countries worldwide via trade and capital flows. While increased openness led to more prosperity, not all members of society benefitted equally (Dauth, Findeisen & Südekum, 2021). Accompanying effects such as offshoring of production stages from high-wage to low-wage economies, created structurally weak regions with high levels of unemployment. A few notable examples in Germany include many rural areas in Eastern Germany and the Ruhr area in the North-West, a former manufacturing and mining hub. These two regions contain some of the counties with the highest unemployment rate nationwide.

Germany's mechanical engineering is caught in the middle of this trade-off. On the one hand, the industry needs access to international markets to sell their machines. On the other hand, globalisation and rapid technological advancements squeeze their comparative advantages, sometimes leading to calls for protectionist policies. Policymakers can support the industry with better support measures that were highlighted in our interviews and are discussed in more detail below.

First, publicly sponsored programs are often opaque due to numerous potential funding initiatives that complicate digitalisation strategies for firms. Especially SMEs are often overwhelmed by the complexity of these programs and bureaucratic hurdles. Second, policy can help implement faster industrial scaling of pilot projects. For instance, the fifth-generation technology standard for broadband cellular networks (5G) is central for the Internet of Things, which connects hardware with software and thus has many potential applications in the smart factories of mechanical engineers. Currently, this technology is primarily used in pilot projects but nowhere near full-scale use. By educating especially SMEs about the benefits of this technology and directing specific resources towards the physical telecommunications infrastructure, policy can expedite its broad implementation and create new jobs. Third, local policymakers can incentivise firms to settle in structurally weak regions, for instance via tax breaks or investment in local infrastructure. Notable recent examples include Tesla, which built a manufacturing plant in the Eastern German municipality of Grünheide, and Intel, which is scheduled to build a chip factory in the East German city of Magdeburg.

All these examples highlight the need for more digitalisation to create new jobs. Therefore, policymakers must provide a framework such that firms are incentivised to invest in domestic production using digital technologies.

2.2.5. Conclusions

In this report we explore the role of mechanical engineering in Germany amid the megatrends of technological change, globalisation, and demographic change. The key challenge we identify pertains to digitalisation. The future of mechanical engineering depends crucially on its ability to adapt to the digital era. As long as hardware is still central to the industry, Germany's mechanical engineering can hold on to its comparative advantage in technical skills. This historical advantage is underpinned by various small SMEs, Germany's 'hidden champions', which are market leaders in many hardware-based market niches.

Yet, once software becomes the dominant driver of value added, Germany's mechanical engineering companies may lose their comparative advantage. Even if we recognise positive developments in some areas, such as E-mobility, the key problem is that their domain knowledge is primarily concentrated in hardware. However, value added is increasingly generated with services. Hence, to stay profitable and compete with global competitors, companies in the sector must integrate data more effectively into their hardware-driven business models. One specific example that illustrates the industry's position as market laggard are platforms, a key technology that has been identified as essential for the future of mechanical engineering.

A key implication of digitalisation is a greater need for software skills. While this development tends to complement highly-qualified workers, low-qualified workers, who already represent a very low share in mechanical engineering, are likely subject to ever-increasing automation. Moreover, social skills will become more important for all workers as the modern factory requires close collaboration between all divisions and all workers.

However, contrary to previous innovations, such as industrial robots and computers, digital technologies may cause broader displacement effects by hurting low-skilled and some medium- and high-skilled workers alike (Webb, 2020). Therefore, we also see automation potential among the skilled workforce and take a more ambiguous stance on employment polarisation in mechanical engineering compared to our interviewees who did not highlight the substitution potentials of digital technologies for skilled workers. The ultimate outcome on polarisation depends primarily on the relative strength of substitution and complementarity effects on the employment of skilled workers.

However, adjustments to technological change are hampered by demographic change and an ongoing decline in the popularity of vocational training among young German workers. An ageing society and increasing enrolment in universities contribute to skill shortages in mechanical engineering and make it difficult to find workers with adequate skills. These challenges are especially pronounced in rural regions and among SMEs. Firms attempt to combat this unfavourable development with improved training measures. Yet, traditional training programs are hard to implement in practice due to high opportunity costs of foregone working time. Instead, modular training and E-learning concepts provide more flexibility and offer more firm-specific needs.

Our general assessment on the future of mechanical engineering and its workforce is that they face a number of significant challenges. These challenges are particularly severe for Germany's

hidden champions, SMEs that are often located outside metropolitan areas where shortages of skilled labour are particularly acute and likely to increase further in the future. The challenges put forth by the three megatrends are often too complex to be solved without public support. As a result, policymakers must support firms in mechanical engineering more effectively. In particular, we have identified the following three key policy challenges.

First, inequality may increase as progress in *Industry 4.0* and further advances in ML have the potential to perform tasks previously performed by skilled workers. Hence, policymakers must be prepared to deal with further sector-specific job loss and consider social and economic policies to alleviate the consequences. Second, public programs must be simplified to help firms develop clearer digitalisation strategies. The burden of programs' complexity is especially pronounced among SMEs, which often do not have the corporate infrastructure to deal with complex bureaucratic processes. Third, all firms, large or small, need guidance and an infrastructure that provides proper incentives in the overarching goal towards a carbon-neutral, potentially circular economy. Climate change is one of the defining challenges of the 21st century. A global problem of this scope is too complex to be combatted solely by private firms.

Our interviewees also pointed out that technologies such as biological computing or technologies built on quantum mechanics could help to tackle the challenges posed by technological change, globalisation and demographic change. For these technologies too, politics can help by providing adequate funding programs and an adequate regulatory framework.

2.3. The biotech ecosystem in Belgium: From research & development to production by Mikkel Barslund and Karolien Lenaerts

2.3.1. Introduction

The Organisation for Economic Co-operation and Development (OECD) defines biotechnology as 'the application of science and technology to living organisms as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.' The OECD distinguishes between two key biotechnology activities: (1) **biotechnology research and development (R&D)** – i.e. research into biotech techniques and the development of biotech products or processes; knowledge products resulting from R&D and (2) **production** – i.e. the use of biotech techniques to produce biotech products; the use of process biotechnology techniques in production (OECD, 2005). Biotechnology can thus be used for a wide range of applications with various end uses (e.g. in agriculture, manufacturing,

veterinary and human health, etc.) and with important economic, societal, and political implications. The biotech industry is intertwined with the chemical and the pharmaceutical industries and it is often difficult to clearly distinguish them.

The Belgian biotechnology sector - also described as the *life sciences* sector - is **one of the most important economic sectors in the country in terms of its contribution to employment and value added**. Over time, following a rapid growth since the beginning of the 1990s, fuelled by a favourable policy and regulatory regime, the **sector has developed into one of the key players in Europe**. Data from the federal government suggests that over 140 biotechnology companies are active in Belgium, which accounts for 7% of biotechnology companies, 16% of sales and 10% of R&D expenditures in Europe (Business Belgium, 2022). Every year, 10-15 biotech start-ups are launched. According to bio.be/essenscia – the sector federation for the chemical and life sciences sector⁹ - the sector provided almost **40,000 jobs in 2021** (or 1,500 extra jobs compared to 2020) (bio.be/essenscia, 2022). Over the last decade, the sector generated about 10,000 additional jobs. Exports and R&D expenditure doubled during this period and in 2021 amounted to 83 billion and 5.1 billion euros respectively (bio.be/essenscia, 2022). Added value stood at 11.6 billion euros in 2020 (bio.be/essenscia, 2022).

The rise of the biotechnology sector in Belgium **went hand in hand with the development of a larger ecosystem or biotechnology cluster**, while at the same time being a driving force behind this ecosystem. This ecosystem is regarded as one of the main features of biotech in Belgium, which makes the country particularly interesting for foreign investment. This ecosystem consists of universities, research centres, spin-offs, hospitals, companies, sector federations, etc. In this ecosystem, several government bodies are active that support the further development of the biotechnology industry in Belgium, including foreign investment and trade agencies (Flanders Investment & Trade, the Walloon Export and Foreign Investment Agency, and others). A consulted expert on the Belgian biotech industry explained that **knowledge production by universities and research centres has been pivotal** to this end. This expert stated that successful research projects run by universities and research institutes have led to the **creation of spin-offs**, which in turn developed into major companies in their

⁹ As the Belgian sector federation for the chemical and life sciences industry, bio.be/essenscia represents companies that are active in the chemical, pharmaceutical, biotechnology and plastics industries. The sector federation has over 720 member companies operating in Belgium in 2022, ranging from national small- and medium-sized companies to large multinationals. The sector federation is a member of the employers' organisations in Belgium and a member of European sector federation for chemical industry. More information is available on: <https://www.essenscia.be/over-essenscia/>

specific area, but this is a very lengthy and complex process. Today, we are bearing the fruits of the efforts and policies from 2-3 decades ago.

This case study examines the impact of three global megatrends - technological transformations, demographic change, and globalisation - on the biotechnology sector in Belgium, reflecting on their implications in terms of employment, skills, job quality and inequality. The case study is part of the series of case studies zooming in on the manufacturing industry. Although the biotech sector is not a traditional manufacturing sector as such and is mostly known for its research and development activities (although the OECD highlights production as a core activity as well), it is **increasingly carrying out production and distribution activities in Belgium** as well. This was evidenced recently with the development, production and distribution of COVID-19 vaccines, yet many biotech companies have a long tradition in the production and distribution of several types of medicine besides vaccines (e.g. the French pharmaceutical company Sanofi has a production facility in Geel).

Turning to vaccines, Pfizer, for example, has its European headquarters in Belgium, along with a dedicated research centre, a logistics centre and a production plant. The Pfizer production plant located in Puurs-Sint-Amands produced over 2.5 million vaccines in the first year of the pandemic, exporting them to around 165 countries worldwide. Production ran very smoothly, was scaled up multiple times, and was overall seen as a considerable success, especially since the timeframe in going from development and pre-clinical trials to full production was very short (just a few months, instead of several years as usual). Over the course of the pandemic, employment in the production site grew from 2,800 to 4,500 jobs. In December 2022, Pfizer announced that in the coming three years it would invest over 1.2 billion euros in the production plant in Puurs-Sint-Amands, in recognition of 'its role in the production of vaccines that proved critical in the global fight against the COVID-19 pandemic and as a 'launch site' for innovative medicine'.¹⁰ This is the largest investment in the site to date. Pfizer announced that the investment will be divided across three areas: (1) an increase of the production capacity, (2) an increase of the options for cold storage, and (3) an expansion of packaging processes. The investment would result in 250 new jobs.

In addition to the Pfizer vaccine, several other COVID-19 vaccines were developed and (partially) produced in Belgium. The Belgian company Janssen located in Beerse, for example, functions as a major 'innovation hub' for different pharmaceutical companies that are part of

¹⁰ <https://www.vrt.be/vrtnws/nl/2022/12/02/pfizer-investeert-meer-dan-1-2-miljard-in-belgische-site/>

Johnson & Johnson, and contributed to the development of the Johnson & Johnson COVID-19 vaccine in this capacity. Janssen Beerse also is a production and distribution facility for different types of medicine. In fact, it is one of the largest production facilities of the Janssen group in Europe. Other companies that are based in Belgium played a role in the development, production and distribution of COVID-19 vaccines too. Examples are Kaneka Eurogentec (in Liège), Novasep (in Seneffe), Thermo Fisher (in Gosselies), Univercells (in Charleroi). In this light, the biotechnology sector is an important player contributing to the preparedness and response to the current pandemic and future outbreaks.

In general, the biotechnology sector finds itself at the **crossroads of several global megatrends**. Biotech research and development and production are carried out through **global value chains, with resources and products being imported and exported worldwide based on knowledge and technology developed across the globe, and relying on an international scientific and non-scientific staff**. The existence of a well-established ecosystem, which contributes to all steps of the biotech value chain (from research and development to production and distribution), in one central geographical location that is well connected to the rest of the world, makes the Belgian biotech ecosystem an interesting case for further exploration. Furthermore, the policy, regulatory and legal frameworks are conducive to the further growth of the biotech sector in the country.

The structure of this case study report is as follows. This section presents a brief overview of the key aspects of the case that was analysed and the methodological approach that was used to do so. The section describes the key characteristics of the biotechnology sector and discusses how it fits into the triangle of technological transformations, globalisation and demographic change. Section 2.6.2 outlines the methodology, and in Section 2.6.3, the main case study findings are presented in more detail. Section 2.6.4 discusses various impacts in terms of skills, employment, job quality and inequality of the three megatrends in scope. Section 2.6.5 concludes the chapter.

The 'story of the case'

This case study zooms in on the biotechnology ecosystem in Belgium, discussing both its research and development and production activities, as well as how these are affected by and contribute to globalisation, technological transformations, and demographic change. In the past three decades, biotech has flourished in Belgium, and the ecosystem of universities, research centres, companies, spin-offs and other actors has become a leading player in the European

context. This transition is fuelled by an increasing investment in research and development, set in a supporting regulatory environment, and a successful knowledge production by universities and research centres, which in turn boosted the production, commercialisation and distribution of medicine and vaccines. The sector federation for biotech bio.be/essencia labels this as a transition from *'invented in Belgium'* to *'invented and made in Belgium'*.

Especially in the early days of the biotech sector, Belgium was known for its R&D, but struggled to commercialise what was developed. On this point, the interviewed expert noted that sufficient access to capital is required to fund spin-offs or start-ups from successful R&D projects, and that this is typically not an issue in Belgium. However, gaining access to sufficient capital that enables a company to grow further, proves much more difficult. As a result, in the past but still today, companies sometimes leave Belgium and Europe for the US or become foreign-owned. This is a key point of attention for policy makers. Biotech today is a major contributor to economic growth, added value and employment in Belgium.

How does it fit into the triangle of technological change/globalisation/demographic change

Although it is clear that all three trends in the scope of the UNTANGLED project are relevant for the biotech sector, the COVID-19 pandemic was the main topic in the literature and the interviews. The pandemic proved to be an unrivalled challenge, but it also enabled the Belgian biotech sector to showcase its strengths and expertise, and confirms its readiness to scale up production. This is the result of a long process, in which Belgium was mainly known for its R&D in this area but failed to move ahead with the production, commercialisation and distribution activities in biotech. The COVID-19 pandemic highlighted the impacts of globalisation, technological transformations, and demographic change, and it accelerated these trends. The global nature of the biotech sector, with its high interdependence between the actors involved for both R&D and production, proved to be a strength (e.g. global sourcing of required materials and resources, reliance on global network of expertise, production facilities in multiple countries, delivery of vaccines to developing countries, etc.) as well as a weakness (e.g. regulatory challenges that block trade, trials or the use of certain products, dependency on materials and resources available elsewhere, geopolitical issues, etc.). It is clear that the COVID-19 pandemic has sped up certain processes (e.g. innovation in production) and confirmed the need to embark on a technological transformation within the biotech industry. Strong partnerships within the ecosystem and a supporting infrastructure and framework are key.

Key impacts and ways these are being addressed or shaped

The three megatrends - globalisation, technological transformations and demographic change - all affect employment, skills and job quality in the biotechnology sector. In terms of employment, the biotechnology sector is recording a continuous growth in the last decades. This was spurred even more by the COVID-19 pandemic, in which Belgium-based companies played a leading role in the development, production and distribution of vaccines. In terms of the skills required, due to the wide variety in opportunities in the sector, there are job openings for both relatively lower-skilled and highly specialised workers. Jobs in biotech typically provide good conditions and are generally well-paid.

2.3.2. Methodology

Methodologically, this case study is based on desk research (literature review of academic and grey literature, with a focus on biotech in Belgium) and four interviews: an interview with an academic expert; an interview with a trade union representative responsible for the chemical and pharmaceutical sector; and two interviews with professionals working in the biotech sector (one interviewee is an employee at a large well-known multinational, the other interviewee works at a start-up). As the Belgian biotechnology ecosystem has received significant attention from policy makers in the past years, there was quite a lot of grey literature available on the industry (such as policy reports, statements by key politicians, publications by sector federations, press articles). The availability of academic research is more limited.

2.3.3. Case study findings

Belgium: Health & Biotech Valley of the Future

The biotechnology sector is high on the agenda of policy makers and industrial actors in Belgium at the national and the regional levels. Under the **flagship 'Belgium: Health & Biotech Valley of Tomorrow'**, in October 2021 a charter was signed by representatives from government, industry and academia, with the ambition to strengthen Belgium's position in biotechnology research and development and production in the next two decades (De Croo, 2021). At the same time, an R&D platform was launched and several working groups were set up to propose initiatives, actions and policies towards this goal. Key points of attention are **innovation, economic attractiveness**, and the **war for talent and training**.

This was emphasised by Prime Minister Alexander De Croo in his speech:

‘The coronavirus crisis was a real wakeup call: health is at the very heart of every individual's life. For years Belgium has invested massively in its talents, in research and development and, thanks to numerous partners, in production tools capable of providing tangible responses to 21st century diseases and pandemics. ... In a changing and more competitive international environment, we must bolster our ecosystem and equip ourselves with a long-term strategic vision to ensure that Belgium takes its place as the Health & Biotech Valley of the future at the very heart of a connected Europe. That's our ambition.’ (De Croo, 2021).

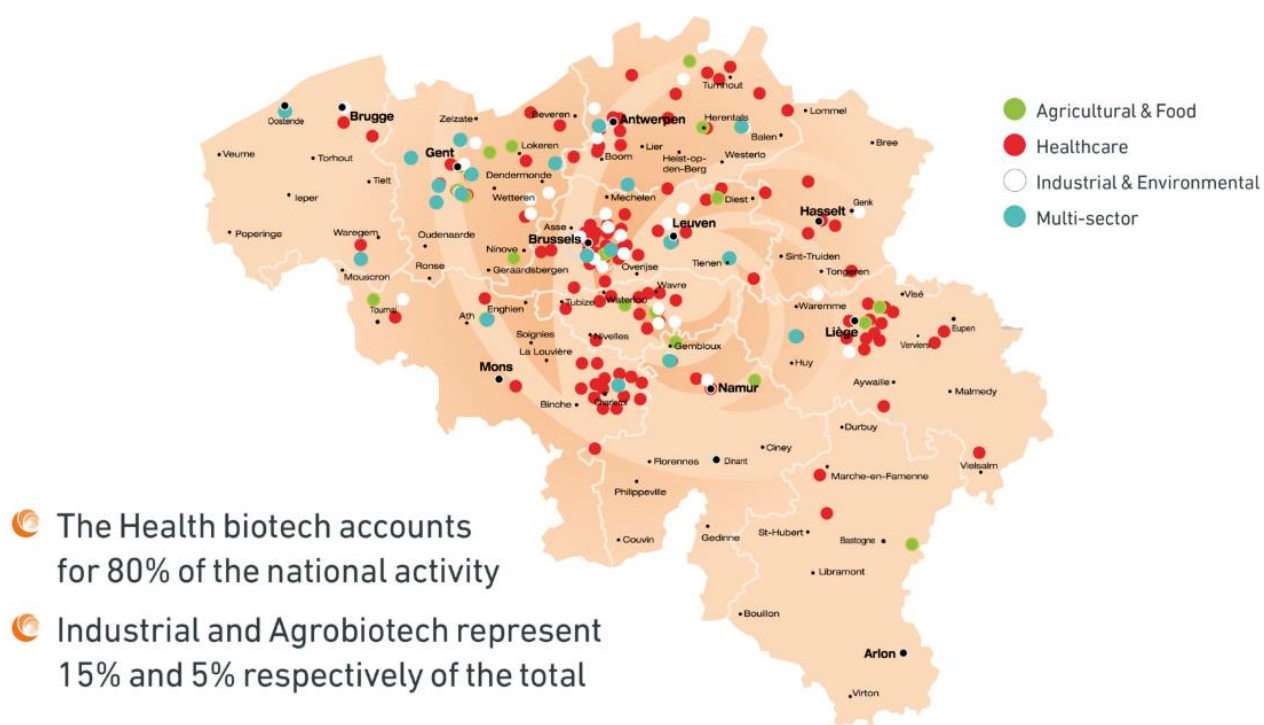
The importance of these initiatives is underlined by leading companies, sector federations, and other key players in this field. The current approach to biotech builds on a wider framework aimed at supporting innovation, e.g. government subsidies, various tax incentives, fiscal options to cut labour costs, etc. Biotechnology is not only a priority from the federal government, but also for regional policy makers (Segers, 2017).

The Belgian biotechnology landscape

Almost all sources on the Belgian biotechnology sector point to four elements that help explain its success: (1) a **conducive regulatory and policy framework** (e.g. encouraging investment, rules on patenting, etc.), (2) the **availability of a (highly) skilled workforce**, (3) Belgium's **central geographical location and infrastructure**, and (4) the availability of an **ecosystem of relevant players** that themselves are well-connected with international biotech companies and networks (Segers, 2016; 2017).

The Belgian biotech ecosystem is clustered **regionally** and **thematically**, as shown in Figure 5. Although healthcare biotech makes up the bulk of all the activities (this is known as ‘red biotech’), agriculture and food (‘green biotech’), industrial and environmental (‘white biotech’), and multi-sector biotech activities are found too. From a geographical perspective, the biotechnology sector is spread quite well across the country (the South is generally much less populated, has less economic activity and a poorer infrastructure). Local biotech clusters are visible around the major Belgian cities with universities or research centres and that are well connected (e.g. airports, ports), such as Ghent, Antwerp, Leuven, Hasselt, Brussels, Charleroi, and Liège. These local clusters often are concentrated around so-called ‘science parks’. The Ghent area, for example, is particularly known for its contribution to green biotech and its focus on making plants resistant against droughts and diseases (Segers, 2017). Such a close geographical proximity fosters collaboration and knowledge exchange between all actors in a specific area, including government agencies, universities and research centres, companies, etc. (Segers, 2016; 2017).

Figure 5. The biotech landscape in Belgium



Note: This figure was taken from the [bio.be/essenscia](https://www.bio.be/essenscia) website and can be found here:

<https://www.essenscia.be/over-essenscia/secties/bio-be-essenscia/>.

Source Figure taken from [bio.be/essenscia](https://www.bio.be/essenscia), based on data from 2021-2022

Globalisation

As the biotechnology ecosystem continues to grow, so does the **share of exports** it represents in the total Belgian exports and its importance in the European context. The country is ranked in the third place with regard to the export of biopharmaceutical products (value of 56 billion euros). For many of these products, Belgium depends on resources and materials that are sourced from abroad, and is thus heavily dependent on **import**. When it comes to the traditional manufacturing sectors, due to its **high wage costs**, Belgium is struggling to compete with other EU and non-EU Member States where the wage costs are often (significantly) lower and production is cheaper. This is different for **niche sectors**, such as the biotech industry. In such sectors, aspects such as the availability of a skilled workforce and the infrastructure, also come into play. In addition, in the ecosystem of actors operating in the Belgian biotech, there are **many international players**. The Belgian biotech companies are embedded into **global value chains**. There is an interdependence between the different actors which can be problematic (e.g. when medicine production is halted as a critical component cannot be sourced).

Especially in the context of the COVID-19 pandemic, the biotechnology ecosystem also plays an important role from a **geopolitical perspective**. The Pfizer production plant, for example, was a major supplier of vaccines in Europe and worldwide, as indicated above. Besides Pfizer vaccines, other vaccines were produced in Belgium as well. AstraZeneca, for example, collaborated with Novasep, a company with a vaccine production plant based in Seneffe. Besides the site in Seneffe, AstraZeneca used two production facilities in the UK and one production facility in Germany. When AstraZeneca - a Swedish-British biopharmaceutical multinational - was unable to deliver to the EU the vaccines it had promised within the agreed upon timeframe and blamed the production site in Seneffe for the delay (in addition to regulatory challenges), the European Commission requested the Belgian government to carry out an inspection of this production site. In response, in January 2021, Frank Vandenbroucke, federal Minister of Social Affairs and Public Health, ordered the Federal Agency for Medicines and Health Products to inspect the facility to make sure that the delay was indeed due to a production issue. Due to this delivery delay, the EU had a slower start in its vaccination campaigns than other major developed countries and regions, including the UK and the US. This point was also raised in a high-profile court case on the matter (Euronews, 2021). AstraZeneca was accused by the EU of breaching its contract, by delivering its vaccines to other countries while failing to meet the timeline it had agreed upon with the EU, and by reserving the vaccines that were produced in its UK production facility for the UK. As a result of this situation, the relationship between the EU and the UK worsened.

Technological transformations

In order to maintain their leading position and stay competitive, biotechnology companies as well as other actors operating in the ecosystem (e.g. sector federation, policy makers), realise that it is vital to follow **technological transformations**. A rising number of biotech companies is engaging in digitalisation and automation processes, for example in relation to their R&D tools and production equipment. Another example is the increasing use of big data in research and development of new medicine, vaccines and treatments (e.g. cell and gene therapy). As biotechnology continues to develop, the research and development activities and the production activities it involves are getting more complex. For example, medicine and treatment is becoming more personalised. This requires a more tailored production in smaller batches. Another key part of biotech production is quality control. According to the interviewees, the quality control is increasingly being done using digital tools and relying on big data, which has

implications for the skills that are required from the workforce and the training that needs to be provided to them.

To be able to support biotech companies undergoing technological transitions, sector federation bio.be/essencia has launched a **digital working group**. Among the main challenges identified by this working group are the high cost of financing investment in digital technologies, coupled with uncertainty about which technologies will really break through on an industrial scale, and the need for future-proof training and an education system that resolutely embraces digitalisation.

Demographic change

Demographic change is the third global megatrend, next to globalisation and technological change, that strongly affects the biotech sector, and which is also influenced by developments in the sector. The **ageing of the population** has raised concerns about the quality of (working) life, since the life expectancy is going up, but so are retirement ages. The older population, however, is more prone to health issues. Biotechnology plays an important role in this regard, by providing insights into understanding and slowing down the ageing process and by finding ways to improve the quality of life (OECD, 2002). The more general impact on health again became clear in light of the COVID-19 crisis. Supporting public health is a priority of the current European Commission, as evidenced by the EU4Health programme, the new OSH Strategic Framework and directives and initiatives such as those on long-term care. As regards **migration**, the available literature and the four interviews confirmed that the biotechnology ecosystem in Belgium attracts a global workforce.

Interrelated changes

To sum up the main points of the above discussion, the biotechnology ecosystem clearly emerges as an important player in Belgium and Europe, that finds itself at the core of technological change, globalisation and demographic change, and is at the same time driving these trends. Globalisation is mostly seen from the perspective of trade and global value chains, the regulatory framework, and the interdependency that arises between different actors. This latter point is illustrated in the context of the COVID-19 crisis. Technological transformations refer to changing processes, tools, etc. in the research and development and the production activities in the sector. Demographic change was discussed in the literature and interviews in terms of healthy ageing and composition of the staff working in the sector.

2.3.4. Impacts

This section zooms in on the impacts following from globalisation, technological transformations and demographic change in the biotechnology sector. The section discusses skills, employment, job quality and inequality. As the first three topics are often dealt with together in publications on the biotech industry, this approach was also used here.

Skills, employment and job quality

As one of the most important economic sectors in the country, the biotech sector **provides a high number of jobs, both directly and indirectly, and serves as a key driver for growth** (Cloots & Steurs, 2022). Besides employment in biotech companies, extra jobs are created along the supply chain, e.g. in logistics and transportation companies. It is estimated that for each 'high tech job', 4-5 other jobs are created in the same region. Almost half of the biotech workforce are women and about one in six does not hold the Belgian nationality (Cloots & Steurs, 2022). The two interviews with workers confirmed these findings on gender and nationality. Both interviewees spoke about working in an international team that is fairly gender-balanced and in which women have leading/managerial roles too.

It is important to note here that there is a **wide variety of jobs** in the biotech industry (Cloots & Steurs, 2022). This is related to the diversity in terms of biotechnology activities (e.g. production versus R&D; red, green or white biotech; etc.), the types of actors involved (universities, research centres, companies, etc.). Although biotech is a knowledge-intensive sector, with a higher share of highly-skilled workers than other Belgian sectors (around 70% of employees at least have a higher education degree according to Cloots & Steurs, 2022), job and skills profiles are quite diverse. For lower-skilled workers with good technical knowledge, there are many job opportunities as well (e.g. in production, maintenance, work in labs or greenhouses, etc.). Jobs in the biotech industry are generally well-paid and offer good conditions.

On this note, the situation of lower-skilled workers and notably production workers in the sector must also be highlighted. Several companies work with **continuous (or full-time) production processes**, where production activities take place 24/7. In such cases, workers may **work in shifts** (early shift, late shift, night shift; fixed or rolling schedule). This type of work is heavily regulated. Workers receive additional premia on top of their wages to compensate for working times. As wages are already very high in biotech (and the chemical and pharmaceutical sectors more generally), workers typically can make a good living, also

compared to other sectors where night work and shift work are common, such as the textiles industries where wages are much lower for similar types of jobs (Apostel *et al.*, 2023). However, there is ample evidence in the literature that night work and shift work can have detrimental effects on the physical and mental health and the overall well-being of workers. A prolonged exposure to working in night shifts, for example, is associated with cardiovascular disease, type 2 diabetes and cancer. Regarding consecutive night shifts, there are conflicting results in the literature, with some studies finding no negative health effect while others do. Having sufficient rest between shift is critical too, as a lack of rest can lead to poorer sleep, fatigue, and work-life conflicts. The interviewed trade unionist indicated that workers in the biotech sector experience similar issues, but that finding a way around them is not so easy. In other sectors, such conditions are typically compensated by higher base wages or wage premia, but as base wages are already high in the sector and the use of premia is common, giving ‘more’ money to compensate for the working times has little or no effect for the workers. Negotiating other forms of compensation seems necessary, but is difficult (e.g. ensuring autonomy in the work planning). The interviewed trade unionist further warned that (some of) the negative effects of atypical working times only materialise in the long run, which is why it is important to keep the issue on the radar of the social partners and the workers.

In the biotechnology sector as well as almost everywhere else, **finding, attracting and retaining talent remains a significant challenge**. Competition for Science, Technology, Engineering and Mathematics (STEM) profiles is very strong. Despite the high levels of education and skills and the high labour productivity of the Belgian workforce, it is widely recognised that lifelong learning and training is required to ensure that Belgium remains a leader in the biotech sector. This is particularly the case in the light of the digital and green transition. As the sector federation for the biotech industry bio.be/essencia puts it,

‘To enable the transition to highly digitalised ‘factories of the future’, we need to accelerate education and training in digital skills’.

Investing in **digital, soft and leadership skills** is essential. Especially the sectoral training centres aptaskil (based in Wallonia) and ViTalent (based in Flanders) play a major role in this regard. These training centres were launched at the initiative of the social partners. More generally, the Belgian social partners are strongly involved in adult education and training, for example by setting up, managing and funding **sectoral training funds** that provide a training offer to workers and companies in the sector; by offering expertise on **skills anticipation exercises**, by working with schools for **internships** and the **transition to labour market**, etc.

In the Belgian national recovery and resilience plan, the establishment of an **EU Biotech Campus** is announced for 2025. The EU Biotech Campus is to be set up as a public-private entity, with governance co-piloted by biotech companies and existing training providers (public and private). It aims to serve as both a training centre and business accelerator and is based on four pillars:

- **STEM immersion:** Sensibilise students and job seekers on the opportunities of the health and biotech sector, as well as business leaders on new emerging therapies. An immersive experience showing the value of biotechnologies on society using the latest digital techniques: movies, VR experience, digital twin academy, interactive museology, interactive workshops, ...
- **Biomanufacturing and supply chain:** Provide trainings to cover the currently unanswered market needs. Top-notch education and training around the next generation of biomanufacturing excellence (connected manufacturing lines, cobotics, robotics, automated processes, remote digital monitoring, vocal commands and reporting, ...
- **Data and digital:** Provide trainings to enhance the digital transformation by focusing on new skills and jobs e.g. IT & OT Skills, Process Skills, Analytics skills, AI, Machine Learning, ... The EU Biotech Campus will provide training on data management and how it can improve and optimise innovation and manufacturing processes.
- **Soft skills and mini MBA:** Professionalise starters in their business mind-set for their starting companies to be further anchored in Wallonia & uplift skills business leaders. It concerns middle management training and MBA specific for the life sciences (targeted training for scientific innovative researchers to get acquaintance with business and management basics).

Inequality

In terms of inequality, very few examples were raised in the academic and grey literature. In the interviews with workers, some examples were mentioned in the specific context of the COVID-19 pandemic. More specifically, an interviewee working in a large multinational explained that it was company policy that all personnel not working in production had to work from home, even after returning to the office was allowed under national policy. Already before the pandemic broke out, the company had an elaborate teleworking programme, and this was further extended during the crisis (e.g. improved equipment, more flexible conditions, etc.). For the interviewee, this implied a further improvement in the already very good labour conditions

the company provides. However, for production workers, the situation was different, according to the interviewee. As the company played a role in the production of COVID-19 vaccines, the production process had to run smoothly and very high quality levels were expected in a short period of time. This was particularly difficult, as some production processes had new elements or were significantly scaled up. The pressure on production workers was, therefore, very high. The approach to COVID-19 itself (e.g. obligatory telework for non-production workers) was used to avoid an outbreak within the company, which would not just have disrupted the production of vaccines but also other related activities (e.g. R&D, trials). The interviewee working for the start-up company, similarly, pointed to differences between the staff members who had to come into the company to work in the lab, versus those who held other positions. Among the group of workers that was required to come in for lab work, the interviewee noticed tensions, for example between workers with and without children during school closures. At such times, many of the workers with children asked for more flexibility in the work schedule, while those without children felt that they always had to adjust to the needs of others. This led to some conflicts as the lab team is quite small.

2.3.5. Conclusions

This case study addressed the biotechnology ecosystem in Belgium, focusing on its R&D activities but also on production, commercialisation and distribution, and how this is intertwined with the global megatrends and the COVID-19 pandemic. In the literature and interviews, the importance of a conducive regulatory and policy, the availability of a skilled workforce, a central geographical location and infrastructure, and the availability of an ecosystem involving well-connected actors embedded in international networks, were underlined as key determinants explaining its success. Biotech is at the forefront of the three megatrends. The contribution of the biotech industry to the country's economic growth, added value and employment continues to rise, replacing other more traditional manufacturing sectors. The federal and regional governments are all heavily invested in biotech, providing tax deduction and other types of incentives schemes, developing policies to support R&D, training the workforce and building new infrastructure. Innovation is encouraged from within the ecosystem too, with the sector federation and social partners playing a role (e.g. developing training, contribution to digitalisation working group, etc.).

2.4. Embracing change and workplace innovation in manufacturing: TRONIC Austria by Ursula Holtgrewe and Martina Lindorfer

2.4.1. Introduction

TRONIC (a pseudonym) was founded in the early 1960s as an electronics company in Vienna. The company specialises in timing and monitoring technology and has been developing components and customised solutions for manufacturing, mechanical and plant engineering for more than five decades. These are very ‘conservative’ products with a focus on high quality and reliability that can last some 10-15 years. Currently, TRONIC has some 90 employees and an annual turnover of 13 million euros.

It was family-run for a long time, and is still owned by the founder’s family, but meanwhile identifies more as a tech company. In 2013, the company introduced a self-developed new work model on the initiative of its managing directors. This led to a process of permanent changes as the company transformed from a traditional hierarchical factory to a self-organised, meaning-driven organisation that has devolved much but not all decision making to employees’ self-organising capabilities. The company vision sees the future in industrial IoT and indeed, sensor and data transmission functionalities are added to products, and some robotics have been introduced on the shopfloor. Increasingly, it develops an ecosystem around its products, its technology and also its self-organised decision making processes.

TRONIC produces for the world market at large and as a so-called OEM¹¹ partner for the world’s largest automation companies. With its ‘factory hub’ of hardware start-up companies, it has also entered into ‘manufacturing as a service’. The products are used almost everywhere where large motors or large currents are operated, also in growing sectors such as renewable energy, water or waste management. TRONIC produces approximately between eight hundred thousand and one million of products in varying lot sizes per year and supplies clients in 52 countries with their products. The electronics sector is of course strongly dominated by Chinese/Asian companies. Still, TRONIC retains production in Austria which allows for more agility and longer-term collaboration with partners and clients. TRONIC has its own sales department, but also distribute through sales representatives and electronics wholesalers worldwide.

Indeed, with its specialised electronics manufacturing the company managed to ‘move up the value chain’: not just manufacturing but also R&D in this small field has increasingly been

¹¹ Original Equipment Manufacturer

outsourced by large automation and electronics manufacturers. Thus, starting as a contract manufacturer, they now offer R&D and engineering services as well as manufacturing. Indeed, the largest share of turnover comes from OEM manufacturing for the biggest automation and electronics companies – a novelty for a company of their size. They also can supply equipment to competitors in the market. *‘We have developed from an extended workbench to a manufacturer’*, says one of its directors (M1).

In 2022, TRONIC has 13 million euros turnover and around 90 employees in R&D, production, marketing, sales and support services. Employees’ average age is around 40 years. The workforce has diverse backgrounds, especially in production, the largest department in terms of headcount with 26 people. Here, the share of migrant and multilingual workers has increased in recent years.

The gender division is rather classic for a European electronics manufacturer: production is predominantly female (99%) and staffed by unskilled or semi-skilled women with a range of training backgrounds – including the elected supervisor who is a single mother. Office management, finance and HR are run by women as well. Technical jobs (R&D, system administration, IT) are predominantly male, as well as quality management and logistics. The two directors are male.

The company has no works council which is somewhat uncommon in Austria in the sector. Instead, it has its participatory decision making system which is further detailed in Section 2.4.3. Nevertheless, it applies the collective agreement of the electronics sector as the bottom line of wages and has its own negotiation procedures on raises and bonuses on top of that.

2.4.2. Methodology

The company was selected as part of the ‘workplace innovation’ collection of cases. It is known in the field for its distinctive participatory approach to decision making, which has in recent years come under the heading of ‘new work’. We conducted desk research on the company’s exhaustive website and interviews with both management and workers.

The 6 interview partners were recruited through an invitation on the company’s intranet, a personal contact, and some help from the earlier interviewees. They covered management, Human Resources, R&D, product development and production. There are three male and three female interview partners in the sample. Their tenure in the company ranges from 1,5 to 27 years.

Table 2. Overview of interviewees at TRONIC

	Gender	Area/responsibility	Working hours	Tenure (years)	Job entry
E1	m	Electronics development	34 hrs/week	20	
P1	f	Supervisor of one production process	Full-time	3	Job transition from hairdressing sector – by ‘coincidence’ at TRONIC
M1	M	1st management level			
E2	M	Product manager	All-in	1,5	Via networking; very fast employment
P2	f	Production planning and control	Fulltime	18	Via an apprenticeship (Lehrstelle)
M2	F	HR	Fulltime	27	As summer internship; then 18 years in financial department/accounting in TRONIC; since 2011 responsible for HR; not originally trained in HR

2.4.3. Case study findings

Globalisation

Being integrated in larger global value chains, for TRONIC delivery capability and reliability are important. Here, the company performed very well in the last years, which also attracted new customers.

The client structure of TRONIC is complex and in addition to its own sales department includes wholesalers, retailers and specialist shops. The core market of TRONIC is still in Europe – Austria, Germany, Italy, Belgium. TRONIC recently established a small office in the US (upon the initiative of an employee who wanted to move there for private reasons) and try to develop their market there. TRONIC also has cooperation partners in South America, Asia, Australia and New Zealand.

Production is 100% done in Austria, which is part of the sustainability concept of TRONIC. However, electronic components are purchased from all over the world. Nevertheless, TRONIC tries to keep its own supply chains as short as possible – again, for sustainability reasons. Plastic material, which is integrated in electronic devices, is purchased mainly from regional partners (located not further than Italy). Most printing plates are also ordered in Austria. Assembly, testing and packaging are done in the company.

‘I mean, in any case, ‘Made in Austria’ is very important to us, yes. And, as I said, we really stand for high-quality, durable products. I think that is also very, very well recognised by the market.’ (E1).

This advantage was retained during the COVID-19 pandemic, as the company was wise enough to build up stock early (whereas competitors had run down their stock). They could rely on

good contracts with component manufacturers and suppliers, well-stocked supplies, and could keep all their order promises for clients. In the view of the managing director both the ownership structure (as a family-owned company with somewhat 'patient' capital) and employees' awareness of economic needs and constraints allowed the company the freedom to build up higher reserves than would have been possible otherwise. However, there is awareness that this could change any time. In one TRONIC device there are around 200 components, and if any of those cannot be delivered, production is in trouble. This apparently had happened to other companies in the sector. However, for workers in production, the two years of the COVID-19 pandemic were a hard time, with overwork due to colleagues' absences due to illness while orders still needed to be fulfilled.

In terms of regulation, product standards and certifications (both legal requirements and those demanded by customers) have had an increasing impact on development. For a new product an estimated third of project time must be calculated for product testing (in-house and with external testing institutes) in order to get all required stamps and quality seals. The company has thus hired a specialist for product compliance.

'Yes, the standards requirements become more difficult every few years because you have to fulfil more and more requirements, yes. That has reached a speed [...] that's not quite easy any more. Now you also have to know your way around the market, so to speak. In the past it was different; people developed something in their garages and then sold it.' (E1).

Hence, the company so far manages to be successful in the globalised sector of electronics manufacturing by relying on private ownership, regional sourcing where possible, local production and employees' shared sense of economic constraints that balances the aspirations of participatory decision making. In addition, it is active and ambitious in building local and further-reaching ecosystems of both electronics manufacturing and 'new work' practices.

For electronics manufacturing, the company has opened a 'factory hub' that offers a co-working place with fully equipped electronic developer stations, meeting rooms and access to a community of start-up hardware innovators and manufacturers. This is co-funded by the federal state. Indeed, it has opened up the new business of an electronics manufacturing service (EMS) to TRONIC for new products designed by start-ups. TRONIC also gives support and expertise for the development of external prototypes into a serial product.

The organisation of work at TRONIC has attracted attention of both media and managers across all kinds of companies and institutions, and the company received inquiries on their company model up to a point where TRONIC even earned some money with it. One of TRONIC's directors

in particular is active in spreading his concept of workplace innovation to the world and has started to offer trainings, consulting and seminars on new work and democratisation in the workplace. Eventually, these activities became a burden on the core business, and TRONIC devolved this task area to a newly established subsidy SPACE (a pseudonym), which aims to build a community for exchange and co-learning among new players and pioneers of new work. It also runs an 'Academy' together with scientists from Austria's largest university of applied sciences, that offers a range of further education courses for companies, administrations and organisations in participatory decision making and work organisation. The director expects interest to increase further:

'But I'd say there's always interest. People like to come here. Yesterday the Chamber of Commerce came again, [...] when they no longer know how to solve a problem and need to be creative, they like to come to us.' (M1).

Technology use

TRONIC identifies not only as an electronics company, which produces technological solutions 'for a better world' but follows a broader vision as a 'company of the future'. It wants to create space for ideas and innovation and follows the mantra: innovation + sustainability = profit.

The company's products are inherently 'conservative' and long-lasting. Yet the company sees its technological innovation pathways of its monitoring and control technologies clearly in Industry 4.0. Their products will 'learn' to gather data through sensors and send data to a variety of interfaces in the network that control, store or visualise data and processes. This has created new market opportunities, but also increases complexity of the business model as it changes towards a 'servitisation' of manufacturing. Data generated through sensors built into products can be analysed and used for customers' purposes, predictive maintenance and also product improvements and innovations, and related analytics services sold to customers.

'On the one hand, I can use this [IoT] - I always call it a tool - to generate new products that didn't exist before. But I can also – and this is something that many companies overlook – use it to massively improve my existing products, because I suddenly know how my end customer, or someone in between, in my chain, uses and treats the products.' (E2).

However, embarking on that strategy was not entirely easy internally. Management wanted it on the agenda, yet developers were somewhat reluctant. Reasons were chiefly historical, as longer-serving engineers had the experience that change could mean redundancies and risks as opposed to the reliable business of building 'conservative' products.

‘Then I quickly realised that it doesn’t work here to be thinking in terms of departments, and that the R&D department isn’t the point, but it needs thinking on terms of networks. That means, I have quite a decent network with marketing and production, where the subject [of IoT] got more support. Also from other sides, and it slowly diffused into R&D. And that, the subject of networks, that really makes [the company] a bit different.’ (E2).

In addition, the company is committed to climate awareness and aims to become climate-neutral. Its starting position is comparably favourable:

‘We have millions of products sitting in control cabinets, and it’s always been important that these consume little energy. That we develop them to be as efficient as possible.’ (E1).

Recently it started to have the CO₂ footprint of some of its products measured in order to compensate it – also for business reasons.

‘Well, you know, anyway, it’s a bit, you buy yourself out of it, [...] but we take care to support sort of sensible projects, like a wind power plant in India or something. And we do marketing, of course. We get a nice sticker to stick on the product or the documentation, and in renewable energies that will certainly be taken into consideration [by customers].’ (E1).

This is triggering some complementary innovations. In 2022, a large energy management monitoring system was set up to evaluate the use of renewable energies and the potential of a circular economy. In this context, employees’ travel to work (often by car) contributes considerably to energy consumption – insights that fed into the decision to introduce an alternating 4day-week in production.

Digitalisation and automation of processes within the company is self-determined, but driven by the need for increasing efficiency due to competitive pressures.

‘But we expect to become more efficient when we introduce software and digitalisation. And we know that it is necessary because we are in a high-wage country.’ (M1).

Generally, employees and teams decide which software they want, and a dedicated circle named ‘advancing digitalisation’ advises colleagues on software tools and also maps software use in the company. Until now, some results were achieved: a new company wide project management tool, which allows for more transparency and better internal cooperation; enterprise resource planning (ERP), a new intranet which adapts information to individual needs of employees; a new product database for the maintenance of over 1,000 TRONIC products which directly feeds the company website with data.

The ERP tool already automated the work of production planning to a considerable extent and replaced three out of four production planning positions. The current ambition is to fully get rid of paperwork in production – which would also enable the remaining production planner and

shopfloor supervisors to partly work from home. *'But I'm not afraid for my job, I think, something else will come up'*, says the remaining production planner.

The company is also making inroads into robotics on the shopfloor but there are constraints due to the size of the company, the long-running products, and the lot sizes and product variety:

'Since we produce series that have been running for 20 years, there's the question, how much do you still invest into a series that shouldn't live much longer? But we are starting on a new series, there you need to see, how will the design be? So that you can take new steps, and then consider a robot or automated systems. So there are activities that could be replaced by a robot right away, even quite easily. But there we don't have the sales volume to say okay, that will be profitable for us.' (P1).

In the dimensions of TRONIC, the investment not just of capital but also of work into a running configuration need to be carefully planned:

'So, you see this robot and what it does. But it's enormous, how much work there is behind it, to get it to run, and the technology behind it. It's really one or two man-years [sic!] to put in, so that it works' (P1).

In addition, there are space constraints on the shopfloor since the soldering machine and conveyor belts cannot be moved. For now, the company has invested in a new transport robot that brings parts to the immobile soldering machine.

Automation of tasks and functions is generally considered necessary. It requires the discussion in the company to start early, in order to address the automation of jobs:

'We have employed [a person] in accounting in such a way that in four years we can also transfer her somewhere else. The [accountant] must have a desire to rationalise herself away, otherwise she will be rationalised away by our customers.' (M1)

TRONIC is aware that it has to make itself fit in terms of digitalisation (*'we crawl our way forward, but it is difficult for a SME'*). A person (interviewee E2) was appointed to manage the topic 'Internet of Things' (IoT) at TRONIC. The website now includes a video series on IoT (*'answers to your burning questions on IoT'*) and an IoT Blog with reading material.

With regard to sustainability, at TRONIC there are sensors in all rooms to monitor power consumption (the building is climate-neutral due to a large solar surface on the roof). Employees founded a 'sustainability group' because the company wants to be climate self-sufficient in 2025. The sensors for power consumption eventually were the reason that the 4-day work week in production was introduced.

Demographic change

The company has seen some generational change as 'old' workers left or retired, and younger ones were hired. Hence, the average age dropped from 50 years some years ago to around 40. Some parts of the tensions around the company's change processes are also interpreted as age-related. Remaining older developers are described as somewhat hesitant in accelerating innovation and getting involved in IoT etc. Still, they are repositories of experience, knowledge and know-how. In production, age ranges from the early 20s to someone in her mid-fifties. Especially, but not only in production, there are many nationalities in the company, and occasionally, German classes are offered to workers.

Recruitment is working well. The company does not experience actual staff shortages and has been continuously hiring in recent years. Development engineers for hardware and software are highly demanded, and at the time of the interviews the company is looking for specialists in IoT-related areas such as telecommunications or batteries and for sales staff to raise customers' awareness of IoT possibilities.

Workplace innovation: The New Work model

The transformation of the company culture into a new work model was an ongoing process of some trial and error. Within the last ten years, the company re-organised four times. *'Meanwhile, it doesn't hurt any more'*, says M1. Staff members are assigned 'roles' and not functions, which makes it easier to re-deploy personnel. Management try to act as 'mentors' in the operational business.

Currently, a roughly sociocratic model of decision making is being used. 'Circles' take responsibility for particular issues or subject matters. A circle is composed by a certain group of elected staff members and meets every two weeks, discusses and takes decisions. Circle 'chairs' or literally, responsible staff members ('Kreisverantwortliche') are elected every two years but can also be deselected by the staff or re-elected. In early 2022 there were four circles along the lines of business functions, that is, on product development, product production, sales and organisational support (which includes everything from marketing to onboarding management or controlling). There are also smaller inner circles within the four major circles. The circle chairs (Kreisverantwortliche) meet as the 'organisation centre' where company-wide decisions are taken. In these meetings, everybody may participate (it is not exclusive). The process is that the organisation centre puts decisions on the table, which then are taken in the company. All circle chairs discuss them in their respective circle und represent the circles' views

when the decision is put to the vote in the organisation centre following a majority principle. In voting the two directors only have one vote each - they can always be outvoted. However, they have a veto if they see economic damage - which has never been used. This back-and-forth takes time, but - according to the director - is faster than the conventional way, where decisions are taken first by management and then negotiation processes start during implementation. Ideas and requests for improvement by the staff can always be brought to the organisation centre. In addition to these circles, there are working groups on cross-cutting issues such as digitalisation, sustainability, or working from home that also develop proposals, gather feedback and coordinate decisions.

The first years of the transformation were tough as experienced employees report, and that period saw some staff turnover through both dismissals and people leaving voluntarily. Insecurity was considerable. One employee had just come back from maternity leave in the first big transition phase and described the atmosphere like this:

'And it also took a little while to realise what was going to happen now? Because in the beginning everyone believed that the company would collapse. 'It won't work anymore.' [...] at that moment, I have to say, it was a bit scary.' (P2).

It was a long process until employees got used to the new system, developed confidence that it actually could work, and adopted the new work culture.

'Suddenly you realised more and more: Hey, I don't need him [my supervisor] as a support! I can decide for myself anyway. Because we often stood together and said: So it would be better if we did it that way. But wait, who do we have to ask now? Well, nobody. Actually no one. Well, do we just decide like that? Yes, let's just do it like this! So it was such a process to get into it that you really dare to just do it.' (P2).

Interrelated changes: Embracing change

For the company, megatrends are to some extent interrelated by definition. Globalisation and technological change are connected through competition and customer demands. The participatory mode of decision making is complemented by management promoting a keen awareness of economic constraints:

'Explaining how the company works and also the economics behind it, that is strongly present in the company, also certainly in production. So the individual employee can distinguish OpEX, EGT and EBITDA. And that also makes the empowerment of workers.' (M1).

Transparency of indicators on sales and productivity and the practices of budgeting contribute to that awareness. In this context, the automation of jobs and functions can also be confidently addressed as long as the company is expanding and other work can be found for people whose

tasks are automated. However, the ownership structure of a family-owned business also contributes to that confidence as owners provide more ‘patient’ capital (for example for building stocks during the COVID-19 pandemic) than anonymous shareholders.

The company intends to cope with change through agile management and M1 argues that the ongoing transformation has built some competence and resilience in making changes.

‘And tomorrow, or a year from now, if the organisation thinks it wants to do it differently, we can do it differently [...] We always react. If our structure doesn't fit anymore because some external factors have changed or our environment has changed, then we try to reorganise ourselves [...] We simply notice that in this increasingly complex world and also with the issue of unplannability, we can no longer make five-year plans [...] the necessity to change is more frequent than we think.’ (M1).

2.4.4. Impacts

Skills

TRONIC has a very flexible approach to skills. Although the company invests in training of employees whenever needed, often changes in job roles require ‘learning by doing’. The director sees work in the company as an educational and personal development project or journey. While the company invests into further training for its own purposes, self-responsibility and proactivity are both demanded and appreciated. He also makes clear that the company does not ‘push employees through life’ and ‘with us in the company you are there as long as you make an impact’. Some skills are considered basic requirements for which the company does not provide training:

‘In 2022 it is no longer the responsibility of the company to teach an employee Excel or MS Office – you can do a do-it-yourself training on YouTube.’ (M1).

In production, a circuit board assembler is estimated to take roughly a year until she is fully trained.

‘Because products are varied and some of them turn up very rarely. But until you really have an eye for the job, like, what is an open soldering joint, what is the typical problem that we always get with that product. Nothing you can do about that.’ (P1).

Shopfloor supervisors and production planners have grown into their roles: P2 started out as an apprentice in the company, P1 as an operative worker. She was supposed to take over when her predecessor retired, but then this person fell ill and was off work.

'I was more or less thrown in at the deep end. [...] I knew the processes, how the whole thing is connected with other processes. And of course, many things I had to find out for myself, so all in all, there was no training as had been planned.' (P1).

However, this shopfloor supervisor is on the way to formally upgrade the skills she has achieved in the company. She had originally trained as a hairdresser and got tired of the customer service role, worked in retail for a while and decided on a career change. She joined the company as a circuit board assembler through a staffing agency and discovered a penchant for technology. She first aimed for taking the final apprenticeship exam in electrical technology, but this would have required electricians' skills that she could not learn at TRONIC. So she took a range of more modular courses in electronics and control technology and is now starting on a course preparing her for the final apprenticeship exam as a mechatronics technician. She paid for the courses out of her own pocket first, then the company reimbursed her.

'Because that's ..., when you get up and do something yourself, that is much appreciated', says M1.

In R&D, E1 reports that the requirements of his job changed quite a bit in the last ten years. This is due to both work intensification and a change of tasks:

'The first ten years in the company, I really have been able to work on one project only and lose myself in it for weeks. Real developing, right? [...] And now that's changed a lot. You are responsible for so many things, need to be involved everywhere for a bit, and yes. It's become more challenging. More varied, that's the good thing. But sometimes I'd rather be able to concentrate on some things more and longer, but I hardly ever manage to do that.'

Apart from formal and technical skills, the new work model also requires and develops certain soft skills that amount to a comprehensive personal development. Notably, it is the women among our interviewees who emphasise that aspect – and to some extent ratify the expectations and values of management. P2 describes it as follows:

'But now, how you change here as a person that is also a very big part, how you develop here, through this organisational form as we have it now [...] from situation to situation you grow into it. And somehow you learn more and more from it. [...] But it takes time, because you're simply not used to it. For example, to have a vote or to be allowed to have an opinion. Or to express your opinion. [...] it wasn't the case in the past that anyone was interested in my opinion, it didn't matter what my opinion was. And you have to grow into it. And I think that was harder than the courses I did for the subject [...] But this personal development that you go through, that was immense.' (P2).

She aptly describes the fluidity of roles in both working and making decisions:

'You have to break out of your accustomed role from one day to the next and have to be totally someone else. You have to partly be the boss although you really are not.' (P2).

The demand for self-direction and initiative reaches some limits on the shopfloor. Although P1 and P2 clearly have benefitted from this approach, such personal development appears not to be a given. They have some work to do to encourage shopfloor workers to make their own decisions and work in that ‘responsibly autonomous’ way:

‘So we are still in the process of educating the girls to be a bit more independent, yes. [...] And when I took over last year, I started to stop carrying things after them. Yes, that they slowly become a bit independent, that they get in touch with others by themselves, with other sub-processes.’ (P1).

For people socialised in more regimented modes of working this is not always easy as P2 explained. Generally, it appears that those workers have a better stake who have a stronger sense of self-initiative and are able to develop and communicate clear opinions.

However, technical and social skills need to be merged for the new work model to function. Taking over new and fluid roles requires trust in colleagues’ competence. As E2 puts it:

‘I can, I can do that with anyone at TRONIC, just discuss what I’m planning, strategy for example. Look at it together and say, hey, what do you think of this. That works with anyone. Anyone who has a clue about it.’

In this context, the question remains to what extent roles in the company can be fluid. The staffing of the position of the HR person illustrates this dilemma. During the transition phase, for a while the HR position was decentralised and duties were divided between several persons from the staff, who were to receive basic training on HR skills. After some time, the organisation found that staff did not feel comfortable with this solution, and it became hard to find volunteers for this task, because candidates felt they lacked expertise to take over HR responsibilities. Eventually, it was decided to give the job back to the initial HR manager who has qualifications in the subject and fills her role with a strong coaching component.

Employment

During the first stages of the transition phase the company cut back on staff in order to get rid of inefficient processes. The abolition of a hierarchical salary scheme also led to people quitting. For two years now the company has continuously been hiring staff. The decision for new personnel within the budget is taken in the respective circles.

Recruitment in the company is two-tiered: For positions in production, new recruits are hired through a staffing agency first, then, if it suits, TRONIC hires them directly after a year at most.

New employees in technical and professional positions always get an opportunity to try out working in the company and receive a fixed-term contract first. This is accompanied by regular

feed-back conversations, which eventually, after a year leads to an open-ended contract if it suits. HR is responsible for onboarding, for which they have established their own process.

Due to its unique management model TRONIC is well known and has a lot of media presence. It is also active in posting job adverts via social media. Hence, they receive many applications.

To match roles and candidates, also with aspirations for internal careers and development, TRONIC uses a predictive index tool. This means that profiles are developed by circles for starting positions and then matched with some personality testing (which is understood as the baseline position where employees start and can further develop). The profiles are always gender-neutral. A wider ambition is to develop this into a general information system of both jobs and expectations on them and employees' skills and potentials. This should support capacity planning, remuneration and training needs.

With regard to personalities, in the view of M1 recruitment is not a matter of simple 'cultural fit':

'Even, we consciously aim to specifically include people who obviously have some difficulty with this form of organisation. In full awareness that that subverts the system, but then the others need to take a position and fight for it. Then systems need to readjust, and then you get challenged again, that's the beauty of it.' (M1).

In production almost all workers are female (currently there is one man). The reasoning echoes arguments used traditionally to justify the assignment of regimented Tayloristic jobs to women:

'We have already tried it with men [in production]. But it is very monotonous work and we work with small parts and we have noticed that all men who came to us for interviews did not like it. It was too monotonous for them and that's why it's mainly women, but from all ages.' (P2).

Office and administrative functions are also women-dominated, whereas sales, R&D etc. are mostly men. No notable changes in the gendered division of labour have occurred in the company.

Transitions happen within the company through job changes (see above), into it and out of it. As the case of shopfloor supervisor P1 shows, production workers may enter the company almost coincidentally. Some come from other occupations that, such as personal services, pay less and get tiresome after a while. Returning to work after parental leave is also common.

Within the company, workers are encouraged to identify issues beyond their original role and figure out how to shape their jobs according to their interest. Awareness of these opportunities adds to the open acknowledgement of automation 'risks' to particular jobs. Interviewees are

generally confident of their ability to find other work in the company. The general condition is that they can show they are 'impactful' in other roles (in the director's words).

He also reports that occasionally TRONIC loses employees who become self-employed (*'Well, they say, that's what we taught them.'*). This can well be an outcome of the general education in business that participation in the company entails. It has also happened that employees left for a while and then returned.

Job quality

Wages are generally based on the collective agreement for the electronics industry. Collective agreements in Austria cover all companies, because private sector companies are statutory members in the Chamber of the Economy that negotiates them on behalf of employers. However, in the sector the collective agreement sets more of a floor for wages and paying above it is common. In addition, there are individual negotiations.

During the early transition period, there was some reshuffling of wages. The circle that took over HR established a group for fair wages that compared actual wages with average wages.¹² The team first aimed to get rid of the most striking inequalities, which did not please all of the higher earners. For example, sales representatives previously received bonuses even when the company was not doing well. 80% of the average bonus were then integrated into regular wages. The change led to stepwise wage increases. E1 for example received regular pay rises until his wage came close to the average wage listed by the online tool – with which he is satisfied.

For a while, taking on extra functions in circles or working groups used to be rewarded by a small pay increase while that role was fulfilled, but these supplements were abolished:

'The way I understood it, the reason was somehow that you don't take that function for the money but simply because you want to take that role, and if you work here, it's part of the job to take some responsibility.' (P2).

In this situation it is likely that rewards for extra work and engagement are assigned or negotiated on an individual level. Still, one developer who works long hours and is not entirely satisfied, sees some appreciation after a small pay rise:

'It wasn't much but at least you got some appreciation. [...] The company sees that some people live this style more and want to advance this democratic company, compared to those that say, well, I'm working to rule.' (E2).

¹² Such data are collected by sector and occupation on a platform hosted by the ministry of labour (www.gehaltsrechner.gv.at).

In production, workers receive a bonus four times a year which is based on productivity, defect rates and process improvements suggested by workers. P1 is quite satisfied:

'It's perfectly all right. In particular, I was a hairdresser before. [laughs] /I: I understand./ And in retail [laughs]. So.'

Generally, there are some tensions in the system when highly-skilled and much-needed specialists are hired and make higher demands. Both management representatives agree that the joint decision making of teams generates an understanding of such pay differences, but that in return, expectations and objectives will be set higher to make sure the candidate still adds value.

The company is flexible with regard to contracted working hours with the exception of production. Otherwise, flexitime runs from 6 am to 8 pm. Above 10 hours and after 8 pm no working hours can be entered into the system. The time model was developed by staff with advice by a lawyer to make it consistent with labour law. Contracted working hours can be negotiated freely. Indeed, E1 was attracted to the company because he wanted to work for four days only, and this wasn't common in the tech sector when he was hired. Some employees have all-inclusive contracts that include lump payments for certain amounts of overtime, e.g. E2 has an all-in contract and works approx. 50 hours per week.

In production, a limited amount of flexitime is also possible. Workers have half an hour space at the beginning and end of the shift:

'For us it's minimal, really, but I think for someone in production it's something bigger, it isn't common.' (P2).

Overtime is generally compensated by time off. Production suffered an intensive phase during the COVID-19 pandemic when contracts needed to be fulfilled, people were off work with COVID-19 or other illnesses, and some machine breakdowns occurred on top of that. At that time, 12-hour shifts were run, production also worked on Saturdays, and workers were clearly exhausted. The production planner also helped out on the shopfloor. She aimed for an even distribution of overtime, and hoped to make sure to increase staffing levels so that time could be taken off again.

In line with the company's sustainability efforts, looking at energy use and the contribution of car travel of employees, the sustainability group and the production circle agreed to pilot an alternating 4day-week in production. It was introduced through a survey among workers. A majority voted pro, so it was tried out with a two-week test cycle. Another survey gathered feedback. Some two or three people were not keen because of their morning routines, but the

majority remained in favour and the scheme was retained. Now, in one week, working hours are from 6 am to 4 pm Monday to Thursday (including breaks), then the Friday is off. The other week, production works from 7 am to 4 pm during the week, and the Friday shift runs from 7 am to 1 pm. Management were not involved in the process and *'cheerfully surprised'* (M1).

For now, the scheme has not been taken over by other departments but is under consideration. E2 with his long fulltime hours thinks the difference would be somewhat ambiguous. However, he would be willing to try it out.

'Hm, well, yes, it would, very likely. Because I'd try to work in a still more focused way. I suppose, probably, at least in the beginning, it would need still more control, more discipline.' (E2).

The possibility to work from home existed before COVID-19 since 2011, with two days' working from home possible for anyone except production workers. Since the pandemic, a 'work anywhere' principle is applied.

'You can work where you can be most effective. I don't care if he's sitting on the beach. Because we are a project-oriented company, and the customer must be satisfied in the end.' (M1).

With the new work organisation, the office infrastructure was also changed. Offices were converted into an open-plan office with no spatial separation between different departments to foster mutual awareness of what is going on. There are stylish sofas and coffee corners, so the plan is to work in a hybrid way, combining the focus of working from home with communication on-site.

'I always say that company should be like coming home. I go there, I have a coffee there, and when they are here [the employees], the demand is that they communicate, that they exchange ideas – that is a very, very important thing.' (M1).

Work organisation in production is based on processes and product lines. In R&D it is project based with 3-4 project teams, who mostly do their own planning. E1 and E2 have more individual roles advancing particular strategies and processes. Generally, teams and circles decide most things by themselves or in direct interaction with other affected teams. Circle chairs and other supervisors only take decisions on hiring or buying in extra resources, or if the company level is affected or some intermediation is needed.

Generally, the participatory mode is balanced by overall transparency of business figures and outcomes. Discretion at work is high throughout, but it is circumscribed by a commitment to delivery and customer satisfaction. Introducing KPIs beyond the obvious ones is under discussion, but they are not implemented currently, as current project management tools do not

deliver meaningful indicators overall. Still, directors are occasionally setting 'soft' targets in planning such as *'In three years' time we should have got back the cost.'* (E2).

In production, times for each lot are calculated in advance based on measurements, but are mostly feasible for experienced workers, although staffing levels apparently do not always allow for much slack. Apart from these timeframes, ways of working are not prescribed in a Taylorist mode.

'I can really work freely [...], I know the target and can find the way on my own. This is for me what makes the little difference.' (P1)

'The way it was in the very, very past, that was really strict work: you can only do it like that, and the resistance has to go in like that, and you can't do it any other way. And I'm just of the opinion that everyone should work in the way that's easiest for them and the result has to fit.' (P2)

Once a year an appraisal interview takes place between an employee, their technical supervisor and HR. It is an optional tool on the initiative of the employee, but HR also invites people for more or less formal conversations if needed. In addition, there is an open consultation hour of the HR manager which is open to all employees for any pending issues. In between, feedback is not regulated by any standards, but employees report a culture of high appreciation in the company.

Overall, the workplace discretion, intensive horizontal coordination and participatory decision making are appreciated by all interviewees. However, some downsides are also noted: Finding solutions horizontally means that some responsibilities are diluted and it can be difficult to find answers to cross-departmental problems. The decision making structure also takes a toll on time, which the developers note in particular:

'Yes, yes, that is what is quickly forgotten, that we all have a basic function here, for which we are here. And without this function, business would not work here. We often forget that. Because I often have the feeling that everything here consists of talking and sitting together and having new thoughts, but as long as we really produce here, it doesn't work one hundred percent [...] the pressure that every employee has here is very high and not healthy in the long run.' (E2).

'It is now a lot about agile management, which has become important here as well. And there is a lot of philosophising, in my opinion. Once, [in a meeting] I just left and said no thanks. Please, let's just agree on something and leave it for some years.' (E1).

E1 for these reasons has to some extent reduced his involvement in cross-cutting groups to what he feels is manageable. Overall, interviewees feel that some people are reluctant to take circle responsibilities, and there is a risk of some participation fatigue.

Interview partners consistently rated the working atmosphere at TRONIC as quite good. The company has experienced ups and downs in last years, also due to the different transition phases when tasks were shifted between employees, which triggered some anxieties and tensions. At the time of the research in the first half of 2022, the company is in a favourable situation with both good market demand and a good working climate. Employees have confidence in the company and in the communication and problem-solving abilities within the company:

'So no matter what comes up, be it a little problem, then we solve the little problem. And we also talk to each other. And that is also what has changed here for the good, this communication.' (P2).

Job quality also expresses itself through discretion at work, scope for job enrichment and personal advancement:

'And that's the beauty here, here you have so much scope to develop yourself. Even the job that I've been doing for eighteen years is changing, I'm changing, I'm in other roles or I'm getting more responsibility here and there, and that's also something that often challenges me, of course [...] And that's what I think is nice here, that you always have the chance to get more out of yourself and not to stand still.' (P2).

Inequality

As we have seen, the gendered division of labour is in line with long-standing traditions in the electronics sector. Management is trying to support having more women in certain divisions., but in engineering, they are not easy to find. Currently, in R&D there are 9 male and 1 female engineers.

The fluid roles in the company and the commitment to personal development are more vocally appreciated by the women interviewees. Indeed, they have extended and upgraded their skills. For example, P1 with her skill upgrading initiative is certainly benefitting from this company's structure and opportunities. For bright women making job transitions from poorly-paid personal services and discovering technical interests in the process, this model appears quite favourable. Men also find more variety in expected working hours than in conventional full-time-plus-overtime engineering positions, although that mode of working also exists in the company.

The introduction of the alternating 4-day working week in production had some positive side effects in terms of diversity and gender. Holidays used to be very much pre-defined in production with fixed company holidays in the summer and over Christmas. With the

flexibilisation of working time it gave staff with e.g. Serbian-Orthodox religion the possibility to schedule holidays more autonomously. The 4-days week also makes it possible for workers with care responsibilities to pick up their children from school once a week.

Although there is a commitment to equal pay, in the end individual negotiation can improve one's salary. If women tend to negotiate less hard, this may disadvantage them (Säve-Söderbergh 2017). This is also illustrated by a comment of P2:

'I can still remember a colleague from our department at the time who asked the production manager for a pay rise and he said to her: 'Well, if I give you one now, you'll want one every year because your standard of living adjusts to it [...]. She didn't get the raise in the end. That's why I was never the type who dared to ask for a raise [...] And after that, when we had these personnel managers, my strengths were recognised. And then, without saying anything, I went further and further up the ladder [...] at the last interview I didn't say anything and still got a raise, because they see how I work here and how I identify with the system here. I am very satisfied with my salary.' (P2).

There seem to be lines between age groups. E2 who is responsible for promoting IoT experiences certain resistances from older employees, who are critical about the topic.

'With the whole reorganisation of the structure at TRONIC, a lot of developers were made redundant at the time, and this is now accompanied by the fact that they are still afraid of being made redundant, but also of innovation issues, of course, because they bring a risk with them. But not to innovate, so to speak, is probably an even greater risk.' (E2).

2.4.5. Conclusions

In the authors' view, the TRONIC case is certainly exceptional but represents 'alternative' ways of doing things, and also shows some prerequisites and consequences of 'new work'. The overall picture is quite dialectical: Globalisation and technological change make for a competitive environment, but the ownership structure and worker participation allow for a forward-looking building of stocks and reliable deliveries. The market is potentially global, but the company bases its business on national production and builds a regional ecosystem of electronics manufacturing and 'new work' initiatives. 'Conservative' products are strategically connected with IoT applications and the business model is being developed in the direction of 'servitisation'.

Employee participation is ambitious and aimed to improve adaptability and resilience. It is circumscribed by transparency and awareness of business outcomes and requirements. It is also unequally distributed. Shopfloor operatives are recruited through staffing agencies and appear to participate to a lesser extent, although their supervisors encourage them to be more

self-reliant. Still, participation requires some skills and personality traits of communicating, having an opinion and switching roles – and such skills may not be so easily achieved in a working-class education. In order to learn and develop ‘by doing’ a person needs to be able to do it. With regard to wages, the emerging need to offer higher wages to sought-after specialists may render the system more unequal. HR’s ambitions to model skills and jobs into a potential matrix to plan capacities and careers may take longer than the dynamics of restructuring the company in a volatile environment allow.

3. Financial Services

3.1. Impacts of globalisation, Technological innovation and changing demographics on the banking sector in Luxembourg by *Adrien Thomas and Patrick Thill*

3.1.1. Introduction

This report concentrates on the banking sector within the broader finance sector in Luxembourg (comprising also insurance activities and investments funds), focusing on the impacts of globalisation, technological change and changing demographics on the sector.

The growth of Luxembourg's financial sector goes back to the 1960s and 1970s with the emergence of the Eurodollar markets and the growing presence of American, German and Scandinavian banks in the country (Bourgain & Pieretti, 2008; Michaux, 2013; Moyses, Meiers & Maquil, 2014). The financial sector was further developed in the aftermath of the steel crisis (Birchen, 2015; Raphael, 2019). Today, the financial sector is the most important economic activity sector in terms of contribution to the national GDP, fiscal revenues and employment (Guarda & Rouabah, 2015). Luxembourg today is a relevant international financial centre with its primary activities in investment funds and private banking. The Global Financial Centres Index has classified it as 27th of the worldwide international financial centres, close to the ranking of Geneva or Munich.

There has been an ongoing debate in the domestic literature on the reasons explaining the growth of the financial sector and the role of external and internal factors, especially the relevance of national legislation aiming to create a favourable tax environment, as Luxembourg refused for a long time to share information with foreign tax administrations on foreign bank account holders in Luxembourg (Majerus & Zenner, 2020). Historically, the banking sector has entertained close links to Luxembourg's policy makers, among others via forums such as the public-private *Haut comité de la place financière* tasked with discussing strategic issues and potential new legislation.¹³

¹³ Key political decision-makers in Luxembourg such as the Prime minister and the Minister of Finance have also entertained direct links with actors of the banking sector. In a publication by the Deutsche Bank Luxembourg, a historian underlines that the '*Luxembourg government was always very open towards the wishes and sometimes the demands of banks for advantageous tax conditions.*' (Kopper, 2020).

Since the financial and economic crisis in 2007/2008,¹⁴ the sector has not only been affected by an increase of EU legislation touching the foundations of the sector and its international competitiveness (i.e. banking secret), but also by low interest rates and uneven financial results (Perray, 2020), cases of restructuring¹⁵ and the reconfiguration of skills and professions. The banking sector has been impacted in particular by the United States' Foreign Account Tax Compliance Act (Facta) to combat tax evasion by US citizens and the introduction in January 2015 of the automatic exchange of information between EU member states on savings income. More recently, the new EU Digital Operational Resilience Act (DORA) regulations reflect the urgent requirement to reinforce the sector's digital resilience.

How does it fit into the triangle?

Because of the small size of Luxembourg's domestic market, the prosperity of Luxembourg's banking sector is dependent on developments in international financial markets and regulations which create opportunities and impediments. The sector is highly internationalised with the presence of numerous foreign banks and only a small number of banks with Luxembourg origins. The workforce of the sector is mainly constituted by migrant workers comprising both cross-border commuters and immigrant workers residing in Luxembourg. Technological change and globalisation have led to the offshoring and outsourcing of activities, and to changes in working conditions. Finally, modified skills requirements stemming from changing regulations and digitalisation have impacted the sectoral demographics.

Key Impacts

The impacts of the identified changes related to globalisation, technological innovation and evolving demographics are mediated by the institutional configuration of Luxembourg's political economy and its industrial relations system. Luxembourg is a small western European country that, following the varieties of capitalism approach, can be classified as a coordinated market economy, in which the market is regulated fairly strongly (Hall & Soskice, 2001). Luxembourg's employment relations system has further been described as neo-corporatist with statist elements because the government retains a coordinating role and a strong foothold in all arenas of national social dialogue (Falkner & Leiber, 2004; Menz, 2005; Thomas, Kirov &

¹⁴ In order to avoid a collapse of the financial sector in Luxembourg, the government intervened by injecting 2,5 billion euros into the FORTIS Bank and 376 million euros into the DEXIA bank with the objective to prevent their collapse.

¹⁵ By restructuring, we understand a process of modification of the company's workforce, both quantitatively (in terms of number of jobs) and qualitatively (in terms of skills and qualifications), following changes in a company's structure, organisation or production processes (European Commission, 2008).

Thill, 2019; Vollaard *et al.*, 2015). The prevalence in many instances of a social partnership approach and the role of the state in facilitating reskilling schemes have mitigated the impact on employees of the transformations in the banking sector.

Nonetheless, the increasing internationalisation of Luxembourg's banking sector and the overall weakening of trade unions' presence raise questions as to the future sustainability of employment relations in the Luxembourg banking sector.

3.1.2. Methodology

Our data collection approach combines semi-structured interviews with key informants and a documentary analysis covering over 30 documents, including academic studies and national publications from national institutions (STATEC, ADEM, ...), collective labour agreements, related legal documents, press releases by trade unions and employers' organisations and industry reports. This exploratory documentary analysis informed the report about the developments in the finance sector, as well as the specific policies and positions of trade unions and employers' organisations. In addition, the national statistical office (STATEC) provided statistical data on employment in the finance sector.

We conducted 5 semi-structured interviews following a common set of structured and open questions. Interviewees included 'elite informants' (Dexter, 1970) with an in-depth knowledge and perspective on the broader challenges affecting the sector under study. Interviewees were senior representatives of three trade unions and of the employers' organisation of the banking sector.

Moreover, the data collection process benefited from the fact that interviewees often had multiple 'hats' and, therefore, were able to provide a more holistic perspective. Interviews were recorded assuring anonymity and confidentiality, and lasted on average approximately one hour. Interviews took place between March 2022 and April 2022 in Luxembourg. A thematic analysis of the interviews was carried out.

Table 3. List of interviews in Luxembourg

Interview	Organisation	Function	Date
1	LCGB	Senior trade union official	4 April 2022
2	ABBL	Senior employers' official	1 April 2022
3	ABBL	Senior employers' official	3 April 2022
4	OGBL	Senior trade union official	24 March 2022
5	ALEBA	Senior trade union official	19 April 2022

3.1.3. Case study findings

The sector

Employment in the banking sector has been stable over the last years, despite the fact that many smaller banks (for instance, German *Landesbanken*) often active in private banking,¹⁶ have closed over the last decades. The number of banks in Luxembourg has decreased from 222 banks in 1994 to 147 in the post-crisis era since 2013, and went down to 122 in 2022. According to 2021 STATEC data, the number of employees in the entire finance sector stood at 50,997 among which 26,317 worked in banking (out of a total number of 458,000 employees in Luxembourg).¹⁷ In 2020, the sector still generated jobs with an employment growth of 1.4%.¹⁸

The banking sector has been less hit by the COVID-19 pandemic than other sectors, as a recent study by STATEC suggests. Given the strong service orientation of Luxembourg's economy, focused on financial services, most employees have been able to work remotely. Indeed, Luxembourg was the EU country with the largest share of employees working from home in 2020, according to the EU Labour Force Survey.¹⁹

A first feature of the financial sector is the high degree of internationalisation of its workforce. In 2018, 49.7% of employees in the financial sector (except insurance) were cross-border workers from France, Germany and Belgium, while resident workers made up 50.3% (among them a majority of immigrants residing in Luxembourg) of the workforce. As concerns the nationality of workers: 24.8% were of Luxembourg nationality, 31.3% were French, 13.8%

¹⁶ While 63 German banks were still present in Luxembourg in 2000 (31% of the total), their number fell to 35 in 2014 (23% of the total) and to 22 in 2022 (18% of the total).

¹⁷ Latest data available. Available at: <https://lustat.statec.lu> (last accessed on 31 May 2022).

¹⁸ Latest data available (ADEM, 2020).

¹⁹ <https://www.eurofound.europa.eu/fr/publications/article/2021/workers-want-to-telework-but-long-working-hours-isolation-and-inadequate-equipment-must-be-tackled> (last accessed on 14 of June 2022).

Belgian, 12.6% German, 12.9% came from other EU member states and 4.7% came from non-EU member states. As concerns gender, 55.5% of employees were male and 44.5% female.²⁰

As the global economic and financial crisis of 2008 made high profitability in Luxembourg's banking sector more difficult to achieve, collective bargaining over wages and working conditions has become more difficult. And yet, collective bargaining has never ceased to function and be relevant in the sector.

Another key feature of the collective bargaining system in Luxembourg is also applicable in the banking sector. The declaration of general interest by the Ministry of Labour, Employment, Social and Solidarity Economy makes it possible to render collective agreements compulsory for a given industry (Thomas *et al.*, 2019), which is the case for the banking sector. At the workplace level, collective issues related to the employer-employee relationship are discussed between the elected staff delegation²¹ and the company management. Bargaining between employers and trade unions also takes place over leave packages in the context of restructuring, where employment policy instruments such as early retirement schemes, training or mobility schemes are mobilised in many instances to avoid lay-offs (Kirov & Thill, 2018).

The following trade unions are represented in the banking sector: the largest organisation in the financial sector is the *Association Luxembourgeoise des Employés de Banque et Assurance* (ALEBA), followed by the *OGBL Syndicat Banques et Assurances* and the *LCGB Syndicat des Employés du Secteur Financier*. While ALEBA is a sectoral union only represented in the financial and insurance sector, the OGBL and LCGB are broader cross-sectoral confederations with specific federations active in the banking and insurance sectors. The election of the Chamber of Employees (*Chambre des salariés*) held every five years gives an indication of the strength of the different unions in the financial sector: in the last elections held in 2019, ALEBA received four seats (49.2% of the votes), OGBL received three seats (31.5% of the votes) and LCGB obtained one seat (19.2% of the votes). On the employers' side, the Luxembourg Bankers' Associations ABBL (*Association des Banques et Banquiers*) is the employer organisation that negotiates the sectoral collective labour agreement.²²

²⁰ This section benefits from data received by STATEC based on the 2018 survey 'Enquête sur la structure des salaires'. The data is based on NACE code 64: Financial services, except for the insurance sector.

²¹ The staff delegation (*délégation du personnel*) is the staff representation body at the company level. Based on a legal framework, the delegation is elected among the company staff. Staff delegations can make proposals on measures improving working conditions within the company and present individual or collective claims to the employer. Companies in Luxembourg with more than 15 employees must hold elections every five years.

²² Representativeness according to the 2004 legal framework in Luxembourg does not apply to employer associations.

Globalisation

From a historical point of view, Luxembourg's banking sector finds its origins in a mixture of external factors (changing regulations in other jurisdictions, liberalisation and internationalisation of capital markets) and internal factors (favourable national tax regulations, increasing specialisation) (Majerus & Zenner, 2020).

Over the last decades, political developments and new regulations at global, EU and national level have had major consequences for the financial centre. New international regulations, such as the Basel III framework on higher minimum capital standards for banks, decided in 2010 in the aftermath of the global economic and financial crisis, have affected Luxembourg's banking sector. The gradual enactment between 2005 and 2015 of the automatic exchange of information between EU member states on interests that non-residents receive from savings in their territory also impacted the activities of Luxembourg's banks and contributed to the closure of a number of banks in Luxembourg. More recently, in the wake of increasing international cyber-attacks affecting companies, the EU consolidated a package of preventive measures in finance in the context of the Digital Operational Resilience Act (DORA).

In addition, given the small size of the national market, Luxembourg's banking sector is heavily reliant on international economic developments. The global economic and financial crisis of 2008 led to the near-collapse in the autumn of 2008 of the Dexia and Fortis banks. Even as the sector recovered rapidly from the crisis, these developments illustrated the sector's vulnerability and dependence on global markets. Luxembourg's banking sector is also vulnerable to international political developments and regulations.

Table 4. Number and country of origin of banks in Luxembourg, 2022

Germany	22	Switzerland	12	Sweden	2
France	13	Italy	5	Japan	6
China	15	Britain	3	Luxembourg	9
US	4	Belgium	3	Brazil	3
Spain	4	Netherlands	2	Qatar	1
Andorra	2	Ireland	3	Norway	2
Portugal	1	Russia	2	Canada	1
Cyprus	1	Denmark	1	Greece	1
Jersey	1	Liechtenstein	1		

Source Banque Centrale du Luxembourg, 2022

In 2010, the global money laundering and terrorist financing watchdog, the Financial Action Task Force (FATF), pointed out the failings of the country's anti-money laundering system and

decided to put Luxembourg on a grey list. The OECD Global Forum designated Luxembourg as a ‘non-cooperative jurisdiction’ in matters of taxation in 2009 and as ‘non-compliant’ in 2013. A series of investigations by the international press, the largest of which was the Luxleaks investigation in 2014, also raised questions as to the negative externalities of the sector’s activities (Majerus, 2020). As a result of this strong external pressure on Luxembourg’s financial centre, the legislator and regulators acted to reinforce the regulatory standards. In November 2015, the OECD Global Forum labelled Luxembourg as ‘largely compliant’ (the same rating as, for example, the United States, Germany or the Netherlands). The globalisation of Luxembourg’s banking sector is further highlighted in the origin and decision centres of banks. Only a small number of banks in Luxembourg are of Luxembourg origin. German, French and Belgian banks are mostly present in Luxembourg, besides other banks from Europe and the United States. Over the last decade, new banks have been attracted, in particular from China and Latin America (Table 4).

In most instances, the decision-centres of banks are located outside of Luxembourg and strategies are decided by the mother houses, which diminishes the autonomy of local bank managers vis-à-vis their headquarters. A number of banks present in Luxembourg have been transformed by their headquarter from subsidiary companies to simple branches (such as Caceis and UBS).²³ International banks can decide to leave the country, change their business strategies in Luxembourg or downsize their activities and workforce. This internationalisation of decision making has an impact on the scope of action left to local bargaining actors for negotiating over restructuring decisions, as highlights a senior trade union official:

‘We also have situations where there is just a Chief Financial Officer that remains in Luxembourg who tells you: could you not send a letter to the headquarter to raise your questions, because I do not have any information. You have people here, but they do not have decision making power.’ (Interview 4).

As a result of the low autonomy of Luxembourg’s banks and the turnover among their leadership, local bank managers are less committed to building links with the national political elite. According to press accounts, the ABBL has recently encountered difficulties in finding bank CEOs willing to serve as president of the employer organisation.²⁴ According to the

²³ The Luxembourg Economic and Social Council already noted in 2014: ‘Following the current trend towards increased regulatory harmonisation, the Luxembourg subsidiaries risk losing influence vis-à-vis their parent companies and it will be increasingly difficult for banks and insurance companies to position themselves within their groups.’ (Conseil économique et social, 2014).

²⁴ ‘ABBL: Maas halten’, *Lëtzebuurger Land*, 4 December 2020, p. 10. Available at: <https://www.land.lu/page/article/530/337530/FRE/index.html> (last accessed on 9 June 2022).

interviews conducted with trade union representatives, internationally mobile bank managers also tend to have less contact with trade unions and are not necessarily committed to the search for consensus and the avoidance of social conflicts that have long been considered characteristic of employment relations in Luxembourg (Thomas, 2012).

Technology use

The technological change in the banking sector is mainly enacted through the digitalisation of services. Digitalisation is part of the trend towards the development of remote client service activities and new online banking offers. This entailed a change in business strategies, with the closure of local bank branches. One of the oldest banks established in Luxembourg, the state-owned *Banque et Caisse d'Épargne de l'État* BCEE, has thus reduced the number of its local branches from 101 in 1996 to 53 in 2022 despite the overall strong growth of Luxembourg's population. The Postal Bank similarly reduced its number of local branches from 97 to 35.

Moreover, the closure of branches has gone in tandem with the pressure for clients to increasingly use online services: this is achieved by reducing opening times, increasing fees for services at the bank, making cash only available at selected branches or by making it mandatory for clients to make an appointment at the bank. The digitalisation of services, which has been further accelerated by the COVID-19 pandemic, often takes place against the backdrop of multi-channel distribution of services and products, through the telephone via call centres, the internet and mobile devices.

Even if the development of digital services enables a cutback of physical branches, increasingly digital banking products require the hiring of new specialised and highly-skilled profiles, such as data analysts, compliance officers and IT specialists, for example in the field of cybersecurity, as digital products require high security standards. One of the consequences of the customer usage of digital products has been that banks had to invest into the development of digital products, while facing the competition from new firms (e.g. Amazon) that also offer traditional banking services. A representative from the employers' organisation highlights the challenges related to the increased use of digital tools:

'It is a demand from consumers, from clients. We must develop online digital applications that are not charged and reimbursed. These are costs for the banking sector, which has to face competitors in the market.' (Interview 2).

Another consequence of increasing digitalisation is the outsourcing of activities such as back-office or IT services. Kirov and Thill (2018) identify three interrelated types of outsourcing in the banking sector in Luxembourg. The first type of outsourcing is offshoring, with activities

(mostly basic IT services) being relocated to countries with lower labour costs, mainly to Asia (India) or Central and Eastern European countries (Poland). The second type of outsourcing concerns the transfer of activities towards service providers located within Luxembourg. These regulated service providers of the financial sector are qualified as PSF (*Professionnels du secteur financier*). The third type of outsourcing concerns the relocation of jobs within the same international banking groups allowing an internal pooling of certain activities, but in other countries. The outsourcing of activities has been facilitated by the introduction of the automatic exchange of information on savings income in 2015, which put an end to the strict banking secrecy. A new law voted in 2018 facilitated the circulation of information on bank clients within international banking groups provided that the client has agreed to the sharing of information. As a result of this change in legislation, a number of activities can be centralised on international IT-platforms within banks, which allows to cut costs in Luxembourg. All three types of outsourcing can be identified as a way of cutting costs by transferring activities to service providers within or outside the company and the country. For collective bargaining, outsourcing strategies to external providers remain challenging, as trade unions are hardly present among service providers where wages are often lower.²⁵ Banks must finally ensure that outsourced products fulfil quality standards, which has also led to new processes of ‘insourcing’ (Kirov & Thill, 2018).

Demographic change

The economic and financial crisis in 2008 led to an ambiguous development of Luxembourg’s labour market. Although overall employment in Luxembourg increased during and after the crisis, employment in the banking sector has slightly decreased since 2009, after a peak of employment in 2008 (27,208 employees).²⁶ This was related to the fact that many banks in Luxembourg reconsidered their business model and operations. Since the crisis of 2008, the pressure for cost-cutting, in combination with technological change and new legislation (in particular the automatic exchange of information) have led to reorganisations and a demand for new skills.

²⁵ Bank employees who are transferred to service providers keep their employment conditions in accordance with the legislation on transfers of undertakings. In these cases, employment conditions might diverge between the transferred workers and the other workers of the company providing services. After a certain time, employment conditions often tend to be aligned downwards in these situations, according to a union representative (Interview 4).

²⁶ Available at: <https://lustat.statec.lu> (last accessed on 31 May 2022).

The banking sector generally depends on a highly-skilled and multilingual labour force. The employees of Luxembourg's financial sector have a generally high level of education, with 23.5% of employees with a secondary education degree, 34.3% with a bachelor's degree and 37.4% with a master's degree.²⁷ While anticipation of skills is still rarely conducted in the sector (Kirov & Thill, 2018), there are indications that the sector will continue to recruit high-level graduates.

Furthermore, the introduction of the automatic exchange of information has strengthened the need for more competent banking staff who are able to advise the newly targeted highly wealthy clients. Given the low number of Luxembourg nationals working in the financial sector, this has further reinforced the sector's dependence on international migration and on commuters from the cross-border regions neighbouring Luxembourg (Lorraine in France, Wallonia in Belgium, Rhineland-Palatinate and Saarland in Germany). The internationalisation of Luxembourg's labour market has accelerated with the development of cross-border work that set in during the second half of the 1980s. Since then, Luxembourg's dependence on cross-border and immigrant workers has steadily increased. In 2018 (latest data available), only 24,8% of jobs in finance were held by residents of Luxembourg nationality.

Banks further confront new challenges related to climate change and the transition towards a green economy. Both the Luxembourg Central Bank and the Luxembourg financial regulator, the *Commission de surveillance du secteur financier* (CSSF), have emphasised that the banking sector in Luxembourg is not yet ready to cope with these challenges. The CSSF highlighted '*transition risks*' and possible '*reputation and liability risks for the bank[s] as a result of scandals caused by the financing of environmentally controversial activities*' (CSSF, 2021). In order to address these risks, the regulatory authority asks banks to train their workforce in environmental risks and to counter '*knowledge gaps*'. This will probably make it necessary for banks to recruit new profiles of specialists with the required skills. The Luxembourg Central Bank asserts in a 2021 report that the financial centre could be '*significantly impacted*' by its exposure to carbon intensive investments and that transition strategies are '*still relatively timid or non-existent*' (Banque Centrale du Luxembourg, 2021).

²⁷ Data from the 2018 survey 'Enquête sur la structure des salaires' based on NACE code 64: Financial services, except the insurance sector.

Interrelated changes

Changes affecting Luxembourg's financial centre have been interrelated. While global developments such as the repercussions of the economic and financial crisis of 2008 have led to tighter regulatory frameworks and increased costs, technological innovations enabled the automation of numerous activities, and new legislation has made it legally possible to outsource a number of activities. These trends have led to a restructuring within many banks, with changed skills expectations and an impact on employment. These changes also have repercussions on job quality and inequalities.

3.1.4. Impacts

Skills

The changes related to globalisation, technological innovation and demography have led to a reconfiguration of professions and skills in the banking sector. The demand for some skills and competences has disappeared, while other profiles are in strong demand, such as skills related to compliance, risk management and IT security, according to interviewees.

The changes in the sought-after profiles are related to the developments in the banking sector's activities. After the introduction of the automatic exchange of information led to the loss of numerous customers from the neighbouring countries, Luxembourg banks have increasingly tried to address the narrow layer of ultra-rich individuals and families, often located outside of the EU, in China, Russia and the Gulf States. This requires client advisors to be more highly-skilled, but it simultaneously calls on banks to ramp up their capacities in the field of compliance and risk management to detect money-laundering schemes. The director of the Luxembourg financial regulator CSSF warned banks in a press interview in 2016:

*'Before [the introduction of the automatic exchange of information], the typical customer had less than a million euros in assets, today banks are interested in very wealthy customers, those who have 10 or 100 million euros, or even more, but all that involves challenges in getting to know the customer and the transactions. And this is where we, regulators, will be very vigilant to check that the bank which goes to regions and countries that it knows less well than the neighbouring countries and in which it is often more complicated to obtain objective information, does not venture into money laundering or corruption risks.'*²⁸

The reconfiguration of professions and skills is reflected by a revised list of 'functions' established by the employer organisation ABBL and trade unions during the negotiation of the

²⁸ *Luxemburger Wort*, 11 June 2016.

2018 collective labour agreement in banking. The focus on a new and updated list of relevant professions in banking reflects the use of new technologies that also affects peripheral and routine tasks, although it remains unclear what impact this update of professions has on employee welfare and working conditions. A trade union official explains:

'In 2018, we established a completely new classification of functions, with 50 typical functions listed. The employers wanted a completely new classification because they considered that the old functions did not correspond anymore to the reality. [...] Now we have 50 generic functions with a classification linked to them [...] What used to be routine activities with a certain cognitive dimension, these are frequently suppressed now.' (Interview 4).

The restructuring of the internal organisation of banks raises the issue of skills mismatches. Luxembourg's banking sector continues to have a strong demand for higher skilled jobs that are not always found in the resident and cross-border labour market. According to a 2021 study by Luxembourg's public employment service ADEM (ADEM, 2021), the most sought-after professions in the financial sector are the following:

- fund manager (gestionnaire de fonds);
- client advisor (chargé de clientèle);
- middle-office agent (agent middle office);
- know your customer analyst;
- IT specialists and IT security specialists;
- compliance and economists.

According to the same ADEM study, jobs less in demand are related to local branches (which are being closed in many instances) and to back-office operations (which are frequently outsourced):

- receptionist (chargé d'accueil en banque);
- counter staff (guichetier);
- back office employees;
- secretaries;

In these more traditional jobs, the risk of digitalisation and automatisisation is considered to be high by the ADEM. ADEM considers employees currently working in these jobs as potential candidates for upskilling or reskilling schemes with the objective to be mobile within the bank

and to avoid lay-offs. Yet, an analysis of the jobs registered by employers at ADEM shows that many open positions are still in finance companies.²⁹

Nonetheless, the internal up- and re-skilling of bank employees raises the question of training costs and wage issues for banks, according to a trade union representative:

'Who has the time in a bank to retrain a 50-year-old employee, when you can recruit a 25-year-old one to do the job? The 25-year-old might also need training but he will be cheaper and maybe he will work quicker. And then I ask myself to what degree does human value still exist?' (Interview 4).

Regarding recruitment, banks in Luxembourg also perceive increased competition from 'Fintech' companies. 'Fintechs' are identified as competitors, among other reasons because they attract highly skilled individuals in search of innovative and flexible workplaces who are willing to accept a degree of job insecurity (cf. Interview 2). However, according to the representative of the employer organisation ABBL, the classical image of banks as bureaucratic and hierarchical entities is no longer valid:

'Today there are dynamic teams that work with different competences on specific projects with objectives.' (Interview 2).

Public policies have also addressed the need for up- and re-skilling processes. A recent example has been the pilot project 'New Skills Bridge' coordinated by the Ministry of the Economy,³⁰ in which employees are upskilled towards a digital profession within the company to keep them in employment.

Another example of a public-private response to the numerous restructuring cases following the crisis of 2008 has been the initiative 'Fit for Financial Markets' for people who lose their jobs in finance or are registered at ADEM. This initiative was led by ADEM, the Ministry of Work, Employment and Social and Solidarity Economy and the House of Training, in collaboration with the ABBL. After a diagnosis of existing skills and possible refresher trainings, job seekers can be certified 'Fit for Financial Markets' and register on an interactive ADEM platform used by employers in the financial sector. The success of the measure is difficult to evaluate as data has not been disclosed. According to the latest data available, 202 participants took part in 2017 in the 'Fit for Financial Markets' initiative, but it is not disclosed if and how the participants are

²⁹ The desk research for this analysis covers the 2021-2022 period and focuses on ADEM data (cf. available at: <https://adem.public.lu/fr/publications.html>, last accessed on 14 June 2022).

³⁰ Available at: <https://digital-luxembourg.public.lu/initiatives/luxembourg-digital-skills-bridge> (last accessed on 14 June 2022).

integrated back into employment (Ministry of Work, Employment and Social and Solidarity Economy, 2017).

The importance of investing into training schemes has also been acknowledged by the employer organisation and the trade unions who established the 2018 collective labour agreement that banks must spend at least 1% of their wage payroll to employee training schemes. In a 2022 study on company training and related costs, the national training observatory of the *Institut National pour le Développement de la Formation Professionnelle* (INFPC) underlines that employers in the finance sector benefit from an average public aid of 265 euros per employee, which is the highest amount, compared to other economic sectors (Observatoire de la formation, 2022).

However, the focus on increased training among employees does not occur without problems depending on the banks, according to a union official:

'In companies where there is a real social dialogue, where there are strong staff delegations and where you have real codetermination, the training of employees works well. [...] But there are other banks who do not invest in their people or anticipate, maybe because they do not get the necessary funding from headquarters. And they run head first into the wall. [...] What we often hear is that people do not get the necessary time to do the trainings, or that they are told that they are supposed to follow online trainings after six o'clock, in the evening.' (Interview 4).

Employment

Despite a steady decrease in the number of banks over the last years and restructuring processes within banks, overall employment has remained relatively stable and recruitments still take place (see Figure 6).

Figure 6. Annual development in banking employment



Source: CSSF (2021).

The loss of revenue and higher costs associated with increased regulation leads banks to centralise their activities and in some cases have led to the closure of banks. The pressure related to costs can also provoke the outsourcing of lower-skilled back-office activities and IT services. Outsourcing schemes are further facilitated by the introduction of the automatic exchange of information which has reduced the need to keep all information in Luxembourg (bank secrecy), the convergence of standards and the use of English as a predominant language in banking. All of this enables specialised service providers and consolidated functions within international companies to achieve significant economies of scale. Some of the outsourced activities go abroad, while others are handled by service providers in Luxembourg with a communicating vessel effect between jobs destroyed in the banking sector and jobs created in the sub-sector of regulated service providers (designated as PSFs), which are mostly not covered by a collective labour market agreement and where wages are lower.

The outsourcing of jobs to service providers located within the country and the offshoring of jobs to other countries with lower wages can lead to a loss of quality of services and in some instances to communication difficulties related to different time zones and intercultural differences, according to a trade union interviewee (*cf.* Interview 5).

In order to cushion the impact of digital and cost-cutting strategies, law-based instruments (with government intervention) are still at play to avoid larger lay-offs in the sector. Yet there is a tangible difference in collective employer-employee relations between continental European banks (from Luxembourg, Germany, France, Belgium, Austria) and banks from the UK, US, China and Japan, according to trade union officials (*cf.* Interviews 1 and 2). This appears to be linked to national patterns and/or cultures of social dialogue and modes of interaction between companies and worker representatives ('home country effects' in multinationals). The variety of employment relations in banks is also related to the nature of their activity (retail banking, private banking, investment funds) and the presence of the state in the capital of the bank.

A trade union official points out that a number of banks do not yet make full use of the possibilities of digitalisation and cost-cutting out of concern over the implications of mass layoffs:

'My personal opinion is that digitalisation is only at the beginning in Luxembourg. There are a number of things being done here and there, but I do not really see the digitalisation in many banks. I remember a discussion with Delta [former Luxembourg Minister of finance] a couple of years ago where we talked about robot advisors. [...] At the time, I said that there would be a tsunami. But until now, this has not happened, there have only been small waves.'

There are still banks I know where overstaffing is of public knowledge. Often banks hesitate to carry out a redundancy plan, although there are functions that could very well be digitized. It is difficult for a company to carry out a social plan, it is bad for the image and brings lots of difficulties.’ (Interview 5).

There are four large banks in Luxembourg with local branches and a state presence in their capital: *Banque et caisse d’épargne de l’État*, *Post Luxembourg*, *Banque internationale de Luxembourg* and *BGL BNP Paribas*. Such banks, that also have local personalities as part of their board of directors, appear cautious to maintain a positive public image, according to the same union representative:

‘Banks that have a local anchoring in Luxembourg are more paternalist. [...] They do not want to give a bad image of themselves. [...] If you have influential Luxembourgers in the board of administrators, they are not eager to see social plans.’ (Ibid.).

The current governor of Luxembourg’s central bank and former director general at the Ministry of finance as well as president of the board of BGL BNP Paribas declared in an interview that it was useful to have the state participate in the capital of banks so as *‘to preserve employment and maintain a Luxembourgish dimension’*.³¹

Job quality

Bank employees have seen their status and job characteristics change over the last decades (Jefferys, 2010). What Jefferys observed for the UK banking system in 2010 can be expected to be true for Luxembourg as well: while working at a bank was considered in the past a stable ‘job for life’ with professional advancement and security, professional identities in the financial sector have changed in line with the redefinition of work profiles and activities, and with evolving professional skill requirements.

Overall, jobs in the financial sector (excluding insurance) are still more stable on average than in other economic sectors in Luxembourg. 96.2% of employees in the financial sector have a permanent contract (*Contrat à durée indéterminée*), which is slightly more than the overall average. 81.3% of employees work full-time, whereas 18.7% work in part-time schemes. Wages are relatively high in the sector: in 2018, the average gross annual salary (including bonuses) for full-time employees in the financial sector was 101,475 euros and the median salary 83,366 euros.³² These are of course higher wages than the ones paid in the neighbouring

³¹ Extract of an interview with Gaston Reinesch in the film documentary *Crise et Chuchotements*, Luxembourg, 2022.

³² Data from the 2018 survey *‘Enquête sur la structure des salaires’* based on NACE Code 64: Financial services, except insurance sector.

countries. However, once adjusted to purchasing power and considering housing prices in Luxembourg, the difference is less significant.

In cooperation with the University of Luxembourg, the Chamber of Employees conducts an annual survey among a sample of employees in Luxembourg on their working conditions and well-being. The resulting index (synthesising 22 indicators covering resources, work incentives and workload) shows that every year, employees in the financial sector have rated their overall working conditions slightly higher than the average of employees across all sectors. Nonetheless, the index underlines that bank employees tend to self-declare burn outs and conflicts between professional and family life slightly more often than the average.

Job quality has also been impacted by the restrictions related to the COVID-19 pandemic. Compared to other activity sectors, the banking sector has been less affected by the economic repercussions of the COVID-19 crisis, given that telework and hybrid working schemes have allowed a continuity of business operations. The impact of telework has however been mixed: on the one hand, teleworking schemes in banks enabled employees to commute less (traffic congestion being a big issue in Luxembourg) and better combine work and personal life. Employers' organisations view teleworking schemes as a positive opportunity in the post-COVID-19 era (ABBL, 2020).

Although employers and trade unions quickly reached an agreement on telework during the COVID-19 pandemic and the CSSF provided guidelines on how to implement teleworking schemes under the specific circumstances of the financial sector (CSSF, 2022), teleworking schemes can entail occupational risks with an adverse impact on employee welfare, such as higher work pressure, longer working hours, unclear work organisation and risks of isolation (Moulac, Pavlou & Vona, 2022). Under the conditions of COVID-19, some workers sought to physically return to work while others wanted to postpone this move depending on their degree of health vulnerability, age, economic situation, nature of work, commuting distance and degree of isolation (Thomas, Dörflinger, Yon & Pletschette, 2022). A trade union official underlined the risks of telework:

'Burnout is higher than ever. Sometimes we have people in telework who call us crying. They say they work 10 hours a day, but the system only allows them to register 8 hours per day. [...] Most employers do not want to take overtime into consideration when employees are teleworking.' (Interview 4).

Inequality

Inequalities in the banking sector should in theory be limited due to the existence of a collective labour agreement that sets common standards for wages and working conditions. Nonetheless, there are indications that the collective agreement in banking is caught in a process of gradual hollowing out. For instance, the multi-annual collective agreements concluded in 2014 and 2018 did not contain any linear pay increases. However, it is to be noted that wages in Luxembourg are automatically adjusted to consumer price increases through the wage indexation mechanism. Only the collective agreement negotiated in June 2021 contained general linear increases of 0.7% in 2022 and of 0.5% in 2023. Furthermore, the number of bank employees who are considered to be senior executives (*cadres supérieurs*) - and thus not covered by the collective agreement - has increased. Trade unions in banking have claimed that approximately one-third of all bank employees are wrongly categorised as senior executives.³³ This classification means that employees are often not entitled to paid overtime. Trade unions have identified the issue and communicated proactively about it, but it remains unclear whether they have managed to change the situation.

In the case of outsourcing of bank employees to other companies, employees who get transferred to these companies see their working environment change. Once again, this dynamic has been cushioned and depends on the banks. According to a trade union official, banks may transfer employees to an external service provider, while giving them the option to come back (*cf.* Interview 1).

In response to the pressure emanating from new regulations, some activities within banks, such as compliance and control functions, are strengthened, entailing a redistribution of status positions. Cost-cutting strategies and digitalisation also have a negative impact on less-qualified workers. Whereas banks in Luxembourg offered once the prospect of upward social mobility for workers without a university degree, this is much less the case nowadays. In addition, the decrease in the number of low-qualified employees in banks requires trade unions to put more efforts into unionising the more highly qualified workforce who in general is less unionised in Luxembourg (STATEC, 2022).

³³ 'Les banques de la Place compteraient 7.385 faux cadres', *Paperjam*, 17 December 2018. Available at: <https://paperjam.lu/article/news-les-banques-de-la-place-compteraient-7385-faux-cadres> (Last accessed: 9 June 2022).

3.1.5. Conclusions

While global developments such as the repercussions of the economic and financial crisis of 2008 led to tightened regulatory frameworks and increased costs, technological innovations and new legislation (in particular related to the automatic exchange of information) enabled banks to automate a number of activities and engage in the offshoring and outsourcing of activities.

These trends have led to restructuring processes within many banks in Luxembourg, with changed skills expectations and an impact on employment. These developments have also had repercussions on job quality and inequalities. The impact of these changes has however been mediated until now by the institutional configuration of Luxembourg's political economy and employment relations system. Like other small countries in Western Europe (Katzenstein, 1985), Luxembourg has been permeated by an ideology of social partnership, which has given industrial relations an orientation towards consensus.³⁴

The prevalence in many instances of a social partnership approach, the still dominant role of the government in facilitating reskilling schemes, and the availability of public funding have mitigated the impact of the transformations on employees. Training schemes are identified as a key instrument to keep workers in employment in the sector and to address skills mismatches to some extent. However, the loss of autonomy of many banks in Luxembourg, the decrease in profitability of a number of banks, the costs of the mobilised active labour market policies and the overall weakening of trade unions' presence raise questions as to the long-term sustainability of the social partnership approach (Thomas *et al.*, 2019).

3.2. Slow-moving changes and continuous downsizing: The banking sector in Austria by Ursula Holtgrewe, Martina Lindorfer, and Nela Šalamon

3.2.1. Introduction

The Austrian banking sector was selected as a case study of the intersections of globalisation, digitalisation and demographic change since firstly, it is known for its rapid expansion to Eastern Europe after 1995, and secondly, a previous comparative study on the impacts of digitalisation on the social partnership in banking was conducted in collaboration with LISER and other partners in 2015 (Kirov & Thill, 2015). Hence, a follow-up seemed interesting. The

³⁴ The Luxembourg banking sector has so far only known one industry-wide strike (July 1991).

sector, as banking generally, has been digitising and restructuring for decades, and job losses and changes in job quality have also been investigated for just as long, also comparatively (Kornelakis, Kirov & Thill, 2022; Regini, Kitay & Baethge, 1999). In many countries, coordinated market economies specifically, the sector is one of the more organised service sectors with strong social partnership and traditionally favourable working conditions, in spite of large income inequalities. Hence, it is similar to the Luxembourg case, although some differences can be found.

Compared with the 2015 findings, and with the rhetoric on disruption, big data and artificial intelligence, banking appears to be a slow-moving sector. In Austria, it has been recovering from the 2008 crisis, built up its equity capital upon new regulations, internationalising further until 2022, continuously introducing new technologies in customer service and back-offices and mostly closing retail branches. However, as it shrunk its employment, it is being increasingly affected by staff shortages in recent years, and some interviewees see a real change in direction from downsizing to focusing on staff retention and attracting highly-skilled young(ish) experts.

However, there is not much institutionalised sector-level anticipation of impacts of digitalisation, globalisation or demographic change in Austria. Financial services as a large knowledge-intensive sector figure in cross-industry trend analyses (Eichmann *et al.*, 2014; Eichmann, Schönauer, Schörpf & Jatic, 2019), and consultancies also contribute reports, surveys and blog posts (KPMG Advisory, 2018).³⁵ In addition, the Financial Market Supervision Authority assesses trends and risks through surveys and dialogues with their constituency (FMA, 2019; 2020) and the Austrian National Bank (ÖNB, 2021) also monitors the sector.

The sector at large

Into the 2000s, Austrian banks were somewhat hesitant in changing their structures. Traditionally they used to be publicly owned and had only been privatised in the 1980s-1990s (while retaining close connections to the state, the political sphere and political parties). The country was regarded as ‘overbanked and overbranched’, and the sector was notably less profitable than in other countries. Banks improved their profitability by expanding in Central, Eastern and South-Eastern Europe (CESEE) after 1989. Whereas in 2020, the sector nearly

³⁵ This report was commissioned by the Austrian Chamber of Labour under its ‘Digifonds’ programme.

halved its net income due to increased risk cost, in 2021 the sector's net income bounced back to an estimated 6.5 billion euros.³⁶

Concentration in the banking sector has been ongoing. In 2015 there were 738 independent credit institutions, which at the end of 2020 was reduced to 543. The top-10 largest banks accounted for 52.9% of the overall sectors' total assets of 974 billion euros in 2021 (Wieser, 2022). The largest, Uni Credit Bank Austria AG, has a market share of 12.2%. Three out of the ten belong to the Raiffeisen 'sector' and account for 15.9% of the sector's total assets alone. Raiffeisen was originally a network of rural co-operative banks but has internationalised considerably and still maintains close ties to the political sphere.

Within Austria, most banks continuously and incrementally closed branch offices. From 2011 to 2018, almost 1,000 branches were closed, which amounted to one in five. One bank branch office in 2020 served 2,833 inhabitants, a continuous decline that brought Austrian banks closer to the European mid-range (ÖNB, 2021). Reduction of branch offices is more virulent in rural areas. Unfortunately for customers, in some regions this coincides with poor internet connectivity (Eichmann *et al.*, 2019).

Employment structure and social partnership

Employment in the banking sector at large has been slowly decreasing since 2008 when 80,293 people were employed in banks. Behind this is ongoing restructuring and downsizing but also a gradual recomposition of the workforce. At the end of 2020 this was reduced to 71,896 workers, that is, 60,009 full-time equivalents. 54.4% of employees are women, 45.6% are men. Co-operative banks and mortgage banks had the largest losses of employment from 2019 to 2022, whereas the Raiffeisen sector gained some employees. Part-time work has been increasing in the banking sector: In 2002, only 15.3% of employees worked part-time, whereas in 2020 there were 31.3% part-timers, of which, as elsewhere in Austria, 83.7% are women. Indeed, between 2011 and 2017 graduates were the only group of employees that expanded in the banking sector. Overall, the sector is more highly skilled than the general economy: in 2017, 64.5% of employees had a 'Matura', 24.2% a university degree. Apprenticeships play a smaller role than in the economy at large (Haberfellner & Sturm, 2020).

Social partnership in the Austrian banking sector is clearly that of a coordinated market economy. The banking sector is organised by GPA-djp, the white-collar union, with a density of

³⁶ <https://de.statista.com/statistik/daten/studie/869041/umfrage/erwarteter-gewinn-bzw-verlust-der-banken-in-oesterreich/>

an estimated 33% (WC1). Employers are organised in five sub-sectoral associations (one each for the Raiffeisen sector, joint-stock banks, saving banks, mortgage banks and co-operative banks) who - through their representation in the Chamber of the Economy - negotiate separate but coordinated collective agreements on the sub-sectoral level. Most banks have works councils, and there are company-level agreements on various subjects such as further training, digitalisation, working from home, etc. as well.

While all interviewees voice their commitment to the social partnership and especially the sector's joint efforts to manage downsizing responsibly, collective bargaining on wages has been getting harder in recent years. The union side observed in 2022 that management were reluctant to increase wages in proportion to the inflation rate and chose not to consider the common staff shortages and the competition with other sectors especially in the IT field. In autumn 2022, employers suggested one-off payments to compensate inflation which unions generally think unacceptable.

However, mobilisation in this traditionally privileged white-collar sector is not easy, and day-to-day social partnership on the company level has become difficult. Works councillors and unionists observe a certain detachment of management.

'Many [managers] hide behind online, but really that started before [COVID-19]. The direct contacts, directors that talk to their staff directly, there's something wrong. It's possibly this new world of management that says, they [workers] have to function, I'm giving the assignments and that's it. [...] And where we have foreign owners, it is a bit worse, because they don't bother with the Austrian culture at all.' (Union).

The union has explored possibilities of sector-wide initiatives on the sector's image and on integrating further training into a collective agreement – traditional areas of consensus-building in social partnership. However, the employer side had difficulty coming on board since further training was part of company-level agreements already. Both companies and subsector representatives in that situation were worried over losing a competitive advantage.

Markets and business models

Similar to Germany (Tullius, 2021), banks in Austria appear to slowly change rather than disrupt their business models. Some years ago, based on a survey of bank CEOs, consultancy KPMG envisioned several possible business models in between 'platform banks' along the lines of Google or Amazon, banks as trusted guardians of personal data, or as customer-oriented 'ecosystems' that control the customer interface and offer comprehensive financial services (KPMG Advisory, 2018). In our research, sector representatives and the unionists also refer to

the 'trust' model to emphasise banks' responsibility and traditional social capital as a basis on which to extend services, retain and upskill jobs and the function of banks at large.

Meanwhile, for our interviewees the variety of business models described by KPMG comes down to a polarisation between standardised self-service and 'boutique' banking business models.

'There's banks that simply say, we have a very good scalable business model where you only have standardised products. Then you can quite easily put that on a platform and the customer can choose these standardised products if they fit them. Then I don't need a branch, I don't need customer contact. But if I need more, if I want a boutique, then I'll need the branch office. [...] Both models work and both models make sense.' (BA, 14).

Yet the bank of works councillor 1 (WC1) is a regional bank that has been expanding from its original region into Austria, Germany, and the Czech Republic, and still opens new branch offices. This requires continuous skill upgrading in sales and customer advice. In contrast, WC2 - based on the downsizing history of his company - sees the future in automation and customer self-service:

'I'm seeing the future in finance much like it is now, that increasingly the customer has to do everything for themselves and will do everything for themselves, and only real class-A customers will be serviced accordingly.' (WC2).

Emerging competitors: fintechs and Big Tech

In Austria, banks appear to be less concerned about new fintech companies as competitors and disruptors than about the Big 5 tech companies and other digital-based challengers such as online bank N26 or non-banks that offer payment services. Start-up fintechs are viewed as potential collaborators and innovators, also, possibly, against the expected Big Tech disruptors (FMA, 2019, *cf.* Tullius, 2021).

Both social partners share a concern over a level playing field for both incumbents and challengers. Banking is tightly regulated and monitored, but regulators may find the regulation of new actors more difficult, and also aim to encourage innovation and experimentation through 'sandboxes' (FMA, 2019). However, the regulation of actual banking still appears to be a barrier to non-bank disruptors. This is one of the reasons why for now, Big Tech companies cooperate with existing payment processors. Vice versa, some banks integrate mobile Apple or Google Pay services into their own mobile services.

Regulation

Since 2008 tighter regulation on both the national and European level has contributed to a certain stabilisation of the financial market. The build-up of equity capital after the financial crisis of 2008/2009 has improved banks' resilience during COVID-19, although the long-term impact of the COVID-19 pandemic on the business climate is yet to be seen.

A regulatory problem in some tension with banks' data protection and privacy is seen with the European Payment Services Directive 2 (PSD2XS2A).³⁷ It requires banks that offer payment accounts to offer access to regulated third party providers via regulated and standardised interfaces (Jansen, 2020). This has opened up spaces for a range of fintech and in particular, payment service providers that 'repackage' functions of payment processing, consumer credit etc. with a focus on ease of use and customer experience. Interviewee CE from the Chamber of the Economy sees a regulatory imbalance here that favours large tech and data companies and allows them to cherry-pick scalable low-cost services that provide further opportunities for data exploitation:

'If these big players that offer financial services and data services use AI and keep everything on all of us in some cloud or other, that needs to work both ways. Because, why can these guys offer so much [service] cheaply or for free? Because they don't make their living from our payments for what they do, they make their living from our data. For that, we need a very strict data protection in Europe, and that needs to apply for everyone.' (CE).

For CE the big current challenges of the banking sector are digitalisation, sustainability (known as ESG in the sector; that is, environmental, social and governance), and personnel.

Sustainability is considered a current priority topic in the banking sector, also containing great opportunities as banks mobilise capital for financing the Green transition. Calculating climate risks has become an important part of risk management, both with regard to direct climate risks to investments and risks of climate policies that may strand investments into technologies that are no longer deemed sustainable. Indeed, the recent European 'taxonomy' for investments aims to leverage banks to direct investments towards sustainability. This also means for customer advisory services that the sustainability preferences of clients have to be discussed - a further need for training.

³⁷ https://ec.europa.eu/info/law/payment-services-psd-2-directive-eu-2015-2366_en

The UNTANGLED triangle and its impacts on Austrian banking

For banks, globalisation - or more aptly, transnationalisation - and digitalisation have taken the shape of ongoing restructuring of companies and value chains. As the sector is strongly regulated on both the national and European level, these patterns have taken specific shapes, in particular, the expansion of Austrian banks to CESEE countries. Intersections of automation (plus customer self-service), outsourcing and offshoring, and internationalisation and cost-saving strategies of banks as well as changes in customer demand have led to declining employment in the sector. All these changes are rather more slow-moving and incremental than the more visionary literature would suggest.

At present we are seeing some changes in these developments: Expansion to CESEE has been profitable for long but in 2023 appears riskier. Some offshored services such as generic call and contact centres are insourced to banks again on a different level of automation. Job losses are continuing slowly whereas staff shortages are not just restricted to ICT and highly-skilled specialists. Banks are confronted with new demands of younger cohorts of potential employees. In a sector digitalising incrementally for a long time, 'new new technologies' (Holtgrewe, 2014) such as AI are being used in an incremental way as well, and their value added may be harder to assess as low-hanging fruits of automation may have been reaped already. All of this may both drive the further automation and transnationalisation and require improvements in job quality in terms of more worker-oriented flexibility in time and space, auspicious perspectives, and possibly, generally shorter working weeks.

The key impact of this interplay is a comprehensive decline in employment in the sector combined with skill and staff shortages. In particular, branch offices have been closed and back-office functions automated whereas specialist functions in ICT, risk assessment and regulatory matters are expanding, and experts and graduates much sought after. Job losses have generally been addressed in 'socially sustainable' ways through the social partnership: through subsidised working time reductions, early retirement arrangements, higher severance pay etc. In 2018 the sector set up a 'Work Foundation' that offers funded retraining and outplacement opportunities. This has been extended in 2022. However, sector-wide initiatives on training or further training have so far been unsuccessful although collective agreements exist on the company level. Here, competition for workers apparently gets in the way of common interest.

In the view of the employer side, job losses have lost momentum and companies' focus is increasingly on retention and further training of workers. This is already opening some

opportunities for newer groups of workers: some banks hire and train people with experience in customer service and sales and train them in bank-specific knowledge and skills.

Skill upgrading is combined with losses in job quality: Work is intensified and monitoring increased, especially with regard to sales targets. With staffing shortages and increasing pressure, time and space for informal learning and quality assurance are lost, and industrial relations have become less co-operative in the view of employee representatives.

3.2.2. Methodology

This case study is based on a literature review of existing research and also various recent institutional reports by the Financial Market Supervisor, the Austrian National Bank, social partners and some consultancies. Interviewees were identified as representatives of social partner organisations, two from the employee side (Chamber of Labour and white-collar trade union GPA-djp, interviewees CL and Union) and two from the employer side (Chamber of the Economy representing the banking sector at large, and the Banking Association, interviewees CE and BA). Two experienced works councillors (one chair and one deputy chair of the works council) from a regionally based expanding retail bank (WC1) and a national, US-owned bank with a history of considerable downsizing (WC2) were also interviewed. One interviewee was female, the remainder were men. The reporting guideline of the UNTANGLED case studies was adapted to an interview guideline for the sector and translated. Interviews were conducted partly remotely, partly in person, taped and transcribed, and then coded and analysed using MaxQDA software.

3.2.3. Case study findings

Globalisation

As the banking sector is mostly nationally embedded and regulated, globalisation is not a handy term. For the Austrian case, internationalisation occurs in terms of ownership, expansion of activities into CESEE countries, and transnational restructuring. International ownership of banks and ongoing acquisitions render social partnership less stable:

'If an Italian owner knows conditions from Italy, then there's trouble. He says, why do you have a collective agreement, company-level agreements, why do these benefits exist, then everything is questioned. Or banks with an American owner that only acquire, sell off, acquire, sell off, that means, there is always some unrest. For works councillors work gets more demanding if there is no continuity' (Union).

Austrian banks in CESEE still have the highest market share of all foreign banks with 23% of the market share in the region. In 2021 risks were – correctly - considered higher than in Austria, and in 2020 profits and profitability decreased especially in the Czech Republic and Slovakia, although the margins were still above those in Austria (ÖNB, 2021). In 2021 profitability of CEE engagements bounced back to the pre-COVID-19-level with expected returns on equity around 15%. Within the EU, engagements in Hungary, the Czech Republic and Slovakia were increasingly attractive, and COVID-19-related credit risks were considered manageable (*cf.* Wieser, 2022). The Russian and Ukrainian markets were regarded as the most lucrative in 2021, but apparently were considered risky even before the war started in 2022: engagements in Russia had shrunk to 9% of all Western bank engagements in wider CEE.³⁸ In Austria, Raiffeisen Bank International, one of the largest players in Russia, has been considering an exit from Russia since spring 2022 and a year later is still exploring ways to split off or sell its Russian activities.³⁹ However, the group doubled their profit during the first three quarters of 2022 to 2.8 billion euros of which half was achieved in Russia.⁴⁰ Due to Western sanctions, this profit cannot be transferred out of Russia, and the bank has stopped any new business in the country. From the 1990s onwards, outsourcing and offshoring played a part in the Austrian banking sector. First IT and ancillary services such as cleaning, catering or facility management were outsourced, then customer service towards the end of the 1990s, then back-office functions such as bond and credit processing, payment transactions, account management, or risk management. Expansion to CESEE also led to some shifts of generic business functions in customer service, back-office and administrative work across borders. According to a survey of works councillors conducted by the trade union GPA-djp in 2014, at that time 56% of outsourced services were contracted out to external providers, the rest taken over by various types of subsidiaries (Hermann, 2015). 52.9% of services had been moved abroad. Especially Poland, Romania and the Czech Republic became not just markets but also offshoring destinations for Austrian banks. However, regulation requires that a bank's core functions remain under the control of the bank and thus cannot be outsourced.

³⁸ <https://www.rbinternational.com/de/media/2021/raiffeisen-research-cee-banking-sector-report-2021-de.html>, visited Feb 11, 2022.

³⁹ <https://www.derstandard.at/story/2000134181715/rbi-prueft-fuer-russland-alle-optionen-bis-hin-zum-ausstieg>, <https://www.derstandard.at/story/2000145052559/rbi-arbeitet-an-verkauf-oder-absplaltung-des-russland-geschaefts>

⁴⁰ <https://www.derstandard.at/story/2000140496083/raiffeisen-bank-international-macht-in-russland-haelfte-ihrer-gewinne>

In recent years, there has been some back-and-forth of outsourcing and insourcing. Works councillor 2 describes the history of 'his' bank:

'Well, a few years ago we outsourced everything from call centres to credit processing. Call centres went to other companies in Austria, credit processing was in Romania before, then in Hungary, then in the Czech Republic, something like that, and finally we took everything back, established own subsidiaries and outsourced it to these subsidiaries, but in Austria. [...] The call centre then was entirely retained in the bank.' (WC2).

In the service functions, both automation and customer self-service have played a part in 're-shoring'. Otherwise, interviewees observed quality problems and banks' interest in control of data and processes increased. Works councillor 2 also sees a managerial interest in ongoing restructuring and revising previous decisions for its own sake, for managers to show activity and make it harder to evaluate actions:

'That's this typical kind of management action, not to have to deliver figures that are comparable with the past.' (Ibid.).

Interviewees from the employer and worker side interpret the relevance of outsourcing and offshoring somewhat controversially. The representative of the Banking Association argues that it is overrated:

'In Europe, on paper we aim for a banking landscape across European borders, but in fact we do not even manage cross-border mergers. That means, we still have national-level banks [...] and outsourcing across borders has been tried but in fact doesn't work.' (BA).

The Chamber of Labour expert points out,

'It's a bit of a threat that may be kept up intentionally to have more power at the negotiating table. [...] On the other hand, proximity to the customer isn't irrelevant, even in the digital age.' (CL).

The union has occasionally made strategic use of the regulations of banks' responsibility for their core business:

'So, many areas have been outsourced to so-called near-bank services [banknahe Dienstleistungen], where other collective agreements apply. But that needs questioning and monitoring, we checked that partly together with the financial market supervisor: is this just simple advice or is it the classical banking customer advice which really gets down to things? In that case, it mustn't be outsourced because it's about risk and liability. And there we've seen examples where one bank really would have outsourced risk management. [...] So we said, we can't have that. The financial market supervisor must check that, also if entire business functions are moved across the border, that needs checking.' (Union).

The union has also tried to influence restructuring on the sectoral level. They suggested that banks establish joint service centres or credit processing centres in Austria and drafted a collective agreement for such ‘near-bank services’.

‘Personally, I thought that was a very smart idea, but then competitiveness within subsectors and among the banks made that quite impossible.’ (Union).

However, without much union initiative some smaller banks have established joint ventures to share IT services.

In the internationalised banks, remote and transnational collaboration has been common even before the COVID-19 pandemic. The further diffusion of working-from-home arrangements may drive further transnationalisation as banks find more services can be delivered remotely. Here, the employer side sees a need for changes in taxation to allow for cross-border ‘telecommuting’:

‘And of course, digitisation has to be feasible [...] if I have employees who sometimes work from Slovakia, 60 km from Vienna, and then it turns out, if they work from home in Bratislava for a few hours this means that fiscally a new permanent establishment is set up [...] and complex, cross-border tax measures are necessary [...] then that's already dead before it's born.’ (CE).

Technology use

Banks have of course been digitising their services and operations for decades. Indeed, online banking and customer advice by video have already been common in the mid-2010s. Back-office processes have been IT-supported across all periods of digitalisation. Interviewees agree with the literature (FMA, 2019; KPMG Advisory, 2018; Tullius, 2021) that technology in banks is developed in more of an incremental than disruptive way - for good reasons as banks by their function to channel money through the economy require stability. However, in 2019, only 15% of Austrian banks surveyed had a digital strategy - which in turn could be risky and underrate possible disruptions according to the national regulator (FMA, 2019).

‘[for IT services] the bank needs to spend a huge lot of money in all of administration, security, mapping of services just to deliver the services that customers expect. That means, if you have a bank nowadays that has been growing over decades [...], then their IT is very robust, very stable, very secure but also very cumbersome. Because these systems aren't rebuilt in a couple of days but they have grown over time. That is both an advantage and a disadvantage, robust and stable on the one hand, cumbersome on the other, in offering new services.’ (BA).

Representatives of employer associations often refer to customer needs in assessing future developments: in their view, customers decide whether to use services online or in branch offices, whether to use banks at all or other providers of similar services.

'If customers do not go to the bank in some parts of the city, and 60% of customers do their transactions online only, then – in the [district's high street] many shops closed down and the bank branches have closed down because nobody went there. That's a cascade.' (CE).

In contrast, the Financial Market Supervisor in its survey of Austrian banks finds that much technological change is driven by banks internally, in particular IT and sales (FMA, 2019).

Reacting to the sunk costs in large, cumbersome IT systems, banks increasingly use generic external ICT services (such as SAP). In banks' own IT development, as elsewhere, agile and DevOps methods are being used, but the FMA points out that this can be risky working with large old systems. Automation of routine and back-office work is ongoing, and further efficiency gains are expected. Machine learning is used to digitise paper documents and parse e-mail and other unstructured content, and in 2019 55% of banks aimed to increase the use of it in the two years ahead. 2/3 of Austrian banks expected to be using cloud technologies in 2021 (FMA, 2019).

Big data analytics are expected to be relevant by 80% of banks to support product development and sales – which of course are being digitally supported already. Here, 'make or buy' questions are considered, building company-specific tools or buying in platform and analytics services from other suppliers. There are external specialists that for example assess customers' credit risks from social network data (FMA, 2019). However, the processing of credit applications, with the exception of housing credits, is automated to a large extent already through standardised forms, steps and decision criteria (Eichmann *et al.*, 2019, p. 26). Hence, the added value of additional uses of big data analytics or AI may not be quite clear in a continuously digitising sector.

Unsurprisingly, Austrian banks and their representatives are also hesitant and sceptical in their approach to distributed ledger technologies. Possible uses are seen in efficiency improvements, acceleration of transactions, and avoiding mistakes. In 2018, there were no bank activities reported in that field (KPMG Advisory, 2018), in 2019, FMA reported three small pilots (FMA, 2019) but in its supervisory capacity did not recommend much acceleration. Unsurprisingly again, the consultancy KPMG recommended workshops and prototyping to push the technology in the sector in the name of innovation. One reason for banks to hesitate is that the technology

might weaken the overall position of banks with its promises to cut out the middle man (cf. Chapter 4.3) and enable digital intermediation without trusted intermediaries.⁴¹

The energy use of current blockchain applications is seen as a problem for larger-scale use by CL. WC2 does not see the value added for the customer:

'I'm lacking the imagination to see what good it would be for me as a customer. I wouldn't know how to use it, and if in the background my transfers happen via blockchain technology or not, I don't care as a customer. So it isn't really a thing for us. Here and there you hear something, someone looks at it, but it's not even partial projects.' (WC2).

Indeed, the bank of WC2 discourages its employees from buying or trading cryptocurrencies. The Chamber of the Economy representative points out the need for a level playing field in terms of regulations, which is seen as all the more relevant following the recent bankruptcies of Stablecoin and FTX.

Customers apparently require services that are simple and convenient to use, easily accessible and can be configured individually. In 2018, banking CEOs thus expected basic products and services to be mostly automated (which means, the remaining work transferred to customers) by 2030. They also assumed that staff and branch offices would decline further, that tech companies would provide many payment services, and that cash transactions would become rarer (Eichmann *et al.*, 2019; KPMG Advisory, 2018) – although Austrian and German customers are known to still prefer cash payments. Indeed, banking transactions are increasingly conducted over smartphones, and all banks offer and advertise their mobile apps. Customer expectations, in particular those of the younger generation, have been shaped by other services: 'invisible payments' are expected to work 'Uber-style', that is, integrated into platform-based services, and smartphones themselves are often paid for by somewhat invisible instalments through mobile providers' fees.

Customer advice and sales in retail banking have also been IT-supported for decades. For more complex questions, even before COVID-19 it was possible to include product experts via videoconferencing when advising customers. This would also allow transnational customer advice, but currently, transferring customer data abroad requires their consent. Increasingly, remote customer contact is automated too, when chatbots and speech recognition replace formerly outsourced call centres.

⁴¹ <https://www.derstandard.at/story/2000082602030/banker-treichl-politik-allein-wird-es-nicht-schaffen-fuer-sozialen>

Investments can also be managed automatically. After the customer fills in a form on targets, willingness to take risks, etc., an algorithm draws up a portfolio, monitors and adapts it. This is the easier as customers favour standardised investments such as Exchange-Traded-Funds (ETFs) (Brand Eins 6/2018, p. 69).

Our union interviewee points out inequalities that are obscured by the reference to customer demand: in rural areas, closures of banking branches contribute to poor accessibility of many services, and (not all) older people may have difficulties with self-service.

'For transfers, deposits and all that, customer contact has been broken off completely, banks don't want that. And if, I saw that lately, an old lady asks a question [in the branch], then they are quite displeased that she still can't do it by herself. That's really [...] a programme to drive away customers.' (Union 46).

She argues that, even apart from the social impact, banks giving up on customer contact may both lose business and render themselves more vulnerable to competitors outside the sector.

Demographic change

For the banking sector demographic change overlaps with restructuring and uneven changes in labour demand. In the 20th century, banks were known for very secure employment and very continuous careers. In Austria, this was incentivised by attractive collective agreements that provided, for example, extra holidays and top-ups of statutory pensions. Currently, labour demand is polarised, but staff shortages also emerge in customer service. Compliance, risk management, internal controls and modelling skills are in high demand as well as IT and cybersecurity skills. Increasingly, banks find themselves competing with the ICT sector proper for people with such skills.

The sector has been ageing in line with general demographic development and increasing skill needs: In 2011 24.8% of employees were aged 50+, in 2017 their share had increased to 32.5%. The younger cohorts all proportionally lost jobs with graduates facing the fewest losses.

'Slowly, in some segments, we [the bank] start to take on apprentices again, but in general, people used to start working earlier. Also, actual pension age is increasing as the legal pension age is simply driven up [for the birth cohorts after 1964], especially for women where it is being aligned with the pension age of men.' (WC1).

In both branch offices and headquarters, staff are becoming more internationally diverse. In branch offices, sales and advice functions, sometimes people with general sales and customer contact skills and qualifications are hired, and many younger employees have a migration background, although they may have attended school and vocational training in Austria. In

headquarters where more graduates and experts are hired, recruitment and trainee programmes are often international, and universities and business schools also have an international student body often from CESEE that may well stay in Vienna after graduation.

Interviewees - in line with general discussions in the business and popular press - note a cultural change among the younger age cohorts:

'What's massively changed that's something I call company loyalty. [...] Coming to stay, that doesn't happen, but simply, coming, maybe it fits into my CV to have that job for now. [...] In sales I notice the young ones aren't stress-resistant at all, as soon as the pressure increases they leave. [...] But then there's the other extreme group, young employees that really give it everything they've got 24/7 for their careers.' (WC2).

CE thinks this is a post-COVID mentality of younger people in knowledge-intensive jobs who have found working less and working from home quite satisfactory and can handle the income loss. CL points out that it may be a secondary effect of companies' own demands that have been changing:

'the younger, newer employees, companies want them to be more flexible and more agile. Then they need to be aware that they are less loyal to the company, that they are more flexible and agile in the labour market than your traditional bank employee. Then companies will be well advised to retain them through more opportunities for co-determination and participation and other things.' (CL).

Interrelated changes

In outsourcing and company restructuring, the trends of digitalisation and globalisation overlap - or vice versa, these trends centrally take the shape of restructuring of companies and value chains. Companies pick up on new business opportunities, technological options of relocating work, and new, often young(ish) and skilled workforces at lower cost. Hence, the impacts of outsourcing and offshoring as both company strategies and trends in their own right have been explored since the 2000s (Kirov & Thill, 2015).

Digitalisation enables more space-independent and remote work and new divisions of labour - but the sector remains nationally embedded and regulated. Both nationally and on the European and international level, this regulation also exerts pressures of its own on innovating products and processes, for example to assure compliance or detect money-laundering activities. Staff shortages may also drive further automation if the respective jobs can be automated. For a sector with long experience in digitalisation, this may not be trivial, and may even open up gaps of uncertainty: if routine functions are easy to automate, they will have been automated already. Even if boundaries of automation are shifting and for example, AI offers new

possibilities, these may not match the bundles of tasks that already-digitised routine bank jobs entail.

The changes also have varied regional impacts, and many of these are not certain yet. Skill upgrading and new functions tend to be located in headquarters rather than regions – but knowledge-intensive functions can also increasingly be performed through remote working. Bank branches as parts of regional infrastructures in small towns and villages are, however, automated or opening hours reduced. Even if customers partly appreciate online possibilities, with the downsizing of in-person services ageing populations in the country may feel increasing gaps in the web of everyday errands and personal interactions that contributes to rural quality of life.

3.2.4. Impacts

Skills

Skill changes are an outcome of some automation and restructuring, of increasing demand for new digital skills and complementary skills such as analytics. They also result from changing and more volatile environments (not least due to the climate crisis and ecological transition), requiring, for example more skills in risk assessment and modelling, and from changing regulation which requires more skilled staff in compliance and controlling. As the sector is shrinking, this amounts to more skill upgrading than polarisation. Yet careers and perspectives are likely to diverge between the newly needed and rare experts and the bank tellers and customer advisors in branch offices, omni-channel contact centres or more flexible working contexts.

Overall, skills are becoming more flexible as tasks become more complex and demanding. Lower-skilled employees or those with specialisations in declining fields are at risk as an overall ‘competence in agility’ is needed across specialisations (KPMG Advisory, 2018). In spite of - or because of - the transition to more customer self-service, customer advisors also need more skills for their remaining tasks: creativity, problem-solving skills and emotional intelligence are needed, not least to translate algorithm-generated sales targets and suggestions into customer-oriented recommendations.

Interviewees mostly mention skill gaps in the sought-after ICT and specific expertise functions. In spite of the competition with other sectors in ICT, banks so far hesitate to pay very high salaries.

On the level of branch offices and retail banking at large, the downsizing of recent years has also generated staffing shortages. In sales, the bank of WC1 (which still relies on expanding branch services) also hires people with non-banking skills and training. Banks that formerly used to require either an apprenticeship in the sector or a commercial academy degree ('Handelsakademie' in Austria) are increasingly finding that sector-specific skills can be learned on the job if a person has the social skills required in sales and customer service. Hence, they use on-the-job training programmes:

'You start with the basics in the branch office, then module after module follows, housing credits, investments, consumer credit, and so on. And if someone gets into that and is ambitious, they can get on really well, especially as a woman.' (WC1).

The number of banking apprenticeships has declined as well, currently there are only some 700 banking apprentices in Austria.

'And there, I think, the sector needs to think again, if they want good young staff, to invest more into their own training again. All over retail banking, with all these staff cuts, many old employees are lost, not old in terms of age but also younger people, but the bearers of know-how are disappearing, and that is a huge problem.' (Union).

Indeed, in 2022 the sector collectively agreed to support an apprenticeship model combining the vocational qualification and the high school graduation. An apprentice who attends evening school for that receives up to five days per year off for learning. Hopes are to render banking apprenticeships more attractive again.

However, the downsizing in retail banking also has an impact on on-the-job learning and training:

'Only, with the staff shortages, there is hardly time [...] for someone [as a beginner] you can go to, ask question, run along with, in a positive sense. These times of overlap hardly exist anymore. If a new person comes in they need to prove themselves on their own.' (union).

Banks generally invest in continuous training and life-long learning, qualifying their staff for new technologies, products, and centrally, regulatory requirements. However, sector-wide coordinated efforts in further training are limited. It is individual companies that cooperate with universities and schools of applied sciences to develop trainings for specific skills such as risk management.

The union GPA-djp has started various sector-wide skills initiatives of which most failed as the employer side lost interest. Developing a cooperation of a bank with a school of applied sciences to offer a modular degree in bank-specific IT seemed a good idea but did not materialise due to ongoing changes in management. In the savings banks' subsector, a collective agreement on the

first six months of basic training was successfully negotiated, but extending this across all five subsectors proved impossible:

‘There’s been many working group meetings with all five employer associations, but no common result, unfortunately. I imagine competitiveness was so dominant that nobody wanted to show their hand, although everybody realised that there would be a need for more qualified basic training that would be better for the entire sector.’ (Union).

The director of the banking association confirms this configuration:

‘With further training, really a lot is happening in the individual companies. [...]. We want to offer as much time and opportunities to employees as possible, but a common framework – there, competition within the sector is too strong.’ (BA).

Employment

In 2015 already, then director of the Austrian national bank (OeNB) Ewald Nowotny predicted that banking in the next years would lose roughly 1/3 of its 75,000 jobs at the time. Indeed, employment has been slowly shrinking from a peak of 80,293 employees in the banking sector in 2008 to 72,996 in 2020, which amounted to 60,188 fulltime equivalents (FTE). In the same period, mostly full-time jobs were lost, with 2.5% fewer women and 1.5% fewer men in full-time positions employed. Part-time positions decreased by 6.1% of men and 0.4% of women (Wieser, 2022).

Interviewees and also the literature disagree if this downsizing is going to continue. In a general mid-range employment prognosis of 2019, economists Fink *et al.* predicted that all financial services would lose another 0.6% of jobs per year until 2025, with slightly higher annual job losses in Vienna (0.7%) (Fink *et al.*, 2019).

However, employer representatives agree that the era of downsizing is over,

‘No bank can afford any longer to terminate younger or even less, older employees but we really are fighting for each employee we can have.’ (BA).

‘It’s turning round and has already turned around, that not enough skilled people can be found. And that increases the pressure to keep people in the companies.’ (CE).

The labour side sees both ongoing downsizing and staff shortages:

‘On the one hand, in the large banks, we have older employees under social plans, and on the other hand they are intensively searching for young workers, but most likely with different skills.’ (CL).

WC2 says, after the large waves of dismissals some ten years ago, jobs are being cut on a smaller scale and in a more decentralised way:

'It happens so that each department gets a budget and then they need to see how to use it. [...] But I don't think it's over. No longer in that intensity, but at the latest, when the next two large banks are merging then it's going to happen again.' (WC2).

This downsizing history of the sector has some unintended consequences, the more so because from the 1990s onwards, sector-specific benefits have been lost that gave strong incentives to remain in the sector. Labour turnover has increased, and the unionist consequently observes a newer trend of people changing careers:

[[Job changes happen] 'Less from one bank to another bank, that used to be the usual way. Now [...] if someone decides to leave the bank, they say, never back to a bank, thanks very much. They prefer to retrain and do something completely different, that's the sad reality.' (Union).

Arguably, this suggests that the sector's staffing shortages and skill mismatches are to some extent consequences less of megatrends but of companies' own strategies: banks did not just downsize and streamline their workforces but gained a reputation for doing so. Hence, a sector that used to pride itself on its job security (that was deemed close to that of the traditional public sector) can no longer credibly promise secure employment and auspicious career prospects.

In Austria, the Works Constitution Act requires employers to inform works councils about restructuring. In cases of mass layoffs,⁴² they are obliged to negotiate a social plan with the works council (but agreement is not obligatory). In the bank represented by WC2, the union had to involve the labour court in order to achieve a social plan. Most downsizing in banks has taken place through early and partial retirement schemes that are more generous than the statutory ones. Some banks used subsidised voluntary reductions in working time in the shape of 4-day weeks, flexi days, or working time accounts for employees to take sabbaticals or early retirement. For younger employees, severance payments above the legally established ones are used. For outsourced staff, agreements aim to protect employment conditions or compensate for less favourable conditions (for a limited time). Such arrangements were collectively agreed on the company level.

In 2015 two companies had already set up Work Foundations, an outplacement and reskilling instrument quite established in Austria since the 1980s. Work Foundations are funded by companies, the Public Employment Service, and the federal provinces' training funds. In 2018,

⁴² Mass layoffs affect at least 5% of staff in companies with between 100 and 600 workers, or at least 30 employees in larger ones - or at least five employees aged 50+.

finally a Work Foundation for the entire sector was established⁴³ and this has been extended for another four years in 2022. The programme can be offered to up to 4,500 employees losing their jobs. It provides re-orientation guidance, individually agreed training or further education of up to three years (four years for over 50-year-olds), and a period of support in active job seeking. Participants receive benefits in line with unemployment benefit (plus a retraining bonus), social security insurance, and the time of participation in the foundation extends the duration of unemployment benefits.

For all interviewees, the sector-wide Work Foundation is considered a success of the social partnership and an important instrument in addressing company restructuring. It is used to a lesser extent than planned originally, as downsizing has slowed down: *'we're talking hundreds rather than thousands'* (CE, 63), but WC2 reports that in his bank 80-90% of those eligible take up the offer. The range of career changes is wide, from self-employment to retraining in health, social or teaching occupations, or staying close to the previous job. Sales and marketing skills especially transfer well to other sectors.

Job quality

The partial shift in the sector from downsizing to staff shortages is not entirely favourable to job quality, as work overall is intensified.

'Fewer and fewer people need to do more and more, because turnovers, I'd say, are increasing quite nicely for banks, thank goodness. So that's a gigantic change, and the problem with the many employment losses is that a lot of know-how is being lost.' (Union).

Collective agreements in banks have traditionally been favourable: six weeks' statutory holidays (compared to Austria's usual five weeks), a month's paid parental leave for fathers well before this became general law, and an attractive pension scheme up until the end of the 1990s made a career in banking attractive and secure. In the 1990s, after retirement the bank topped up regular pensions up to 79.5% of last salaries. This was changed in 2002 and replaced with a pension fund with less advantageous outcomes. This previously had been a strong incentive not to leave the sector. Changes in both law and sector-specific benefits thus have contributed to the increased volatility of bank employees' careers. Indeed, with its vocational training and further training system, it used to be known for good career prospects even starting out as an apprentice.

⁴³ <https://www.waff.at/jobs-ausbildung/arbeitsstiftungen/branchenstiftung-finance/>

Interviewees observe increasing flexibility in working hours for several reasons: during the COVID-19 crisis, banks quickly implemented working from home (WFH) which had not been common before. In branch offices, some split their staff, and sub-teams took weekly turns in working from home or in the branch. Some customers also preferred remote conferencing with their bank advisors – which had been tried out before already when product specialists joined conversations with customers remotely, or advice was provided by phone or chat. Banks were also quick in making laptops, mobile phones and other equipment available to their employees. This was agreed on the company level, with the bank paying for equipment and a flat allowance for internet fees.

In 2022, most banks allow one or two days WFH per week. The bank of WC2 went a step further and cut down on office space, keeping desks for ca. 1/3 of employees. Departments and teams thus need to agree on specific days to come in. Some teams have also organised virtual forms of informal interaction such as online coffee breaks.

However, the unionist points out negative impacts not just on mutual learning and the working climate, but also on quality assurance and due process:

'If everybody sits at home, in front of their little box and no one can look left or right, what is the other person doing, and is the process working if they do that, not everybody does one thing from beginning to end, but processes in banks [...] always require the double-check principle. And there, a lot is lost and that will only be noticed in one or two years' time.' (Union).

Both customer demand (already before the pandemic) and the expansion of WFH then rendered working hours more flexible, with appointments for customer advice also available in the evenings at many banks.

Working part-time is still mostly a subject of women employees and much is apparently related to childcare needs. However, many women in the sector do not return to full-time work once the children are at school, accepting lower incomes and pensions.

'In our sector it's not true that women are put under pressure to work fewer hours, certainly not. It is clearly the women who do not want to work more,' says WC1.

Both works councillors note that young employees increasingly demand part-time even if they do not have children or other people to look after. Young men as well ask for 32-hour contracts to have long weekends or more time for other interests. WFH opportunities are also noted as a new criterion to choose a job or not. This apparently is where the shifts in the labour market make themselves felt in terms of new demands by employees. Indeed, WC1 concludes:

'At some point in time employees will be critical for the existence of the business, and if that gets more critical those companies will win that do not just compete on financial terms. Banks aren't the frontrunners there anymore. But there's a lot of things, such as working hours, right. How flexibly can I schedule my working hours, how many hours do I have to do full-time? There are first examples where a full-time contract is 35 hours.' (WC1).

Overall, work in banks is changing much in the same directions that have been observed since the 1990s. There is some skill upgrading but also ongoing standardisation. More work is expected to be done in flexible project teams which may also involve remote collaborators. 'Work is autonomous in space and time. Performance is more easily measurable', predict KPMG Advisory (2018, p. 66) and assume optimistically that work-life balance will be ever-improving. Changes are expected to concentrate in customer advice, with regard to more complex products and services:

'These stable structures and working forever in the same teams, that's going to dissolve, and the faster the wheel turns, the more flexible project teams will be deployed. And the classic customer advisor will be replaced by a multi-channel manager who serves the customer through all kinds of channels, by phone, by app or in person.' (CL).

Indeed, employee representatives observe increased pressure on employees, through direct performance monitoring, delegation of increasing regulatory demands, and through ongoing reorganisation:

'Comparing a bank employee's job today and 25 years ago, it's a different world: the work intensity, the monitoring, statistics for everything, you have to achieve this, that, and something else in the different sales fields. You are being assessed on a monthly basis.' (WC1).

Increased demands by regulation also translate into pressure handed down through the hierarchy:

'In other areas, such as compliance or prevention of money-laundering, much has been delegated to the front line, and a lot of responsibility handed down to frontline workers, whereas it's really a structural responsibility of the company. But then it's employees who end up with the lot of forms and reporting.' (CL).

Whereas team and project work multiply, the prerequisites of collaboration are eroded through ongoing restructuring:

'All the time branch offices are reorganised and mixed up, also teams, works councillors report this and as a customer I see it as well, then you have a new customer advisor every three months. Banks themselves do not give employees a chance to work well together as a team.' (Union).

All of this - in the view of worker representatives - has slowly eroded the attractiveness of the sector and certainly is not contributing to overcoming staff shortages.

Workers in retail banking share an additional challenge with salespeople and health workers: customer aggression has become an issue with both the COVID-19 pandemic and the closures of branch offices:

'It's got something to do with the fact that we have ever fewer branch offices and basically do not want customers to come to the branch office, except for advice. So queues are quite long as customers are expected to be doing things online. And then, something happens [to this customer], to reach his advisor he can phone the call centre, this guy can only set up an appointment, and then all the difficult cases arrive at the remaining few branch offices, and, yes, then things escalate.' (WC2).

Burnout and other stress-related conditions thus are seen as an issue in the sector as well as declining general job satisfaction. Some banks subsidise psychotherapy and there is a collective agreement on support to people returning to work after a longer illness. Yet more systemic approaches are not very frequent. One regional savings bank ran a successful initiative on burnout prevention with the union, looking at factors of stress and changing processes:

'And job satisfaction increased, sickness levels decreased, also satisfaction with management [increased].' (Union).

Starting wages in banking are not very high at some 1,900 – 2,200 euros, and some benefits have been reduced over the years, but collective agreements are still favourable. Monthly salaries are paid 14 times a year which is generally common in Austria, and banks pay additional bonuses related to the company's, the team's and individual performance.

However, wages vary between subsectors and also within sectors, especially between retail banking, headquarters and investment banks. Competition for highly-skilled experts increasingly extends across sectors (such as IT), but banks appear to be somewhat hesitant in increasing wages. Yet, staffing shortages exert some pressure. WC1 says that new hires with experience in other banks often earn more than comparable employees who have not changed jobs. As employees increasingly discuss their salaries (which used to be somewhat taboo in German-speaking countries), this may create a sense of frustration.

'I talked to my two HR managers the other day, and said, I don't have a solution. I just know what we're doing in the sector can't be the solution, always to expensively hire people from other banks and then get an imbalance in-house where salaries are concerned. I just have this revolutionary idea, [...], I do believe you have to pay that to get the people, but then you mustn't forget about the people in-house, you also have to pay them something more.' (WC1).

Inequality

Inequalities in the banking sector are not a new phenomenon: retail and investment banking with its huge boni, larger and smaller institutions and the subsectors are traditionally known for their differences. Top earnings are among the highest: ten of the 20 top earners among board members of Austria's largest publicly traded companies worked for the three joint-stock banks in the Austrian Traded Index (Haager & Wieser, 2021). They increased their salaries and boni although these banks in 2020 had had considerable losses in profits.

The employment structure in recent years has brought inequalities between age cohorts to the fore: for years, during the restructuring of the sector, older workers in branch offices in particular lost jobs (under relatively favourable conditions) and newcomers are younger highly-skilled experts with academic backgrounds. In a shrinking sector, relative youth and sought-after skills appear to command a (limited) premium – but the sector according to experts has lost attractiveness to these talents.

Overall staff shortages, however, are opening up opportunities to new employee groups. In customer advice and sales and also in the remaining branch offices, more diverse employees are being hired for apprenticeships and trainee programmes. Interviewees agree that banking employees have become more diverse across the hierarchy in terms of ethnicity, and that banks are increasingly open to people of diverse looks, ethnicities and sexual orientations. *'That isn't happening intentionally, it's just happening'*, says WC1. Employer representatives argue that this commitment to diversity is intended, both with regard to the attractiveness of the sector to employees and to the increasing diversity of customers. The transnationalisation of bank ownership has also played a part in this issue as US-based managers in some banks are more aware of equal opportunities policies.

The subject of gender is more complex. The sector is almost balanced by gender, and improvements in equal opportunities have been made. Yet, management positions are still male-dominated, and a gender pay gap persists. Women's career interruptions due to parental leaves and part-time work are one of the reasons, and fathers' share in parental leaves has not notably increased.

The bank represented by WC1 has introduced a gender quota for management positions. To achieve this, it has a procedure of advertising open positions and conducting hearings to fill them, with transparent criteria.

'It's not like the positions are left open if no woman applies, not that. But just by saying, do apply, and by advertising positions, women are actively given the opportunity to put themselves in the game and to apply for the function. And to present themselves and prepare for it, and if a woman does well [...] she may not get the first position, but then she's in the pool of people who are being kept in mind.' (WC1, 45ff.)

3.2.5. Conclusions

In spite of its transnationalisation and digitalisation the Austrian banking sector remains a nationally embedded sector comprehensively shaped by the coordinated market economy. Globalisation and digitalisation are entwined and mutually enabling in that context. The sector has been digitising and automating for decades, but new products and processes, new regulations especially post-2008, and its 'systemically relevant' functions in the economy contribute to a generally incremental mode of innovation. In addition, social partnership has enabled comparably 'social' career changes or transitions into retirement for workers affected by restructuring.

In some ways, we are currently observing a second round of digitalisation, transnationalisation and demographic change in which the impacts of the changes that developed from the 1990s onwards are now feeding back into the processes and making themselves felt as consequences: The transnationalisation of banks and their expansion to CESEE has exposed some of them to increased risks in these countries. The offshoring of non-core functions (and automation and self-service at home) has generated quality and management problems and appears to be partly under revision. Cuts in 'old' banking positions and remote collaboration are eroding know-how, team working cultures and learning on the job while work has been intensified.

In addition, the sector has lost attractiveness both for the highly-skilled 'talent' they are competing for, and for the bright school leavers that would have been proud to land an apprenticeship or entry job in banking years ago. Some of these shortages may offer new opportunities for career changes to workers from other service sectors if and where skilled customer advice is still needed as in the bank represented by WC1 – but only if banks recruit and develop skilled advisors instead of increasingly standardising and automating services.

Currently, some companies make concessions to individual applicants in terms of salaries, working hours or work location. More ambitious and comprehensive improvements in job quality, such as shorter full-time working hours, further training and opportunities, or health initiatives are rare – and the union is somewhat left alone in creating sector-wide strategic ideas while the employer side relies on competition.

3.3. Technological change in the insurance sector in South Africa: Disruption with the potential for social good in a developing country context? By *Zaakhir Asmal, Haroon Bhorat, Lisa-Cheree Martin, and Chris Rooney*

3.3.1. The 'story of the case'

In South Africa, we are seeing uneven development in terms of the adoption of technological innovations, and correspondingly, in the impacts of these on the workplace. Specifically, in the insurance sector we are seeing the formation of two groups of insurance organisations. On the one hand, we have the well-established, older insurance firms. On the other, we are seeing the emergence of what we call 'Insurtech' start-ups. The latter are known for making use of technological innovations, such as big data and AI, as a core part of their operations and product offerings. Furthermore, a significant selling point for these start-ups is the lack of human interaction needed to access their products. The former, however, has shown a mixed response to the use of technological innovations in the workplace, leading to a slow uptake of technology-related innovations within these firms. While some are hesitant, due to the cyber-security risks associated with these types of technologies, others are working through the aforementioned 'Insurtech' start-ups via investments and financial backing in order to 'test the waters'.

Another factor, important for a developing economy like South Africa, is the uneven distribution of skills and access to technology itself. This makes the approach that firms take to the adoption of technologies in the workplace a difficult balancing act. Firms must balance the need to remain competitive with ensuring that the labour market - current and prospective staff - is on par with skills requirements of the sector. The uneven distribution of skills and access to technology in South Africa means that some individuals may not be equipped to meet the needs of the firm should certain technological innovations be adopted. Thus, it may create a barrier to entry into the labour force.

The aim of this case study is to identify trends related to technological innovation and the workplace in the insurance sector of South Africa within this context and provide insights into how these trends are impacting job quality, employment, skills and inequality in the sector. We also consider whether such innovations have the potential to drive better social outcomes beyond the sector itself.

The case and its context

Against the backdrop of the 2008 economic crisis and the European Union's need to remain globally competitive, there has been a growing urgency for innovation and sustainable growth, which has resulted in a focus on workplace innovation (WI) at the EU policy level (Kesselring *et al.*, 2014). Globalisation and technological change have continued to create competition, and with improvements in technological innovations, a number of WIs have been implemented both in Europe and beyond (McMurray, Muenjohn & Weerakoon, 2021). Companies are realising a need to shift their focus to technological and business (model) innovation and efficiency (Oeij *et al.*, 2021).

This case study focuses on the role of technology in driving such WIs, as well as the role of technology in product development and access in the insurance sector in South Africa. With respect to the workplace, technology is an important enabler of WI and vice versa, and the COVID-19 pandemic has been a catalyst in the uptake of technologies in the workplace. According to Beblavy *et al.* (2012), the four main factors at the intersection of WI and technology are fragmentation and disaggregation of work, crowdsourcing, virtualisation of work and cloud computing and equipment.

Fragmentation and disaggregation of tasks can be understood in a number of ways, for example, breaking up work across various geographical spaces, working outside of the normal 9 to 5 timeslot or redistributing tasks across workers, software or machines. Crowdsourcing goes hand-in-hand with fragmentation, allowing for improved access to outsourcing and freelancer services through online platforms. Furthermore, the growth of crowdsourcing cannot be considered without the inclusion of the virtualisation of work, as companies no longer need co-workers to be in the same space, instead using online messaging, teleconferencing and videoconferencing software. Finally, access to improved internet access, cloud computing capabilities and new cloud computing equipment has allowed firms to provide fast and on-demand access to the organisation's network, servers and software.

If effective, these improvements to the way in which an organisation conducts business are intended to directly improve the productivity of the organisation and job quality of employees, but also have the potential to indirectly benefit its customers and the broader society. However, since many of these innovations are relatively new, their long-term impacts on job quality and productivity of employees cannot yet be known for sure. In South Africa and abroad, there is a growing general trend to make use of such innovations. However, the effectiveness of each company's approach to such innovations differs. In many cases, when companies do not fully

commit to the changes and rather support change at a superficial level, the result is inefficient. Successful approaches to innovation, especially technologically related innovations, require commitment to organisational renewal and complementary social innovations in the workplace (Kohlgrüber, Schröder, Bayón Yusta & Arteaga Ayarza, 2019).

In South Africa, organisational renewal and uptake of innovations in the workplace can have potential positive and negative impacts for the labour market. Many of the abovementioned innovations may have the potential to improve access to the labour market for people living in remote areas. However, and specific to the South African case, these innovations may also negatively impact marginalised groups who do not have sufficient access to the relevant technologies and lack the skills required to make use of them.

In the South African insurance sector, we have identified two main groups of organisations in the sector with different trajectories of technological change. The first group consists of smaller 'Insurtech' start-ups that make use of machine-learning, automation and cloud-based technology to improve their product/service and employee experience, while simultaneously making things more convenient for consumers. Conversely, the second group of established players within the South African insurance industry - such as Old Mutual, Sanlam and Hollard - has limited innovative capacities (Moodley, 2019; Molloy & Ronnie, 2021). We have also identified one relatively established insurer which is still technologically innovative.

Collins, Hannah and Giuliani (2022) note that one of the key reasons for a lack of innovation amongst established insurance companies is that across Africa, the insurance industry only targets a small proportion of the population due to the complexity and higher costs associated with providing more insurance products to a wider segment of the population. According to the Financial Conduct of South Africa's *Financial Sector Outlook Study 2022* (2022), although three-fifths of South Africans report having one insurance product, this is somewhat misleading since 42% of South Africans report having funeral cover only in 2021. If this product is excluded from insurance coverage calculations, the proportion of South Africans who have any other type of insurance product falls to 19.0%, mostly comprising life insurance (10.0%), physical asset insurance (11.0%) and health insurance (9.0%). The FCSA (2022: 39) also report that '*Life insurance is strongly correlated with earnings and income, where the poorest 20% of the population have only 3% of the coverage they need.*' Due to this correlation between income and having an insurance product, South African insurance companies tend to target their insurance products solely at big businesses and wealthy individuals who tend to value stability over

innovation. As a result, there is little incentive to innovate, because there is no demand from their current clients.

Molloy and Ronnie (2021) examine the use of Fourth Industrial Revolution (FIR) technologies - a proxy for innovation - in the South African life insurance sector and find that there are several reasons why the impact of the FIR on the sector has, at present, been minimal. Their findings were based on interviews with twelve senior executives at life insurance companies across South Africa.

The first reason provided by several insurance industry participants was that the lack of innovation was intentional because the market was not yet ready for products that were radically different from the previous products on offer. Related to this, the South African insurance market needed to innovate at a slower pace than other countries due to the broad unfamiliarity of workers and customers with new technologies. In addition, while some insurance companies were happy to embrace aspects of the digital revolution - such as using iPads and computer to reduce paper use - some insurance brokers insisted on still using paper.

A second reason provided by some participants was that their firms were unable to respond to opportunities and challenges presented by the FIR due to inter-related structural and cultural issues. Firstly, a number of participants identified structural inertia in their company, which relates to how things are done in a company. Structural inertia was reinforced by companies using outdated legacy systems and industry protection mechanisms (such as complex regulation, high capital solvency requirements) that limit the number of new entrants into a market and therefore, the need for established players to change. The second issue was cultural inertia. In any business environment, there are individuals who are doing well at present and thus do not see a need to change anything. As a result, anything that threatens their current standing will face fierce opposition, resulting in many new initiatives being shut down, again limiting innovation. The third issue related to the inherent risk aversion present amongst the established insurance companies. This was ascribed to the dominance of actuaries in the insurance profession who heavily rely on data and other evidence to make strategic decisions. With innovations where data are by definition not available, they emphasise the risk that it might not work out.

Overall, established insurance firms in South Africa are not at the forefront of innovation in the sector. Five factors – the small market size, consumers' unwillingness to try radically different products, structural and cultural inertia and excessive risk aversion were offered as reasons for the current state of affairs. However, it is possible that senior executives within established

insurance firms have recognised this lack of innovation and have looked outwards to understand new developments in the sector. Indeed, a number of established insurance firms have acted as underwriters for the new wave of insurance firms dubbed 'Insurtech'. These firms use technological innovations to make insurance products more accessible and affordable.

The lack of innovation amongst established insurance firms in South Africa meant that the market was ripe for disruption by new entrants. Indeed, a whole wave of Insurtech firms have entered the South African insurance market and have since become well-known brands amongst the South African public. These include Naked Insurance, Pineapple Insurance, Simply, Lumkani and JaSure.⁴⁴

At a first glance, it might appear that Insurtech firms are fiercely competing with the established insurance firms. However, this is not the case. The South African Insurtech sector is currently simply not big enough to make a significant difference to the profit of the established insurance firms. Instead, established insurance companies act as under-writers for these Insurtech firms. Hollard, for example, acts as underwriters for Naked Insurance and Lumkani, while Old Mutual play the same role for Pineapple Insurance and Simply.

According to a senior executive at an Insurtech firm, there are multiple reasons why established firms underwrite Insurtech firms. Firstly, the insurance sector is a capital-intensive business and the Insurtech firms do not have access to large cash reserves. To access capital, one option is to negotiate with an established firm to underwrite their business so that they can assure their clients that they will be paid out if necessary.

Moreover, underwriters are responsible for the compliance, legal and regulatory operations of the Insurtech firm. As a result, the established firm carries these expenses on their income statement, rather than the Insurtech, who do not want to be burdened with significant expenses at an early stage of their development. An additional benefit to this arrangement is that the Insurtech firm can focus on its core functions of customer acquisition and customer service. Underwriters also help Insurtech firms understand the importance of risk management. With the design of a new product, risks and opportunities need to be identified to decide whether it is worth bringing the product to the market. Underwriters typically have access to a large team of actuaries who can undertake sophisticated modelling of these new products, providing useful data on whether to launch the product.

⁴⁴ More detail on the way these firms use technology and offer innovative insurance solutions can be found in the Technology Use section below.

In return, established companies obtain access to innovations in the insurance sector. Essentially, the innovation function is 'outsourced' to these Insurtech firms, while the established firms use their financial muscle and reputation as a trusted corporate to 'purchase' the innovation. We can expect this trend to continue in the future because it is a mutually beneficial arrangement: Insurtech firms require capital and established insurance firms are consistently on the lookout for innovations to enhance their own business.

An interesting player in the South African insurance sector that somewhat bucks the alternative of either being a large established insurer that fails to make use of technological innovations at a wide level or a smaller Insurtech start-up which focuses on such innovations is Discovery Insure. Discovery applies a principle they have named 'Shared-value insurance' to its insurance product offerings, meaning that all stakeholders, clients, the insurer, and society as a whole should benefit in some way – and they use technological innovations driven by incentivisation towards achieving this goal. This was first used in the company's older and more established medical aid scheme, which started the Vitality Health and Wellness programme. This programme is an add-on to the medical aid products that incentivises a healthy lifestyle through rewarding healthy behaviour. In turn, this is better for medical aid profits, which creates the funds to further incentivise clients to live healthier lives, which is better for clients' overall health. And this continues in a virtuous cycle.

This business model then spilled over to the short-term insurance market, specifically car insurance and the introduction of the Vitality Drive programme. Much like the Vitality Health programme, vitality drive *'uses behavioural economics together with technology and data power to nudge clients'* to drive more safely and creates benefits at an individual and societal level.

How does it fit into the triangle of technological change/globalisation/demographic change

With increasing globalisation and integration of South Africa into the world economy, technological changes within the country are quick to follow global trends or be influenced by those seen elsewhere, and this again accelerates globalisation. Demographic change is also influenced by the global economy via migration. South African youth and skilled workers are more easily able to leave the country, and the skill and age distributions in the country and the sector are changing. Finally, technological and demographic changes will impact inclusion in the sector. The changing skill requirements that result from changing demographics and adoption

of technological innovations will make the reskilling of employees necessary. This entails ensuring that continuous learning is taking place.

Key impacts and ways these are being addressed or shaped

In order to ensure the successful adoption of technological workplace innovations, organisations either need access to a workforce with the necessary skills or need to reskill current employees. This is especially true in the insurance sector, as there are two skills gaps observed within the industry. The first is due to older employees with technical knowledge and experience exiting the labour market without passing on knowledge to younger graduates. The second is related to the technology changes taking place in the sector. In order for reskilling to be successful, older generations and those in leadership positions will need to be willing to adopt newer technology, and essentially to drive the adoption of these technologies. The reskilling of staff must also be aligned with the strategy and vision of the organisation.

The onset of the COVID-19 pandemic has changed the way in which we work and has impacted job quality positively. The pandemic has forced employers to make changes to work organisation, and although these changes were rushed and forced by lockdown measures, many employees have benefited from improved job quality as a result. Furthermore, technological improvements have the potential to positively impact the insurance sector in other ways, typically in the form of improved product offerings, improved consumer experience and by reaching consumers that previously were not able to benefit from insurance. However, technological innovation may also increase inequality in the sector's own workforce.

Our respondents agreed that discussions about employment and potential job losses as a result of technological innovations in the workplace are important and unavoidable. Our interviews indicate that there will be two potential outcomes along the lines of technological substitution or complementarity of tasks. There will be some jobs that can be successfully and efficiently done by technology and AI, and although this is still a distant future for South Africa, it will result in job losses. However, there will always be consumers in the industry that prefer dealing with a human being and meeting or talking face-to-face. This highlights the importance of continuous learning, upskilling and reskilling employees.

3.3.2. Methodology

An analysis of the insurance sector labour force data was conducted. These data provide information about the number of jobs in the sector and the gender, age, and racial breakdown

of the workforce. In addition, a literature review was performed to gather information on the global outlook on workplace innovations, and the current state of the insurance sector in both a general sense and with a specific focus on workplace innovation.

Table 5. Interview details

Respondent	Organisation type	Position of interviewee	In-person/ Online Interview
1	ASISA (Association for Savings and Investment South Africa)	Policy Advisor	In-person
2	SAIA (South African Insurance Association)	Executive	Online
3	IISA (Insurance Institute of South Africa)	Executive Manager	Online
4	An established insurance company – Discovery Insure	Head of Telematics	In-person
5	An established insurance company – Discovery Insure	Deputy CEO	In-person
6	An established insurance company – Discovery Insure	Marketing	In-person
7	An established insurance company – Discovery Insure	Head of Operations	In-person
8	An established insurance company – Discovery Insure	International Operations	In-person
9	An ‘Insurtech’ firm – JaSure	Co-founder	Online

The background data and literature were used as guides to structure interview questions, the focus of which was understanding technological innovation and workplace innovation in the South African insurance sector. A number of interviews were scheduled with members of various organisations within the insurance sector. Table 5 provides more detailed information on each of the individuals that were interviewed, as well as their organisation. These interviews and background information provided insight that was used to complete the case study.

3.3.3. Case study findings

The sector

The South African insurance sector forms part of the Finance, Insurance, Real Estate and Business Services industry. In 2021, the insurance sector had a total of 3,603 active employers (Oosthuizen *et al.*, 2021), and the sector had gross earnings of an estimated R33.2 billion in

2020 Q4 (Table 6). This makes up 4.5% of the earnings of the formal non-agricultural economy. The total relative growth of the insurance sector gross earnings over the 5-year period from 2015 to 2020 (46.6%) was larger than the finance industry, tertiary sector, and the total non-agricultural economy. Similar results are seen for average annual growth of the insurance sector.

Table 6. Employment and Earnings in the Insurance Sector, 2015-2020

	2010	2015	2020	Change (2015-2020)		
				Total	Relative (%)	Ave. Ann. Growth (% p.a.)
Employees ('000s)						
TOTAL NON-AGRIC. ECONOMY	8,481	9,600	9,640	40	0.4	0.1
TERTIARY SECTOR	6,802	7,957	8,084	127	1.6	0.3
Finance	1,879	2,181	2,172	-9	-0.4	-0.1
Insurance sector	147	195	211	16	8.2	1.6
Gross earnings (R billion, nominal)						
TOTAL NON-AGRIC. ECONOMY	353.4	569.5	740.9	171.4	30.1	5.4
TERTIARY SECTOR	288.6	476.2	626.7	150.4	31.6	5.6
Finance	87.3	145.3	192.6	47.3	32.5	5.8
Insurance sector	11.1	22.6	33.2	10.5	46.6	7.9
Mean monthly earnings (R '000s, nominal)						
TOTAL NON-AGRIC. ECONOMY	13.9	19.8	25.6	5.8	29.6	5.3
TERTIARY SECTOR	14.1	20.0	25.8	5.9	29.5	5.3
Finance	15.5	22.2	29.6	7.4	33.1	5.9
Insurance sector	25.3	38.6	52.3	13.7	35.4	6.3

Source Oosthuizen *et al.*, 2021

Relative growth in mean monthly earnings of the non-agricultural economy, tertiary sector and finance industry is closer in size when compared to the insurance sector. This is mirrored by the average annual growth of the mean monthly earnings in Table 6. However, the growth experienced by the insurance sector is still the largest. The converging growth rates can be explained by the differences in employment growth rates between the categorisations.

According to Table 6, the insurance sector employed an estimated 211,000 people at the end of 2020, up 8.2% from 2015. Conversely, the finance industry experienced a declining number of jobs (-0.4%), and the tertiary sector and total non-agricultural economy experienced significantly slower job growth over the same period.

Globalisation

South Africa is a developing economy that is relatively well-integrated into the global economy. Globalisation impacts the labour market in two ways (Fang, Gozgor & Nolt, 2022). Firstly, it greatly impacts global value chains, as production processes are divided among various

countries and locations. Although the insurance sector does not have a physical product to offer, knowledge and innovations can still be shared across countries.

Global innovations in the insurance sector filter through to South Africa. The established companies in particular learn from large players in other countries and adapt to make use of new global best practices in the industry. In some ways, South Africa influences other countries as well due to the unique circumstances and solutions required for the South African market. An example of this is South African insurers' readiness to work together despite it being such a competitive industry. According to a respondent from SAIA, with fraud and crime being such a huge problem in South Africa, insurers were co-operating to work towards a solution, unlike elsewhere. *'So we [South Africa] were actually quite advanced in terms of that.'*

Second, globalisation impacts the movement of human capital between countries. On one hand it encourages governments to deregulate labour markets in an attempt to attract investors, which can negatively impact workers' employment conditions. However, this appears to be an issue that is more prevalent in lower-skilled segments of the labour market, whereas the South African insurance sector has a relatively high proportion of high skilled workers. On the other hand, globalising labour markets make it easier for workers with sought-after skills and knowledge to migrate, especially if skill demands converge globally. However, improved opportunities for individuals result in a problem in South Africa, as the country struggles with skills gaps as many skilled workers leave for better deals abroad, and the education system has not been able to produce skills at the rate that is required by the national labour market. In addition, the COVID-19 pandemic has acted as a catalyst to decouple work from physical presence and create more flexibility for workers. This adds to the ways in which labour can be attracted out of the country.

According to our respondent from JaSure, in the post-COVID world, all companies appear to be looking for digital skillsets, and it seems that many companies are approaching the same people. In addition,

'The international tech companies are really getting far more aggressive with their sourcing of talent in South Africa, both to work remotely and for them. Also, there's a lot more of the sort of complete deal immigration type recruitment happening, so the employer will sponsor you and your spouse and your children's immigration to wherever and cover all costs.' (JaSure).

This is something that is also common among European employers.

In terms of operations in other countries, one of the firms we interviewed, Discovery Insure, is involved in a number of markets globally, not least due to the scalability and repeatability of the Vitality Drive programme. Outside of South Africa, the company offers a version of the Vitality programme in the UK, as well as various Asian markets. There, Discovery partners with regional insurers that offer the Vitality programme. The programme has also been applied to rental cars, for example with Avis SafeDrive, which was later expanded into the Netherlands, the UK - and recently - Saudi Arabia.

In addition to technological improvements in remote work, which assists in these global partnerships, COVID-19 has also been a catalyst in the uptake of Discovery's business model by international clients. According to our interviewees at Discovery, the company has become an early and expansive innovator due to the '*South African adaptability*' and the unique country circumstances. The underserved market and divided business models apparently left the company the space to innovate its products.

Technology use

The South African insurance sector is dominated by large and well-established insurers. These organisations in the sector currently make limited use of technological innovations, but have been taking steps towards learning more about technological innovation, such as using 'big data' or 'artificial intelligence' in the design and development of product offerings, and updating and streamlining their business processes. Only recently have they started to release mobile phone applications that assist customers and make dealings between consumers and the organisation easier. However, these applications are limited, and some individuals have reservations about adopting technology in their dealings with insurance companies.

However, the onset of the COVID-19 pandemic has been a catalyst in the adoption of technological innovations in the insurance industry both in the workplace and in the offerings of companies to their consumers. In terms of the shift out of the office and into work-from-home (WFH) setups, the industry was '*well-equipped to move people to their individual homes and not disrupt productivity or any functionality*'. Still, now that lockdowns have been lifted there are 'strong calls' for people to return to their offices. It appears that productivity has started to drop since the initial move to WFH, and some of our interviewees believe that employees working from home lack team connectedness and that face-to-face contact is essential in the insurance sector, where relationships and building trust with clients is very important.

Nonetheless, there are benefits to WFH. One respondent discussed the time-saving and convenience benefits of online work, for example when scheduling meetings. Furthermore, companies are acknowledging that digital innovation has been positive for business and operations. Some companies have already experimented and put measures in place to take a hybrid approach to the workplace. For example, some redesign the office environment, using unassigned office cubicles or communal workspaces where anybody at any level of the company hierarchy can work.

Molloy and Ronnie (2020) identified a range of factors that either enable or inhibit digital transformation and innovation in the South African life insurance industry. Overall, these findings show a disparity between what insurers know is necessary to implement change and digital innovation, and what is being done. Enablers include a continuous learning mind-set within the organisation, partnerships within the broader ecosystem, and the role and attitudes of senior management towards shaping the organisation's culture and structures.

Molloy and Ronnie identified a connection between the optimal functioning of an organisation and individuals' skills and abilities to act as enablers of innovation and drive or inspire action across the business. Continuous learning is relevant to technology use, as employees will need necessary skills to be able to adapt with the changing organisation. This requires either reskilling of employees or potential employees that already have the necessary skills.

The role of senior leaders in shaping cultural attitudes and structures is also discussed by Molloy and Ronnie. Leaders appear to have substantial influence to guide transformations but so far have failed to recognise the need for these transformations. However, our respondents indicated that the leaders of the insurance sector are aware of the need for changes and have started to take the necessary, albeit slower, steps towards these changes.

The majority of respondents have emphasised cyber-security as a concern when discussing the slow adoption of technological innovations in the workplace. This is especially important within the financial services and insurance sphere, as customers provide insurers with very personal financial information. This makes insurers and their customers more likely targets of scam artists, which is one further reason for financial services' slow and incremental approach to technological innovation. This is also a strength that established insurers have over new start-ups. Thus, Insurtech start-ups can benefit from partnerships with more established insurers that have more experience with cybersecurity and with

'Accessing the types of resources that you need to properly manage that risk, and it also links back to the talent. The talent point is the ability to find and retain cybersecurity talent.'

They're exceptionally rare and they're among the first to get headhunted by overseas employers, so they're a pretty scarce skillset in this country.'

Furthermore, many large firms in the insurance sector in South Africa already make use of a database - the Insurance Data System (IDS), which was developed in 2001 'to combat fraud and crime'. The data used is mostly insurance claims data and the system aids in identifying patterns of fraud within these claims data. In addition to this, the South African Crime Bureau was created in 2008, and there are future plans in place to expand the scope of the system to include underwriting data as well. However, there are also some remaining issues within the sector, with regards to the IDS. Mainly, there is a need to improve the collection of data from insurance organisations by standardising the data format as well as ensuring that all contributing companies provide complete and correct data. According to a respondent from SAIA, a solution to the former problem will be in effect during the second half of 2022, by enforcing the use of a standardised data template. Another issue is that not all companies provide data to the system. Contribution to the database itself is not compulsory, and some companies likely choose not to share their data as a means of remaining competitive and not wanting to share information with their competitors.

The lack or slow pace of innovation amongst established insurance firms in South Africa meant that the market was ripe for technological disruption by new entrants. Several Insurtech firms have entered the South African insurance market and have since become well-known brands amongst the South African public.

One of the more prominent Insurtech examples is Naked Insurance. The main focus of Naked Insurance is motor insurance, which reportedly is one of the least profitable lines of insurance due to market saturation (Littlejohns, 2019). However, according to the Automobile Association, around 60.0-70.0% of the 11 million vehicles on South Africa's roads are uninsured (Automobile Association, 2020), presenting an opportunity for a firm, such as Naked Insurance, to capture a large share of this market. The fundamental value proposition of Naked Insurance is that they can offer lower motor vehicle premiums than established insurance firms through technological innovations such as an AI chatbot and computer vision technology. In addition, the process of signing up is very quick. Naked Insurance boasts that they can provide a quote within 90 seconds and the individual or company is covered three minutes after acceptance of the quote (Littlejohns, 2019).

Pineapple Insurance provides insurance for a far wider range of products than Naked Insurance. They provide insurance for any material object, provided it is not a house, vehicle or drone

(Littlejohns, 2019). To do this, they require the client to upload a picture of the product they want covered, and using sophisticated machine-learning and AI algorithms, a quote will be provided within minutes. By removing bottlenecks in the signing up process, Pineapple Insurance can offer competitive quotes. In addition, Pineapple Insurance's policy involves returning unspent premia to their clients, resulting in lower profit margins than would typically be expected at a traditional insurance firm.

Lumkani targets an under-serviced part of the insurance market: those who live in informal settlements, who tend to be amongst the poorest people in South Africa. One of the greatest risks there is the threat of fire damage. This is mainly due to two reasons: firstly, paraffin is used extensively as an energy source as many of these informal settlements do not have access to electricity (Kimemia & Van Niekerk, 2018). Secondly, informal settlements are usually built with highly flammable materials (Littlejohns, 2019). To address this major issue, Lumkani provides a fire detection device that is distinct from a smoke detector and triggered through a rise in temperature. In addition to providing this low-cost product to impoverished communities, an insurance product is offered to these communities to rebuild after a fire has occurred (Littlejohns, 2019).

In contrast to the other three Insurtech firms described above, Simply focuses on life insurance. Typically, obtaining life insurance is a tedious process, requiring a lot of information and possibly a medical check-up in order for the insurance company to obtain an accurate picture of the customer's health profile. Simply, however, removes the arduousness of the process by only asking a potential client a few select health questions on a mobile application, and processing the application expeditiously. The company also offers group cover for all employees to corporate clients through a digital application process obviating the requirement for a broker to meet the business to discuss terms and conditions (Littlejohns, 2019).

JaSure is a new insurance company that offers unbundled insurance - meaning that the client chooses specific items to insure, not an umbrella such as 'home contents insurance' - on a range of items that includes cars, home insurance and other technological items and camera gear. Furthermore, all interactions with the client are done via the company's smartphone application. This includes signing up and adding items to be insured by uploading pictures and information regarding the item, in a similar manner to Naked insurance. The company's key innovation is that it provides clients additional flexibility by allowing them to turn cover on or off during the month, so that the cover paid for is only for the days on which the client had cover turned on.

Discovery is an exception in that it is not an Insurtech firm but is quite established in the South African market. It makes technological as well as workplace innovations a core component of its operating model. Discovery uses various technological innovations in their product offerings, such as telematics and smartphone application technologies. The data collected from these technologies are used to identify trends in client behaviour and to develop and refine the vitality drive programme to create incentives that will successfully change driver behaviour for the better.

According to Discovery's own research, *'driving behaviour is shown to be more predictive than claims history for risk'*. The telematics and cell phone data collected by Discovery provide detailed information on driving behaviour, and result in a better assessment of client risk. For example, telematics data can be linked to the frequency and distance driven by clients, which has drastically changed since COVID-19 altered the lifestyles of many individuals through increased uptake of work-from-home systems. Therefore, more accurate premiums can be charged to clients. Telematics is also useful for reducing claims fraud, since it can be used to confirm incident time and date, speed of car, etc.

Discovery places a great emphasis not only on the technology but on the big database that it generates the many uses for this data. The data that Discovery has access to is very granular, which makes it easy to identify patterns or incidents that are relevant to clients. One use case was the activation of car alarms if driving data show that a client needs assistance without the need for a phone call. In the event of hijacking of cars, the recorded driving behaviour will likely change as well as the location, which will allow Discovery to automatically respond. In addition, the telematics data can be used to detect road conditions and find potholes to repair, which is a Discovery programme that is aimed at improving driving conditions for clients. Other uses of the data can assist insurance brokers by leveraging the data to give insight into client needs and offer improved or more specific rates.

Demographic change

According to the Quarterly Labour Force Survey, there were 197,000 individuals employed in the insurance sector in 2020. This is a considerable decline from 242,000 in 2019. Table 3 provides an overview of the distribution of those employed in the insurance sector across a number of factors. In 2020, there were more women (55.5%) employed in the insurance sector than men (44.5%). This is worth noting, as men accounted for more than half of all those

formally employed (56.2%) in South Africa in 2020, and this pattern is generally mirrored in both the tertiary sector and the finance industry.

In terms of race, the proportions of those employed in the insurance sector are 39.4% African, 35.3% White, 13.6% Coloured and 11.7% Asian. This is unlike the distribution seen in the rest of the employed population. In both the total economy and the tertiary sector, around three quarters of employees are African, followed by just over one-tenth White, one-tenth Coloured and less than 5% Asian. Within the finance industry and even more so in the insurance sector, the White proportion is thus disproportionately high whereas Africans are underrepresented compared with their share in the population at large and among the formally employed population.

Three-fifths (58.9%) of those employed in the insurance sector are between 35 and 54 years of age. Over one-third (34.4%) of those employed in the insurance sector are between the ages of 15 and 34 years. There is a similar distribution of ages across the total economy, tertiary sector and finance industry. Among young people, the 25-34-year age cohort make up 90% of employment in the insurance sector. Due to the comparatively high skill level, young people in the sector are older than in other parts of the economy. Finally, the remaining 6.8% of those employed in the sector are over the age of 55 years.

Table 7. Overview of employment in the insurance sector, 2020

	Insurance sector	Finance industry	Tertiary sector	Total economy
Total Employment ('000s)	197	2,401	11,163	15,253
Distribution of employment (%)				
GENDER				
Male	44.5	58.5	49.6	56.2
Female	55.5	41.5	50.4	43.8
RACE				
African	39.4	64.8	75.1	74.6
Coloured	13.6	9.4	9.3	10.0
Indian/Asian	11.7	4.6	3.5	3.3
White	35.3	21.2	12.0	12.1
Other	0.0	0.0	0.0	0.0
AGE GROUP				
15-24 years	3.3	5.1	5.5	5.7
25-34 years	31.0	30.5	28.6	28.6
15-34 years	34.3	35.6	34.1	34.3
35-44 years	36.0	34.4	30.7	31.2
45-54 years	22.9	21.2	23.9	23.4
35-54 years	58.9	55.5	54.6	54.5
55-64 years	5.5	7.8	10.1	9.9
65+ years	1.3	1.1	1.2	1.3
EDUCATIONAL ATTAINMENT				
Up to NQF Level 1	0.7	6.3	11.8	13.9
NQF Levels 2 and 3	3.7	24.2	25.7	27.6
NQF Level 4 (grade 12 Equivalent)	41.7	39.3	35.5	34.4
NQF Levels 5 and 6	22.4	12.7	12.8	11.8
NQF Level 7	20.1	9.8	7.7	6.5
NQF Levels 8-10	11.3	7.1	5.6	4.8
Unknown NQF Level	0.0	0.5	0.9	0.9

Source Oosthuizen *et al.*, 2021

The insurance sector is relatively well-educated, with 95.6% of those employed in the sector having an education level of grade 12 or higher, compared to only 57.5% in the total economy and 68.9% in the finance industry. Furthermore, more than half (53.8%) have an educational attainment higher than grade 12 (NQF Levels 5-10), and nearly one-third (31.4%) have degrees. This is in contrast to only 11.3% of graduates in the total economy and 16.9% in the finance industry. This suggests that the insurance sector has a higher concentration of skilled employees when compared to the rest of South Africa.

Despite this, the insurance industry suffers skills gaps on two fronts. Firstly, with regards to skills that are specific to the insurance sector, such as underwriting and modelling. According to an interviewee from SAIA, these are skills that are gained through experience over and above

a university degree. Furthermore, many of these experts in the industry are older and exiting the sector without a proper transfer of this technical knowledge to recently hired graduates.

Secondly, with the technological advancements taking place in recent years, there is a growing technological skills gap. Technology allows companies both to offer more customised services and to reach more consumers. Employees need to keep up with these technological changes and insurance companies require new types of employees to take on emerging tasks relating to technological change. However, as the uptake of technological and workplace innovations by firms is slow-moving, there has not been a sufficient push to upgrade the skills of staff. In addition to the typical insurance occupations, there is now a need for more ICT-specifically skilled workers, such as data specialists, software and web developers.

Interrelated changes

Increasing globalisation and integration of South Africa into the world economy accelerates the diffusion of technological changes in the country's economy, and also that of South African innovations in other countries. For example, in the insurance sector, one of our respondents was invited to speak at an international workshop about the advancements surrounding the insurance data system. Discovery Insure, in particular, is making inroads in international markets through marketing its innovative incentive-based shared-value approach and entering into partnerships with global insurers to adapt this approach to localised conditions in other countries.

Demographic change is also influenced by the global economy through migration. South African youth and skilled workers are more easily able to leave the country, so skill and age distributions of the country and sector are changing in accordance with this. At the same time, technological innovations in the sector will require employers in the sector to have access to the pool of skills required to drive these innovations and their implementation. Both labour supply and demand are thus globalising actually or potentially. As an example of one response to this, our respondent from SAIA has noted that the sector has worked to include specific skills on South Africa's Critical Skills List via INSETA, the sector's training and education authority.

Furthermore, technological and demographic changes will impact inclusion in the sector. The changing skills requirements that result from changing demographics and adoption of technological innovations will make the reskilling of employees necessary. This entails ensuring that continuous learning is taking place. It is also important to keep in mind the potential impacts of these changes for inequality since the distribution of skills and access to technology

is uneven and South Africa's history has created a tie between racial background and access to education. As the insurance sector has a lower proportion of Black workers and a higher proportion of White/Asian/Coloured workers compared to the racial distribution in the general labour force in South Africa, it is important to ensure that skill-related changes do not exacerbate these inequalities.

3.3.4. Impacts

Skills

To ensure the successful adoption of technological innovations, organisations will either need access to a workforce with the necessary skills or will need to reskill current employees. There are two key skills gaps within the industry: The first relates to older employees with technical knowledge and experience exiting the labour market without passing on knowledge to younger graduates, while the second is related to the technological changes taking place in the sector.

Modise (2019) conducted semi-structured Interviews with 13 leaders in senior roles within the insurance industry (heads of business units and senior managers in human capital management and development areas), in order to provide an in-depth understanding of factors that are considered important in the success of reskilling insurance sector employees, especially for technological adoption and innovation during the 4IR. The report indicates that reskilling employees is influenced by both organisational culture and organisational structure.

Since senior management is often part of the older age cohort, with regard to organisational culture it is important for leadership to encourage continuous learning and development, so that employees can learn and effectively benefit from technology adoption. Our respondents agreed that the senior staff are typically much older and possess skills mostly gained through experience, but that these experienced individuals are *'exiting the insurance industry at the moment and have been for a while'* and *'there is hardly any transfer of knowledge into those technical skills and there is a lot of graduates coming in'*. Thus, a gap in the transfer of these technical skills is a problem in the sector. As a response to this, SAIA currently runs a mentor/mentee programme as a pilot solution where older, more experienced individuals transfer their technical knowledge and leadership skills to graduates.

With regard to reskilling and organisational structure, participants of Modise's 2019 study highlighted the impact of technology within their business and how it has changed their product offerings, customer service and back-office operations. Participants agreed that reskilling of staff must be aligned with the strategy and vision of the organisation. As mentioned earlier in

this report, according to our interviewees, leaders within the insurance industry are aware of and share the belief that technological changes need to be taken advantage of and that the sector must adapt, despite the reluctance and slowness of some actors to adopt technological and workplace innovations.

While the focus in our interviews was predominantly on addressing technology-related skills gaps, the challenges in the sector appear to be twofold: Acquiring new skills requires training and/or recruitment of skilled individuals, and retaining existing knowledge and skills requires such skills to be continually filtered through to younger staff from those retiring or exiting the sector. Both requires continuous learning and re-skilling supported by appropriate training and learning interventions – and working conditions supporting the exercise of these skills.

Currently, a number of courses are offered to employees by insurance sector associations. A general sense from our interviews is that companies are making use of these course opportunities for their staff, in addition to company-specific courses. Apart from encouraging employers to upskill their employees, ISSA has offered courses that include a focus on digital transformation, critical thinking and problem-solving skills, and in September 2022 ran a course titled 'Certificate Digital Insurer'. ASISA also operate an academy that aids in the education of current and prospective insurance sector employees. However, these courses are aimed at insurance-related skills and not information technology.

Employment and Job Quality

With regard to job quality, the onset of the COVID-19 pandemic has changed the way in which we work. These changes have also taken place in the insurance sector, and many of these changes will remain as part of a hybrid work environment and style in many companies. The pandemic has forced employers to make changes to work organisation, and although these changes were rushed and forced by lockdown measures, employees have experienced changes in job quality as a result.

Specifically, employees now typically have more flexibility of work hours and location of work, which is typically split between working from home or working in an office. Companies are also testing out new, more open office layouts that allow employees to collaborate in a more casual, less hierarchical way. This includes unassigned workspaces and shared areas for working together as a team. These physical changes are closely tied with changes in work organisation, which is usually less strictly supervised and controlled and affords employees more autonomy.

However, as one of our interviewees mentioned, this places more responsibility on employees to meet work demands and deadlines.

Whether some of these changes are beneficial or not is hard to say, since many of these innovations and adoptions are relatively new to most companies. Although many of these changes are seen as positive, more time and research will be required to understand the full, long-term impacts of these changes on employee job quality. For example, flexible working hours may be considered positive, but may result in employees working more or less than they typically would, given that they do not have a set schedule. Similarly, working from home has many benefits, but one drawback is that it may be difficult for some employees to separate home and work. Previously, it may have been easier for employees to ensure work-life balance by having a separate work location. Even if commuting time can be saved, it may require time and adjustment for workers and companies to develop a healthy work-life balance with the new modes of working.

With regard to employment, our respondents agreed that discussions about potential job losses as a result of technological innovations in the workplace are important and unavoidable. They agreed on two potential outcomes in this regard. First, there will be some jobs that can be successfully and efficiently substituted by technology and AI, and although this is still in the distant future for South Africa, it will result in job losses. Second, there will always be consumers in the industry that prefer dealing with a human being and meeting or talking face-to-face. These preferences will be met, but typically remaining or newly developing customer-facing jobs will require the insurance-specific technical skills discussed earlier. As such, the proportion of employees that will remain employed within the sector will have to possess these skills and be able to adapt to technological change and a more technological workplace. This highlights the importance of continuous learning, upskilling and reskilling employees.

Discovery Insure offers an interesting case in its approach to employee engagement and organisational culture to incentivise innovation across the firm. Discovery's culture is similar to that of a tech-focused firm (like those investigated in this volume in Italian or Austrian manufacturing or Polish business services), which encourages constant innovation and generation of ideas among employees. Incentives for employees to innovate are part of the company's business model and mission statement. Staff are rewarded in a number of ways for participating and contributing to innovation in the firm. In this sense, innovation is driven through a culture which permeates the firm and is embedded within the jobs done by

employees. This is positive for employee engagement and job quality on the one hand, and beneficial to the company on the other.

Inequality

Technological improvements have the potential to positively impact the insurance sector, typically in the form of improved product offerings and customer experience. These changes can be beneficial not only for the sector itself, but also broader society in terms of financial inclusion and risk mitigation. However, technological innovation may also increase inequality in its own workforce.

With regards to improvements in firms' offerings to consumers, technology has allowed for insurance firms to reach consumers that previously were not able to be served. Our respondents agree that, in general, technology has improved the coverage and penetration of insurance services across a wider range of customers and aided in reducing cost and improving affordability. Specifically, with regard to Insurtechs, *'consumption of the insurance actually matches the usage of the asset'*. Instead of a one-size-fits-all insurance product that typically has little variation from one customer to the next, these start-ups are able to offer *'episodic insurance'*, which allows for *'personalisation and customisation and this ability to construct your insurance solution around your needs'*. This has meant that there is now better access to insurance and financial inclusion for poorer households and individuals, which will have positive outcomes for inequality in the broader society.

With regard to employees and the impact of technological change, there is more to consider to ensure that inequality is reduced. In terms of employee demographics, the insurance sector has a majority female workforce, which is above average for the South African labour market. In terms of age, the distribution of employees in the sector aligns with the South African economy. However, there are two aspects that distinguish the sector from the South African economy at large, which appear to be linked. The first is that the racial distribution has a higher proportion of White and Indian individuals and a lower proportion of African individuals employed in the insurance sector. Second, the insurance sector has a high proportion of well-educated employees. In South Africa, education outcomes and race are closely related as a result of the country's past. The impacts of the apartheid education systems have persisted and are yet to be reversed. Thus, a large proportion of the country's population with lower educational attainment are from the Black and Coloured ethnic groups.

With the increased incorporation of technological innovations in the high-skills insurance sector, barriers to employment will remain and likely worsen for those from a disadvantaged background. Without a focused effort from the parties involved in the sector to improve the education and training of the workforce, racial inequality in the industry may worsen. The sector already suffers from gap in insurance-related skills gap which requires changes in South Africa's education system. However, a new information technology skills gap has now developed as well.

Discovery Insure's shared value approach offers an interesting case to consider in terms of broader societal benefits of innovation within the insurance sector. A key factor in the case of Discovery is that 'data permeates' through all processes and products. The analysis of big data on customers and their behaviour that is able to be collected via telematics devices and smartphone applications feeds into the creation of incentives to pursue less risky behaviours in health or driving. Behavioural economics is combined with technology in the successful gamification of the insurance product. Discovery's 'Vitality' programme is able to be applied to a variety of settings and is currently being implemented in a number of other countries. There as well, the telematics technology and the big data produced from its use make a difference in incentivising safe driving behaviour. This has created 'better' clients for the insurer, enabled more savings and profits for the company due to fewer claims being made as a result of fewer and less severe accidents.

Beyond driving behaviour, Discovery places an emphasis on improving driving conditions. This is not only beneficial for clients, as improved road conditions will result in lower claims, less accidents and lower risk for clients, but simultaneously creates overall safer roads for non-clients and society. Discovery runs various initiatives with societal impacts. For example, in the Western Cape province, where bus accidents have been a significant problem, the company has applied the Vitality Drive programme to the school bus industry, which has improved bus driver behaviour and reduced such accidents (through an initiative called 'Childsafe').

3.3.5. Conclusions

This case study has considered technological change and its effects on the workplace in the insurance sector of a developing economy, namely South Africa. With increasing globalisation and integration of South Africa into the world economy, technological changes within the country are quick to follow global trends or be influenced by those seen elsewhere, and vice versa, South African innovations can be scaled to other countries. However, demographic

change and available skills are also influenced by the global economy through migration. South African youth and skilled workers are more easily able to leave the country, so skill and age distributions of the country and sector are changing in accordance with this.

We identified two key groups of firms in the insurance sector in the country, and adaptation of new technologies in the sector appears to be somewhat dualised. On the one hand, we have the well-established, older insurance firms that have been slow to adopt new technologies. On the other, we are seeing the emergence of what we call 'Insurtech' start-ups. The latter group is known for making use of technological innovations, such as big data and AI, as a core part of their operations and product offerings. While some incumbent companies are hesitant, not least due to the cyber-security risks associated with these types of technologies and the sector's traditional risk aversion, others are working through the aforementioned 'Insurtech' start-ups via investments and financial backing to test and possibly incorporate new technologies into their operations.

For both of these types of firms, skill gaps are a major concern. In order to ensure the successful adoption of technological innovations, organisations either need access to a workforce with the necessary skills or to reskill current employees. There are two key skills gaps within the industry: The first relates to older employees with technical knowledge and experience exiting the labour market without passing on knowledge to younger graduates, while the second is related to the technological changes taking place in the sector. To address these gaps within the industry, changes in both organisational culture and organisational structure may be required to enable effective reskilling and skill upgrading of employees.

With regard to skills, another factor to consider for a developing economy like South Africa is the uneven distribution of skills and access to technology itself among potential employees. This makes the adoption of technologies in the workplace a difficult balancing act. Firms must balance the need to remain competitive with ensuring that the labour market - current and prospective staff - is on par with skills requirements of the sector. The uneven distribution of skills and access to technology in South Africa means that some disadvantaged groups may not be equipped to meet the needs of firms adopting advanced technological innovations. Then, these changes may increase barriers to entry to comparably skilled emerging jobs.

The pandemic has forced employers to make changes to work organisation, and employees are impacted by changes in job quality as a result. Whether these changes are positive or negative is not yet certain. However, technological improvements have the potential to positively impact

the insurance sector in the form of improved product offerings, overall customer experience, and access to consumers that previously were not able to be served.

Ultimately, it is important for insurers to understand that technological innovations are inevitable and they will need to make use of them. For example, smart cars and homes incorporate a number of technological advancements and provide a number of data points that insurers can use to improve and target their own product offerings. Such innovations merge technological and workplace innovations. In the event that they choose not to keep up with such innovations within the sector, they risk becoming less competitive. Our interviewees have stated clearly that they do believe that these innovations are significant for the future of the sector's productivity. Notably, they and other studies (such as Modise, 2019) emphasise that complementary changes in organisational culture from the top down will be necessary to reap these gains.

Discovery Insure provides an interesting case of how innovation and technology can be used to both drive performance of an insurance company and encourage positive behavioural changes among customers (and also employees) which drive positive social outcomes. Discovery uses technological innovations, in particular big data analytics, to incentivise behavioural changes among the insured that lead to positive outcomes for individuals and the insurer – and broader society as well by reducing overall societal risk. The idea was first used in the company's older and more established medical aid scheme, which started the Vitality Health and Wellness programme. This programme is an add-on to the medical aid products, and it incentivises a healthy lifestyle through rewarding healthy behaviour.

This business model has now been transferred to the short-term insurance market, specifically car insurance and the introduction of the Vitality Drive programme. Much like the Vitality Health programme, Vitality Drive '*uses behavioural economics together with technology and data power to nudge clients*' and create benefits on an individual as well as societal level by improving overall driving conditions. Discovery has taken this model to the global market by partnering with insurers in other countries to design incentivisation solutions that are appropriate for local conditions in those countries.

Other insurers have not been as explicit about the social outcomes that have resulted from their technological innovations. Yet, the Discovery example makes a case for the potential of such innovations to drive positive change in societies that go beyond just the sector itself. However, it also highlights that for such positive outcomes to be achieved, a model of operation which links these outcomes to the operations of the insurer is essential. For Discovery, this has been

made explicit in what the company calls the principle of *'shared-value insurance'*. The company actively seeks to innovate to provide solutions and products that generate benefits for multiple stakeholders which include clients, the insurer, and society as a whole. This ultimately benefits the insurer – but it is through the benefits to multiple stakeholders that this ultimate benefit to the insurer is realised.

4. Business services

4.1. Detroit or Silicon Valley? The future of automated shared services centres in Poland by *Zuzanna Kowalik, Piotr Lewandowski, Tomasz Geodecki, and Maciej Grodzicki*

4.1.1. The 'story of the case'

Globalisation has changed the nature of trade, and with the decreasing costs of long-distance communication, it has also reached the office. At the same time, the improving efficiency of emerging markets substantially increased the motivation to externalise and outsource processes. The economies that joined the European Union in the 2000s soon became important players on the global outsourcing map, and **the business services sector widely contributed to this picture.**

The business services sector is a crucial employer in the Polish economy and has been one of Poland's most dynamically growing sectors. The sector is diverse in terms of performed functions and includes various types of organisations. **In our study, we focus on the impact of automation on Shared Services Centres (SSCs)**, which are entities responsible for the execution and handling of specific operational tasks within a company. SSCs are a vital part of the business services sector in Poland and constitute nearly a quarter of all centres. Generally, most of the tasks performed at SSCs are repetitive and routine-intensive.

Right now, SSCs are undergoing a structural change. New emerging technologies such as Robot Process Automation (RPA), Artificial Intelligence (AI), and Intelligent Process Automation (IPA) could eliminate routine-intensive tasks and substitute them with technology. Work in SSCs is at high risk of automation, mainly due to the important role that repetitive cognitive tasks play. The fast pace of automation of jobs involving such tasks can pose a threat to the currently booming sector. Furthermore, rising wages and labour shortages may accelerate this process, as it may be easier and cheaper to deploy a robot or algorithm than to find a suitable employee. **The question of whether SSCs will be able to upgrade and continue to grow in the face of automation constitutes the story of this case.**

We find that there is evidence of **gradually advancing sophistication of the processes performed in SSCs** in Poland. More advanced and knowledge-intensive tasks are flowing into Poland, even though the number of new entities entering the sector in Poland has been

gradually decreasing. The centres in Poland continue to grow and attract employees. However, the sector's multinational character and the intangibility of the offered services make them potentially easy to relocate further to the East. So far, skills, human capital gathered in Poland, and cultural similarities have successfully prevented further relocation. Nevertheless, this may change in the future, as there are potential risks on the horizon, including rising labour costs, inflation, an unstable institutional environment, and the labour shortages already mentioned.

So far, **automation has not considerably reduced employment**, as its scope is reduced, and the sector is growing. However, in many cases, it contributed to the **improvement of employees' job quality** by removing tedious, repetitive tasks. According to the interviewees, the main aim of automation in SSCs is to enhance human labour rather than substitute it. The time gained thanks to automation can be spent on more ambitious, creative tasks. As a result, automation might eventually lead to employees' upgrading and improving occupational prospects. Fear of automation as a process that could destroy jobs is apparently more prominent in Western offices. There are at least two reasons for this. Firstly, people in Western offices already felt the reduction in employment when their tasks were moved to Poland. Secondly, Polish employees better understand the logic of constant improvement through standardisation and automation, as perpetual organisational change is deeply embedded in the organisational culture of business services centres.

The impact of automation on skills in the investigated SSCs is mixed and depends on the seniority of the position offered. For entry-level roles, automation of the most repetitive tasks created space for more creative or ambitious tasks. Therefore, **the need for soft skills such as critical thinking and creativeness increased**. The best-suited candidates do not necessarily have a master's degree, but are proactive, thrive on challenges and want to learn and develop their skills. At the same time, there is an **increasing need for highly qualified specialists with programming skills**, apart from being knowledgeable about their specific business area.

The shared services sector is now at a crossroads between two scenarios. CEOs and managers must prove that they can appeal to suitable candidates to stay on the path toward functional upgrading and attract more knowledge-intensive processes. They must show that the human capital, skills, and knowledge gathered in Poland are of unique value. If it does not happen, wage pressure and labour shortages will accelerate the trend toward automation and further outsourcing to Southeast Asia. Consequently, jobs in Poland will disappear. Poland will become the 'Silicon Valley' or 'Detroit' of business services.

The case and its context

The economies that joined the European Union in the 2000s became important players on the global outsourcing map, and the business services sector strongly contributed to this picture. Business services are activities performed by an enterprise for another enterprise or public administration⁴⁵. Business services centres (BSCs) are separate entities that provide business services either in-house or to other companies. They are usually classified according to their functional types into one of four categories: business process outsourcing centres (BPO), shared services centres (SSC), information technology centres (IT), and research and development centres (R&D).

Relatively low labour costs and a relatively high skill supply have been the two key factors behind investment decisions in CEE. Other factors include political and economic stability, transport accessibility of cities, and the vicinity of Europe's economic core (Geodecki & Zawicki, 2021). Despite the considerable growth of labour costs in the CEE in the 2010s, the wage-adjusted labour productivity in the business services sector remains higher than in Western Europe. Therefore, CEE countries continue to attract multinational service providers and independent companies looking for low-cost locations for their business services centres. The abundance of a disciplined and relatively well-educated workforce was an important criterion for locating manufacturing plants in countries of the region (Noelke & Vliegthart 2009; Augustyniak *et al.* 2013). The human capital factor even gained importance along with the growth of the FDI inflow in services (Stephan, 2013).

Poland is the regional leader with regard to the size of the business services sector, both in terms of the number of facilities and total employment. Among all types of business services centres (BSC), employment growth was the highest in Shared Services Centres. These are centres characterised by a relatively high share of transactional processes compared with IT and R&D centres. SSCs constitute almost a quarter of all centres in Poland and are the second most common type of business services centre.

⁴⁵ According to the [Eurostat methodology](#), business services include the following activities:

- technical services (such as engineering, architecture, and technical studies);
- computer services (such as software design and database management);
- other professional services (such as legal, accounting, consultancy, and management services).

How does it fit into the triangle of technological change/globalisation/demographic change?

Globalisation has changed the nature of trade. Instead of a traditional exchange of cloth for wine, economies increasingly specialise in trade in tasks, i.e., specific production stages of a given good or service (*cf.* Grossman & Rossi-Hansberg, 2006). Two (or more) countries are involved in the production of one good and share tasks according to their level of productivity and the respective supply of unskilled and skilled labour. In such a setting, skilled workers in a 'headquarter (HQ) economy' are engaged in creative tasks, for example, design. On the contrary, unskilled workers in the 'factory economy' are engaged in transactional or manual tasks (Baldwin 2006).

With the decreasing costs of long-distance communication (ICT), globalisation has reached the office (Baldwin, 2019a). Therefore, more advanced tasks and activities such as accounting, human resources management, and R&D could be transferred to low-cost countries. Markusen (2005) argues that educated professionals in low-cost economies would not have developed their competencies if Western companies had not appeared along with the requisite infrastructure, contacts, and brands keen to absorb their skills. Relocating knowledge-based assets enables a firm to interact with a skilled, low-cost workforce. This proves to be an advantage for the low-cost workforce and headquarters but a loss for skilled workers in the countries of the global North, whose services are no longer needed (Geodecki, 2021).

As the efficiency of emerging markets improves, the motivation to externalise increases. Milberg and Winkler (2013) argue that as competencies and infrastructure improve, more and more developing countries offer specialised business services at a decent quality level. Offshore outsourcing makes it possible to rely on competing suppliers and lower intermediate input prices. However, many firms prefer FDI, which enables them to maintain capital control over the offshore process. Apart from knowledge capital (ownership) and the benefits of low wages (location), it is also important to maintain control within the firm (internalisation) over the quality of the most value-adding processes (Gupta *et al.*, 2006; Moe *et al.*, 2014). Therefore, instead of outsourcing services to an external provider, multinational corporations establish shared services centres (SSCs) to decrease labour costs without losing capital control over the processes carried out.

Improving the quality of products and the efficiency of processes to meet a value chain's requirements is a precondition for joining it (Baldwin & Lopez-Gonzalez, 2015; Pietrobelli & Rabellotti, 2011; Milberg & Winkler, 2013). Therefore, participation in global value chains has

become an opportunity for developing economies to gain competence in knowledge-intensive activities. Processes that traditionally required human intervention and execution may be enhanced by new technologies such as robotic process automation (RPA), artificial intelligence (AI), and intelligent process automation (IPA). They steadily eliminate human labour and substitute it with technology. The so-called 'Globotics' (Baldwin, 2019b) describes the phenomena resulting from globalisation together with robotics. In effect, some professional jobs in services are becoming obsolete in the same way that automation and trade disrupted manufacturing jobs in the past. This process seems to be accelerated by shortages in labour supply and skills.

Maintaining an advantage over competitors in services is greatly based on skills and human capital (Sirilli & Evangelista, 1998), as it requires the latest technologies to be rapidly implemented. The sale of services is limited by the human potential available to the service provider, which is why they are located in places where human capital is abundant (Fernandez-Stark *et al.*, 2011). Along with rapid improvements in education attainments in the CEE region and with growth in the number of ICT specialists, service providers increased their interest in investing there. However, population ageing and low unemployment rate increase the tightness of CEE labour markets, which could discourage further investments in this sector (Bykova *et al.*, 2021).

Key impacts and ways these are being addressed

The gradual shift toward more knowledge-intensive processes and a trend of digitalisation shape the sector's impact on employment and skills. Knowledge-intensive processes require different skills, and if the trend continues, companies of all sizes will have to increase their spending on training significantly. According to the survey conducted among CEOs in Kraków in 2020, the change in the complexity of tasks over the last five years has been significant (Głowacki, 2021). At the same time, accelerated automation of transactional tasks may make many jobs redundant and lead to a substantial decrease in headcount. Whether employees would be reskilled or laid off is one of the key questions shaping the sector's future. If the sector in Poland is not ready for the change, many jobs will disappear, the process of adapting to more knowledge-intensive tasks will stop, and the 'trip to the middle office' will not occur. This is especially concerning in the light of a scarcity of adequately skilled human capital and a persistent mismatch between educational offers and the needs of the services sector (Górecki, 2021).

The increasing share of knowledge-intensive processes and the functional upgrading of SSCs accelerated by automation could improve the professional prospects of employees. It reduces inequalities within the global value chains (between Polish and Western offices) and the business services sector (between SSCs and other types of centres performing more advanced tasks). It is hard to assess the sector's impact on inequality at the city level. The wages offered by SSCs are presumably substantially higher than those offered on average by the business sector in smaller Polish cities like Bydgoszcz, Olsztyn, Radom, Rzeszów, etc. A similar discrepancy can be observed regarding job quality, understood as access to flexible working time, non-wage benefits, worker-friendly organisational culture, etc. However, there are no studies on the potential spillover effect from SSCs to other firms in terms of wages and job quality. Neither is there any research on the potential role of SSCs in attracting workers to cities with large labour demand in this sector. Both issues form interesting research questions which, however, go beyond the scope of this case study.

4.1.2. Methodology

Table 8. Summary of analysed companies

No.	1	2	3	4
Industry	Insurance	Technology	Petrochemical	ICT
Location	Warsaw	Kraków	Kraków	Kraków
Employment	300	400	5,000	2,000
Country of origin	USA	Japan	UK	USA
Business functions	Shared services for brokers in Western Europe: issuing invoices, archiving documents, support with issued claims	Finances, taxes, internal audit, IT, data analysis	Finance, HR, customer operations, sales support, legal	Software engineering, R&D, customer experience, sales, HR
Established in Poland in	2017	2007	2007	2012

We conducted 31 interviews in four companies. In each company, we interviewed the head of the centre, managers, and regular employees. We chose our interviewees according to their familiarity with the scope of automation in each company. We also targeted employees who work with automated processes daily. Additionally, we interviewed an HR manager responsible for recruitment and training strategy. In our sample, there were 17 women and 14 men. Three people were foreigners working for a company in Poland. All interviewees had higher education. Our desk research was based on the annual report issued by the Association of Business Services Leaders (ABSL). Additionally, we analysed materials from the YouTube channel [CEE](#)

Business Media and Awards, including recordings from the CEE Business Services Summit & Awards 2022 (4 videos in total).

4.1.3. Case study findings

The sector/the subsector

The Business Services sector is a crucial employer in the Polish economy. In 2021, 355,300 people worked in over 1,600 BSC companies in Poland (ABSL, 2021, p. 46), accounting for 5.6% of total business sector employment. The industry is highly concentrated. Three cities - Warsaw, Wroclaw, and Cracow - constitute 53% of all entities in Poland (p. 30) and account for 57.6% of all jobs (p. 57). The competitive advantages of locations in Poland's major cities include a large pool of highly-skilled workers (in particular in IT activities), relatively low nominal wages, a developing office space market and geographical accessibility (p. 21).

The sector is diverse in terms of performed functions. It comprises a few main types of centres: IT centres (45.9% of all companies in 2021), Shared Services centres/Global Business Services (24.7%), Business Processes Outsourcing centres (15.2%), Research & Development (12.5%), and hybrid centres (1.8%). In terms of headcount, Shared Services centres account for 36.3% of all jobs in the sector (p. 55) and dominate in each Polish city, including Cracow (38,900 - 47.5% of employment in the sector) and Warsaw (29,000 - 43%) (p. 69).

The business service sector has been one of Poland's most dynamically growing sectors. Between 2008 and 2021, the number of employees increased by 610%. Between 2020 and 2021, the overall dynamics of the employment growth in SSCs amounted to 6%. This was the highest growth rate in the entire business services sector. Employment growth was driven mainly by two industries: ICT and professional, scientific, and technical activities.

The number of new entities entering the sector in Poland has been gradually decreasing. Only nine new centres were opened in 2021 (p. 32). This constitutes an abrupt decline from the levels observed in 2011-2020, when over 80 new centres were established per year on average. So far, it is hard to assess whether 2021 was just an outlier caused by pandemic pessimism or whether it reflects a major structural shift in outsourcing strategies.

Globalisation

One of the key features of the business services sector is its multi-national character. Of 1,600 centres operating in Poland, 67% are owned by foreign investors, and foreign capital generates 82.0% of jobs in the sector (p. 31). Investors in BSCs come predominantly from the

USA (28% of total employment) and European high-income economies: the UK (10%), France (9%), and Germany (7%) (p. 42). The companies with foreign capital are typically larger, more productive and internationalised (p. 10). The existence of the sector is also perceived as a pulling factor for highly educated migrants, as 13.7% of those working in the sector are foreigners (p. 58). In addition, it has become a significant source of Polish export revenues, providing more than a quarter of commercial services exports. Poland's trade surplus in knowledge-intensive business services (KIBS) reached 10 billion USD in 2020 (p. 38-39).

All companies in our sample are of foreign origin, operate in multinational environments, and employ foreigners. The teams are often multi-national, and some Polish managers are in charge of teams in the whole CEE or EMEA region. Speaking a second foreign language (apart from English) is considered an asset, as some support for Western offices is still provided in national languages. At the same time, the globalised office sometimes impedes changes and creates difficulties.

'But the truth is that in such a large company, it's hard to change something quickly globally. If there's a system that doesn't work, or creates difficulties for employees, but it's a system that operates in 160 countries, well, we don't really have a say in how we can improve it, how we can change it, what we can do to make it easier and better, locally.' (Insurance_1).

The Polish BSC sector has achieved substantial upgrading in global value chains. This has been reflected by the gradually growing complexity and sophistication of business processes and the upskilling of workers (p. 16). In 2021, 53.8% of all functions performed in the centres were considered knowledge-intensive, an increase of 8 percentage points compared to 2019 (p. 99). In SSCs, the share is smaller and amounts to 47.9%. All interviewees confirmed the trend toward centres' upgrading. The trend accelerated after the COVID-19 pandemic as the shift toward working from home proved that more sophisticated tasks can also be done remotely. The drive for continuous upgrading is communicated by management in the investigated companies and is noticeable in common disregard of the term 'shared services'.

'Our centre stresses its character as the 'Centre of Excellence', not just an ordinary 'Shared Services Centre' [...] receiving only the worst part of the job [...] kind of back office. And the message from our leadership is that we're not here only to do manual, tedious click work that nobody else wants. We aim to find in these processes, which might be seen as tiresome or complicated, something to improve, automate, to do better.' (Insurance_9).

Receiving more sophisticated processes is also of high interest to the company's top management as their position and prestige depend on that. The more advanced processes, the more bargaining power the centre's management have, resulting in a better perception of the Polish centre by headquarters.

The upgrading of business centres is also driven by macro trends. Poland is no longer considered an inexpensive location, and it faces labour shortages. The reported average salaries at the lower job levels are still much lower than in Western Europe. Yet, they are higher compared to Bulgaria, Romania, or emerging economies in the global South. Many companies have troubles with recruitment, particularly of high-skilled and experienced workers. This is reflected in growing vacancy rates, especially in ICT.

The sector's multinational character and the intangibility of the offered services make them potentially easy to relocate further to the East. The most concerning risks on the horizon are rising labour costs, inflation, an unstable institutional environment, and labour shortages. Finding employees with the right skills, knowledge and experience is expected to be a crucial challenge for the sector in the future. The decreasing working-age population and labour shortages are among the biggest obstacles to maintaining the sector's growth. So far, the threat of relocating processes from Poland further to the East has been mitigated by the accumulated experience of working in global structures, higher-end language competencies, and cultural similarities between the Western headquarters and Polish units. However, in the long run, the potential relocation can be only prevented by sustaining the innovative approach and the centres' ability to upgrade further. If the disadvantages of location, mainly rising labour costs and labour shortages, exceed the benefits, the growing scope of the possible automation of routine tasks could provide a partial solution to both problems. In the interviews, heads of the centres understood the risk of relocation much better than other managers.

Technology use

The sector is undergoing a technological change. Most companies introduce solutions based on Integrated Process Automation (IPA), Robot Process Automation (RPA) and AI. All these solutions allow the automation of repetitive tasks. However, the pace of automation is still limited at this stage. In most centres in Poland, only 1 to 10 processes have been automated by now (ABSL, 2021, p. 110), mostly by using IPA (p. 112). In most centres, this has so far not led to the large-scale automation of job positions (less than 1% of total employment). There is certainly much space for further automation since in SSCs transactional tasks still account for the majority (52.1%) of all processes.

Depending on the size, maturity, and industry, the progress of task automation differs from one company to the other. However, the management of each interviewed company is sure that the process will accelerate in the future and will be a 'game-changer'. Although AI, RPA,

and IPA are 'hot topics', they are comparatively expensive to design and so far have not been responsible for the greatest savings and improvements. The most common tool is Visual Basic Applications, the fairly simple programming language used in Microsoft Excel. Other tools and ideas include a 'paperless office' (digitalisation of all documents), optical character recognition (OCR), Workflow, Workday, or other customised platforms that link data from various systems. The idea of 'citizen developers' was popular in each company. A 'citizen developer' is not a specific role but an employee without a solid IT background who actively looks for opportunities to automate their tasks. After spotting the gap, they create a tool (usually a macro or a bot) that automates and enhances the task. Citizen developers usually use specific tools and platforms that allow writing bots in a simplified way.

A special 'improvement/transformation team' has been created in three out of the four companies. Depending on the company, their main tasks include setting the field for automation or designing and deploying tools and platforms to be presented to specific teams. In addition to that, there are also 'hobby groups' dedicated to automation and technology. For people who perform operational tasks, belonging to such a group was perceived as a way of increasing their professional prospects.

Demographic change

Workers in the Polish BSC sector are, on average, relatively young, as compared to the total economy. In all knowledge-intensive business services, over half of the workers are aged 25-39, and approximately 5% are less than 25 years old. Information and communication is visibly the youngest segment in terms of its employment structure. Regarding the gender structure, there is a disparity between feminised 'Financial and insurance', and 'Professional, scientific and technical activities' (56%-62% of women), and masculinised ICT services (28% of women) (Eurostat data for 2021). The ABSL report demonstrates the potential of Polish tertiary education, which is the major pool of prospective workers in the BSC centres. It exceeds 200,000 graduates per year and the programmes related to work in BSCs (ICT, languages, business, and administration) have gained popularity (p. 160-162).

The average age of workers in each interviewed company was relatively low and ranged from 26 to 32 years. Labour market entrants are considered a challenge for HR recruitment strategies. HR managers stressed that the youngest employees' sometimes have contradictory expectations: an increased need for work-life balance and well-being and a desire for challenges and fast promotion. Young candidates are ambitious and self-confident but also spoilt, bold, and

incompetent in their view. However, the fast pace of growth in the sector and the decreasing number of graduates due to demographic change sometimes force companies to lower their expectations of candidates.

'Unfortunately, it is quite random whom we hire, because we rely on the principle that we just need more people, and we're going to teach them everything later. And this is not just our company, but generally, there is such a tendency. And on top of all this, the candidates are just spoiled. I remember when I was looking for a job, I was preparing my resume for a week. (laughter) I knew it should be beautiful, that there should be no typos, etc. And now, the resumes I get – I would never send that to anyone.' (Petrochemical_5).

A high turnover rate is considered a problem in the whole sector. Depending on the seniority of the position, there are slightly different reasons for that. Young people at entry-level positions (mostly students or graduates) leave for jobs in different sectors because SSCs struggle to meet this group's very high expectations and offer them a unique value proposition, both in financial and non-financial terms. At the same time, experienced specialists' wages rise at a very high pace, partly due to the opening of the Western labour market for remote workers.

4.1.4. Impacts

Skills

The SSC sector in Poland has experienced a gradual shift towards higher added value and more knowledge-intensive processes. This structural change toward knowledge-intensive processes requires a different set of skills. Two highly demanded areas of competence are broadly defined IT and data analytics, as well as soft skills (including resistance to stress, flexibility, creativity, and emotional skills). Their combination, or so-called 'stempathy', is highly valued by SSCs in Poland. There is already a substantially higher demand for such specialisations as Robotic Process Automation Analysis, Cloud Computing Architecture, Business Intelligence (BI) Data Analysis, and Data Science/Big Data Mining (ABSL, 2021, p. 148). Business functions which already see high demand and rising salaries include Recruiting Professionals, HR Operations & Employee Data, Supply Chain Planning Professionals, Revenue Accounting & Reconciliation Professionals, IT Applications Development Professionals and IT Infrastructure Systems Administration Professionals. The broad scope of the list demonstrates that highly demanded skills are related to very diverse business areas.

The shortage of skilled workers will be a major challenge for SSCs in Poland in the coming years. It is driven by the demographic change that reduces the size of the working-age

population, especially the young. The skill shortage is most visible in IT functions but also when recruiting for high managerial positions. Centres located in Poland are already affected by worker shortages, for instance, in terms of their capacity to introduce innovations (p. 197). A related challenge is the dynamically changing skills-content of existing business functions. According to research by the Adecco Group, nearly 40% of existing skills become outdated every 3-4 years (p. 171). To rise to the challenge, companies of all sizes will have to significantly increase their spending on training and upskilling. The majority of SSCs in Poland are already planning to implement more upskilling and reskilling. Skill development in data analytics is the top priority for most employers (84%) and employees (59%) themselves (p. 171).

The impact of automation on skills in the interviewed SSCs is mixed and depends on the seniority of the position offered. Entry-level roles in SSCs have usually been characterised by repetitive work. Automating algorithmic procedures results in an increased need for complementary skills such as thinking outside the box, the ability to spot abnormalities, and critical and creative thinking. Therefore, on the one hand, the core of skills sought after by the managers in SSCs includes mostly soft skills: analytical skills and attention to detail, commitment, teamwork, client focus, and language skills. There is a gradually decreasing need for formal education, and a bachelor's degree and a *'good attitude'* is often enough. Well-suited people are proactive, thrive on challenges, and want to learn and develop their skills. In practice, such an approach favours younger candidates, who have less knowledge and experience but are more adaptive and audacious.

'I'd rather we focus on hiring someone with the right attitude and teaching them almost everything they need to do to do the job.' (Insurance_4).

On the other hand, considering the idea of 'citizen developers', there is an increasing need for people with programming skills who are also highly knowledgeable about their specific business area. They are called 'purple people' since blue is considered a business colour, and red is an IT colour. These workers can deal with various kinds of automation and manage large quantities of data, but are also very familiar with a specific domain, like finance.

'We call it purple people [...] who understand the expectations of the business side, know a specific domain and can program, or analyse big sets of data.' (Petrochemical_3).

It seems that the responsibility for upskilling themselves is mostly assigned to employees, even though managers spoke a lot about learning and training in the interviews. Companies offer possibilities to upskill (for example, access to a learning platform), but it is considered something workers should do after hours. As long as their daily responsibilities

remain the same, their opportunities to use those platforms and learn a specific skill at work are limited. Most on-site training offered for regular employees addresses soft skills or managerial skills, not learning VBA or RPI from scratch. At the same time, most HR managers noted that the life cycle of competencies shortens, and anticipation of the most wanted future skills is getting harder. Additionally, a shortage of skills related to automation and digitalisation may be more prominent in Western offices, especially among older employees. A manager of the petrochemical company said:

‘There are people (in Germany) who have been printing Excel sheets for 30 years, mark something with a marker, then someone comes, signs it, stamps it ... And now such people are forced to work with a computer - they can’t, won’t learn, they have three years to retire ... From the company’s perspective, it’s hard to allocate their skills to another department, but the company must move forward and digitise [...] We won’t be competitive if we keep printing, signing, stamping.’ (Petrochemical_5).

These differences between Polish and German employees were mostly explained by the manager by cultural differences and a ‘*wrong attitude*’ which - according to some interviewees - means being reluctant to change. It is worth noticing that the constant organisational change is deeply embedded in the organisational culture of Polish SSCs. The focus on constant improvement and delivery of results is their ‘*license to operate*’, which justifies their sheer existence. One of the interviewees described their SSCs’ organisational culture as ‘*squeezing the lemon*’. In contrast, the organisational culture in Western offices may be more conservative and focused on business as usual, which has been successful, effective, and profitable for years. However, it clashes with the urgent need for organisational change forced by accelerating digitisation and automation.

Employment

So far, automation has not considerably substituted human labour and reduced employment in the investigated companies. Firstly, the scope of automation in most cases is still limited and serves to enhance human labour rather than substitute it. Secondly, the sector’s pace of growth contributes to the constant inflow of new tasks and processes from Western offices. Even if, in limited cases, automating some processes reduced employment, it was considered a convenient way to dismiss people who were planned to be made redundant anyway. Therefore, we cannot perceive automation as a game-changer considering labour shortages. Human labour is still highly needed.

There is a contradiction in the perception of automation between CEOs and end-users of automated tools. The former perceive reducing employment in the long run as very probable.

The latter point out the constant need to control and correct the work of bots. At the same time, reduction in employment seems to be a bigger problem in other subsidiaries, from where the processes are moved to Poland. It was mentioned that employees in the West are unprepared for the poorly-communicated transition process, and employees' attitude considering disruptive changes is reportedly far more conservative than in Poland.

'Automation so far is rather about people who don't have to work overtime any more than about serious redundancies in the headcount.' (Technology_2).

Job quality

Wages in the BSC sector in Poland are among the highest levels of all industries of the national economy. Both Eurostat data for knowledge-intensive business services and the recent ABSL report (p. 142+) demonstrate dynamic growth of wages and salaries, and their coming closer to levels observed in Western Europe. However, even in 2021 average labour costs in Polish knowledge-intensive business services still did not exceed 50% of the levels recorded in comparable industries in EU-27. This is evidence of the overall cost competitiveness of the economy, which might contribute to its resilience to potential threats of layoffs due to automatisisation or relocation.

In SSCs, one of the most significant concerns is repetitive, routine work, which contributes to high turnover rates. The reason may be a contradiction between (1) the need for people who are ready to do repetitive work and (2) the need for people who feel comfortable with changes and seek new challenges. Most managers strive to get the best of both worlds from their subordinates. Managers' work is not repetitive at all – they manage people and deal with various challenges daily, which is also more stressful than operational work.

'I'm looking for people who are OK with the fact that this work is repetitive, but at the same time, they don't fully accept it. They will constantly look for the possibility of doing something differently or better.' (Insurance_2).

Automation removes 'click work' - tedious tasks that employees generally dislike. The time gained from eliminating such work can be spent on more creative tasks. Thanks to implementing bots and macros, employees can improve their skills and upgrade. Automation has been described as empowerment and an engine of occupational growth and personal development. As a result, employees are happier and less prone to leave their current jobs.

'Automation is meant to remove tasks that educated people - let's be honest - shouldn't do. They shouldn't sit and mindlessly click [...] move documents from the left to the right because that's how it is, that's the type of job. Those people didn't graduate from university to do such work.' (Petrochemical_7).

Automating more repetitive tasks means less time spent following procedures, and more weight is placed on critical thinking. This results in greater autonomy, which is vital for job quality. At the same time, the increased level of autonomy may lead to decreased security at work. The organisational culture of SSCs encompasses constant change, transitions of processes, and restructuring of teams. Therefore, employees are expected to be flexible and enthusiastic about ongoing organisational changes. Nevertheless, all interviewees seemed to enjoy it. However, sometimes the changes introduced in companies seem superficial - teams are restructured, and employees are promoted, but their scope of work remains the same. To further upgrade job quality, employees and HRM initiate various hobby groups that aim to animate employees, establish a bond, and let them take a breath from repetitive work. Some of these groups are more focused on personal hobbies, and some on occupational growth.

'In the long run, I hope we switch to a 4-day workweek, or maybe even a 3-day because we will use robots for support. And we will have more time for hobbies that aren't only about self-improvement. But I'm not sure if I will experience it myself.' (Technological_4).

There are no trade unions in either of the interviewed companies. The relationship between workers and companies is mediated by the Human Resources department and the team leaders. Employees' voices are present through yearly satisfaction surveys designed to spot problems and corporate meetings to raise concerns (anonymously or not). Typically, the most common request was the design of career paths, which can give employees a picture of what to expect in the future and what to aim for.

Inequality

Historically, the relative position of SSCs and the prestige of working there were low, even within the business services sector. The share of transactional tasks was substantial, and, in general, the centres were perceived as unattractive in terms of career development. Consequently, they attracted mostly students, and the turnover rate was high. However, this has changed as more knowledge-intensive tasks are being transitioned from Western offices. This offers opportunities for employees, as due to the inflow of more advanced and creative tasks, there are more possibilities to upgrade and abandon repetitive and boring work.

Offices in CEE sometimes grow at the expense of Western offices, although this is admitted grudgingly. 'Selling' the concept of automation to other offices is sometimes difficult, even in

technological companies. The fear of automation taking away jobs seems more prominent in Western offices. There are at least two reasons for this. First, people there already felt the reduction in employment when their tasks had been transitioned to SSCs. Second, Polish employees are accustomed to the underlying logic of constant change and improvement. They also strongly believe that there are possibilities for them to advance, as most of them experienced only the dynamic growth of the sector.

The shared services sector is now at the crossroads between two scenarios:

'We'll either become the Silicon Valley of Business Services, or we'll become Detroit.'
(Technological_CEO).

In the first scenario ('Detroit'), the wage pressure would remain high and companies would face problems finding highly qualified people for advanced tasks. Due to labour shortages, simple processes would be automated or relocated to Asia. This would result in a decreasing possibility to train inexperienced students and graduates on the job. As a result, SSCs in Poland would lose talent, human capital, and finally their significance. In the second scenario ('Silicon Valley'), SSCs would continue to attract the right people and stay on the path toward functional upgrading. They would show that the human capital, skills, and knowledge gathered in Poland are of unique value. In such a case, neither automation nor relocation to Southeast Asia would pose a threat to the flourishing sector in Poland.

4.1.5. Conclusions

Fear of automation destroying jobs is not present in Polish shared services centres. Instead, automation is mainly understood as a way to improve job quality and free up resources to lead a more satisfying occupational and personal life. At the same time, the scope of automation is still somewhat limited. Therefore, in most cases, the time gained by automation is not sufficient to acquire new skills or achieve new occupational goals. The threat of automation to the sector in Poland was much better understood by CEOs than by managers and regular employees. The relatively good economic situation in Poland in the last decade and the perpetual growth of the sector may have created the illusion that the good condition of the sector will last forever. Nevertheless, there are some potential threats on the horizon, including rising labour costs and labour shortages. However, the daily experience of working with robots and algorithms may lead to a more cautious and reserved approach toward automation. Employees who use robots daily are aware that human control over work done by a robot is still necessary.

There is an increasing need for highly qualified specialists with programming skills, even though they are very expensive. In the near future, the rising demand for these skills and the opening of the western labour market for remote workers will likely lead to a further increase in labour costs. The best solution would be to turn to the internal talent pool and upskill and develop employees. However, the upskilling strategies in most companies still appear to be underdeveloped. Although management is well aware of the increasing demand for ‘skills of the future’ such as programming, most of the training on that is done by employees as a hobby, after hours.

Nevertheless, the shift toward the middle office is likely to happen. The sustainable development and performance of the sector, as well as the number and the quality of the workplaces, suggest that the ‘Silicon Valley’ scenario may come true. There is a shift from SSCs to more elaborate centres of excellence within global organisations, and Poland follows this trend. Success will depend mainly on the ability to provide and sustain the higher-end competencies required for more complicated and advanced operations.

4.2. Coordination to support inclusive growth in developing countries in the context of globalisation: the case of the business process outsourcing sector in South Africa by *Caitlin Allen Whitehead, Zaakhir Asmal, and Haroon Borat*

4.2.1. The ‘story of the case’

The Business Process Outsourcing (BPO) services sector has seen remarkable growth in South Africa in recent years – this growth has been sustained even with the impact the COVID-19 pandemic has had on worldwide economies. By leveraging its strengths in this sector, South Africa has been able to attract considerable investment from abroad and to generate jobs in this sector even in a period of economic uncertainty. The case study aims to find out whether globalisation and plugging into global value chains can be an impetus for inclusive and sustainable economic growth in a developing economy such as South Africa. To do this, we seek to understand what factors have contributed to growth of the sector up to now and whether there is potential for further growth. Specifically, we interviewed a number of representatives from the industry body and its partners with a view of obtaining insights on the following:

1. What is the potential for inclusive economic growth and job creation in the sector?

2. What factors have contributed to the success of the sector, and can be expected to contribute to further growth and job creation in the sector?
3. What is the nature of jobs and job quality, and what are opportunities for further sustainable development of individuals engaged in the sector?

This outlook connects with the idea of a post-COVID world in which remote work and decentralised operations may provide further opportunities for gains in such service sectors' growth. A key finding is that globalisation does present opportunities for growth in services in a developing country such as South Africa. However, to capture the maximum gains to support inclusion in such economies, it is imperative that stakeholders take a coordinated approach that targets specific outcomes and act in a concerted manner to achieve them.

The case and its context

The unemployment rate in South Africa is one of the highest globally. As of Quarter 2 of 2022, the official unemployment rate was 33.9%. The expanded unemployment rate, which includes discouraged work-seekers among the unemployed, is even higher at 44.1%. The unemployment rate of individuals between the ages of 15 and 24 is unsustainably high at 61.4%. In addition to these high rates of unemployment, South Africa also faces skills shortages as growth in the economy has been biased towards sectors in which relatively high levels of skills are required despite a supply of labour which is, overall, relatively low-skilled.

Individuals with education levels lower than a tertiary qualification have the highest unemployment rates. Those with a completed secondary education have an unemployment rate of 35%, whereas those with a level of education below completed secondary school have an unemployment rate of 40.1%. Important policy documents such as the National Development Plan, the Human Resource Development Strategy, the White Paper for Post-School Education and Training, and the National Skills Development Plan all point to the risks that come with a poor supply of skills from the national education system (DHET, 2022). They agree that developing skills is critical for economic growth.

Unemployment is highest for the African and Coloured groups of the population, at 37.8% and 27.4%, respectively. The unemployment rate is also higher for women than for men (33.9% versus 32.6%). African women have the highest rate of unemployment at 37.8%. In Within this context, it is important for the South African government to support the growth of sectors that can generate jobs for the large numbers of South Africans who need employment – and it is

important that this job creation is able to absorb the most vulnerable groups who are more likely to be unemployed in the South African population.

As far back as 2006, the BPO sector's potential to create the type of jobs required in the country has been recognised by the country's government. In that year, a cabinet memo was signed off recognising the business process outsourcing (BPO) sector as a key enabler for job creation in South Africa. Since 2008, the country has thus positioned itself as an upcoming offshore destination for BPO (Lacity, Willcocks & Craig, 2014). Key to this has been a coordinated effort involving government, the private sector, and social partners in creating an enabling environment for potential investors. It focused on a deeper domain skills advantage coupled with significant cost savings when compared to other outsourcing destinations (Department of Industry, Trade, and Competition, 2018).

BPESA (Business Process Enabling South Africa) has been at the centre of continued efforts to promote South Africa as a destination of choice in this regard. BPESA is a not-for-profit company that serves as the national industry association and trade association for Global Business Services (GBS) that serve the international and domestic markets. BPESA promotes domestic and foreign investment in the South African GBS sector and aims to match supply and demand of skills; bring business and government together; coordinate the activities of social partners; lead and drive a transformation agenda; and galvanise a group of people with a common purpose, value, and intentions to grow the sector. A senior member of BPESA stated that *'All roads lead to BPO and GBS (global business services).'*⁴⁶ They went on to explain that all industries have a customer base that requires some kind of customer engagement and BPESA aims to make South Africa the choice international provider of such services. In fact, South Africa ranked number one for customer experience in the sector in 2020 and 2021.

It seems that through leveraging its strengths in this sector, South Africa has been able to attract investment from abroad and grow the sector even in a challenging global economic environment. In this case study, we aim to further understand the factors that have contributed to growth of the sector up to now and whether there is potential for further growth in this sector.

The study is limited to the Global Business Services (GBS) component of the BPO sector in South Africa. That is, the focus will be on the BPO activities related to servicing international

⁴⁶ The GBS sector touches many industries and mainly consists of the following: customer experience BPO, centralisation of shared services for large multinationals (e.g., procurement, legal BPO, knowledge BPO, and creative design outsourcing), and digital and information-technology services.

organisations as opposed to the domestic outsourcing of business services. Unless specified elsewhere, the data used for sector statistics is that provided by BPESA for GBS, in their quarterly GBS Sector Reports.

How does it fit into our framework of globalisation, demographic change, and technology use?

The sector sits at the intersection of a number of key globalisation, demographic, and technological trends. With respect to globalisation, growth in the sector is driven by international businesses increasingly outsourcing functions, with South Africa aiming to attract this increasing demand with a strong value proposition. Demographically, the demand for these services can be met by a large (and growing) young labour force in South Africa that is in need of employment and can be trained to acquire the skills to provide these services. Finally, technological advances make it possible for services required in one part of the globe - such as developed economies such as the United Kingdom - to be provided from elsewhere - such as South Africa. Technology may even make it possible for this type of outsourced services to be provided from anywhere within a country such as South Africa rather than from central premises if the challenges of infrastructure provision can be overcome.

Key impacts and ways these are being addressed or shaped

According to a senior staff member from BPESA,

'[t]he sector does indeed represent a significant opportunity for South Africa to address the unemployment and growth challenges and [...] we [the GBS sector] are well-positioned to capture an increasing share of this growing export opportunity globally.'

The South African Department of Trade, Industry, and Competition (dtic) has provided a large share of the government support in the sector through an employment incentive scheme and through marketing and the promotion of investment opportunities. Underpinning the growth in job creation in the GBS sector, the incentive scheme has supported approximately 80% of recorded new jobs. In addition, a senior staff member at BPESA stated that *'80% of the new job creation are youth and 64% of those youth recruited are women.'* Between 2010 and the first quarter of 2022, the GBS sector has contributed 109,133 jobs and an annualised contribution of 1,754 billion USD to export revenue.

Through our engagements with stakeholders in our interviews it became clear that outcomes in the sector are driven not only by a number of factors which make South Africa an attractive

provider of these types of services such as demographics and technological possibilities. Importantly, relationships and understanding between employers, the government and relevant social partners have shaped demand for these services in South Africa, as well as the supply of skills to meet this demand. This collaboration has been concretised in a Masterplan for the sector. The first draft of this framework was signed in November 2021 and speaks to the strategies that will be implemented to achieve a total of 250,000 to 500,000 net jobs in the GBS sector by 2030. This plan was put together by BPESA, in conjunction with the dtic (Department of Trade, Industry, and Competition) and Harambee, a non-profit organisation, to run programmes to provide work-readiness skills to unemployed individuals. These three partners collectively make decisions, design marketing strategies, and work on skills strategies to drive growth in the sector. According to a senior member of BPESA *'this sector has shown the effectiveness of a multi-disciplinary partnership, which should be incorporated in to other sectors.'* Additional stakeholders include the Department of Education and Training and the relevant Sector Education and Training Authority. The sector also falls into the purview of multiple trade unions, including those associated with banking and finance, as well as communication and ICTS. Information on the extent of union membership is not easily accessible and would be an interesting topic for further research.

Indeed, one of the topics discussed in the Masterplan is the importance of making sure this collective is sustainable, scalable, and that it continuously supports and provides value to its target community. **Fehler! Verweisquelle konnte nicht gefunden werden.**⁹ below sets out, in broad terms, the key players in the GBS sector and their envisioned contributions to realising the sector's full potential.

Table 9. Masterplan role players and responsibilities

Government (the dtic)	Industry	Labour	External partners
<ul style="list-style-type: none"> • Develop and implement policy to create an enabling business environment • Provide incentives to improve the cost effectiveness of operating from South Africa and encourage additional economic value, such as employment opportunities for disadvantaged youth • Promote foreign investment and international marketing and provide aftercare to existing investors • Advocate for required skills development for the sector within government • Facilitate enabling infrastructure for GBS expansion 	<ul style="list-style-type: none"> • Identify and strengthen South Africa's unique value proposition as a GBS delivery location for the key source markets and industry verticals • Attract global operators and companies and buyers to shift delivery operations to South Africa • Track job creation and skills training requirements and plan to scale the skills pipeline • Organise the industry's position and inputs on policy and enabling environment issues impacting the GBS sector • Contribute to the realisation of the country's B-BBEE and spatial development objectives 	<ul style="list-style-type: none"> • Advocate for fair working conditions and employment practices within the GBS sector • Promote the finalisation and implementation of a decent work framework for the GBS sector • Support and strengthen training of workers and help promote a stable working environment 	<ul style="list-style-type: none"> • Act as an ecosystem facilitator supporting the coordination of demand-side and supply-side development of the GBS sector • Channel available funding to high-impact interventions to improve the absorption of young South Africans into the sector

Source Masterplan for the Global Business Services Sector in South Africa (2021)

Of the Masterplan’s target of between 250,000 and 500,000 cumulative jobs to be created by 2030, 30% are projected to be complex and highly complex jobs to boost export revenue (annual target of R24 billion by 2030). In addition, priority has been given to improving Black ownership, management control, and linkages with Black-owned enterprises in the local economy. Another focus is to enable job opportunities to be created across a wider number of geographic areas. Finally, the Masterplan supports inclusive hiring, whereby employment opportunities are matched with South African citizens aged between 18 and 35 years of age and living in a poor household and community with low or no levels of employment.

These objectives are to be achieved through a combination of globalisation, scaling the supply of workers, and developing technology-based infrastructure. For a sector which is by definition part of the global value chain, the aim is to capture a greater share of the demand for GBS services by bringing new offshore work into South Africa and expanding current GBS operations within the country. The intention is to make use of marketing and investment promotion as well as financial and non-financial incentives. To meet this increase in demand, the Masterplan outlines a strategy to increase employment, thereby ensuring the sector’s ability to scale delivery of offshore services from South Africa. The key components of this plan are to create a demand-led and sustainable skills pipeline; develop physical technology-based infrastructure to enable hybrid work-from-home (WFH) models; and to grow broadband infrastructure as well as work toward better data policies.

4.2.2. Methodology

An in-depth analysis of documentation provided online by the BPO industry body, BPESA, was undertaken. Documents such as reports from the dtic, reports compiled by independent consulting groups, and legislation were used to provide background information about the origins of the BPO sector in South Africa and the factors which have led to its success. In addition, BPESA prepares quarterly sector reports which are rich in data, and we have used these to create a dataset for the period 2010-2022Q1. These data provide information on the potential for economic growth and job creation, including information about number of jobs in the sector and the gender, age, and racial breakdown of the workforce. In addition, data on export revenue generated and global source markets serviced provide insight into globalisation and the integration of South Africa’s BPO sector in global value chains.

Table 10. Interview partners

Respondent	Organisation type	Position/Level
1	Former dtic	Executive
2	BPESA	Executive
3	Harambee	Executive
4	Former BPESA	Executive
5	BPESA	Skills expert

The data and documents provided online by BPESA were used to structure a questionnaire, the focus of which was understanding opportunities for inclusive growth, job creation, the nature of skills in the sector, and factors that have contributed to the continued success of the sector. We interviewed five individuals with involvement with the industry body BPESA, Harambee (one of BPESA’s partner organisations), and the South African Department of Trade, Industry and Competition (dtic). These interviews, along with the analysis of documents mentioned above, were used to produce this case study.

4.2.3. Case study findings

The South African Global Business Services Sector

Since 2008, South Africa has positioned itself as an upcoming offshore destination for business process outsourcing (BPO) (Lacity, Willcocks & Craig, 2014). According to data from BPESA, costs for providing GBS in South Africa are on average 60 to 70% lower than those in the UK and Australia and are comparable to other GBS providers. This is supplemented by a national Business Processing Outsourcing and Offshoring Incentive offered through the Department of

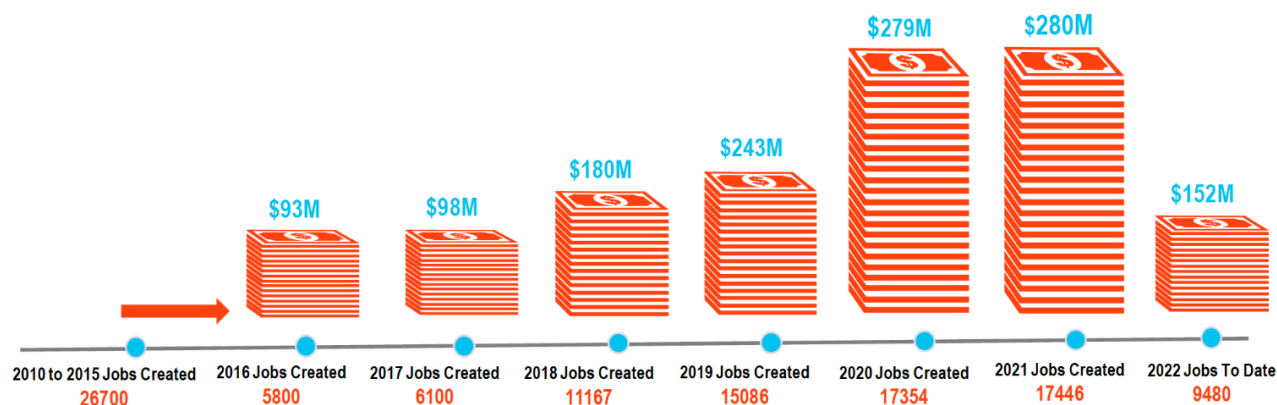
Trade, Industry and Competition (previously the Department of Trade and Industry) whereby prospective investors can earn up to R290,000 (16,280 euros, at the time of writing) per job created (dtic, 2018).

However, Lacity *et al.* (2014) find that for client companies based in the UK, the US and Australia, the value of South Africa as a provider of GBS goes beyond affordability. Its high-quality service and staff, cultural affinity, and a favourable time zone enhance South Africa's attractiveness as a service provider. BPESA (BPESA & Everest Group, 2019) has put forward a value proposition for South Africa that includes factors such as the country's strong foundation in contact centres; the availability of a large, young, and trainable talent pool many of which have a strong grasp of technology; strong government support to boost infrastructure and skill development; and the fact that the country has one of the best ICT infrastructures in Africa.

Accounting for 73% of total employment, contact centres still are the core function of the GBS industry (BPESA & Everest Group, 2019). Looking at the net new hires in the second quarter of 2022, 81% were frontline, voice-based contact centre agents. The digital transformation of contact centres as well as the rise in automation in the sector contributed partly to the capture of a larger share of the GBS market using non-voice services (BPESA & Everest Group, 2019). For example, the use of chatbots is on the rise. However, despite such technological advancements in call centres, the sector has demonstrated a growing capacity to create jobs.

Between 2010 and June 2022, the GBS sector has contributed 109,133 jobs and an annualised contribution of 1,754 billion USD to export revenue. This is summarised in Figure 7 which shows the growth in employment in the GBS sector since 2010 in terms of both employment and export revenue. Growth in export revenue continued to grow even in 2020 within the COVID-19 pandemic. In 2021, 17,446 jobs were created, with a contribution to export revenue of 280 million USD. The most recent data reveals that 9,480 jobs were created in the first half of 2022 with a 152 million USD contribution to export revenue.

Figure 7. Export revenue and employment contribution, 2010 to 2022



Source Global Business Services Sector Job Creation Report (2022)

The GBS sector’s talent pool extends throughout the country – it is however concentrated in and around the large cities of Cape Town, Durban, and Johannesburg. For the potential of the sector to create inclusive jobs to be achieved fully, efforts will need to target employment opportunities throughout the rest of the country. Adequate infrastructure however remains a major challenge in this regard.

Globalisation

The GBS sector, with support from the country’s Department of Trade, Industry and Competition (dtic), has successfully positioned the country as a credible provider of outsourced global business services to meet global demand for such services. Interviewees indicated to us that BPESA’s close work with government is recognised internationally and encourages international investment by reassuring investors of a relationship with government which seeks to enable the sector and not inhibit it.

In terms of net new jobs, the largest source of clients in recent years has been the UK (54% between March 2019 and June 2022). A decline in this share is observed over the period; however, in absolute terms the value of services provided to the UK is growing. In particular, support services to the British utilities and retail sectors are growing fast. The US is a relatively new, but rapidly growing, entrant. The US comprised just 1% of South Africa’s GBS market in 2018. In 2019, this share increased substantially to 17%, and in 2020 it increased further to 27%. While data is unreliable for 2021, the US comprised 34% of source markets served in the second quarter of 2022. Australia is another key market serviced (10% in 2019, 4% in 2020, and 3% in 2022 quarter 2).

According to data from BPESA, costs for providing GBS in South Africa are on average 60 to 70% lower than those in the UK and Australia and are comparable to other GBS providers. However, the dtic emphasise the value proposition to potential investors rather than simply cost advantages. For the UK and Australian client companies, the value of South Africa as a provider of GBS goes beyond affordability and includes its high-quality service and staff, cultural affinity, and, in the case of the UK, a favourable time zone. In addition, providers have niche domain skills and knowledge for high-demand vertical industries in international offshore markets such as the UK and the United States e.g., insurance, financial services, healthcare, and legal services. To achieve further growth, BPESA is aiming at creating 24-hour service in South Africa to serve firms in the US. In addition, South Africa's GBS sector is well positioned to take advantage of the UK GBS market as remote working opportunities become prioritised there and may lead to further relocations of business functions.

According to feedback received from our interviews, South Africa also plays an important role in collaborating with GBS sectors in other African countries to support growth in the sector across the continent. This includes countries coming into South Africa to do business and South African companies looking to do business outside of the country. There was a five-fold increase in the share of GBS being supplied to the African continent, from 2% in 2019 to 10% in 2020, holding steady in the first half of 2022.

A further trend in globalisation can be seen in how the GBS sector in South Africa has contributed to global standards for the sector. Around 2007, the South African BPO community and relevant stakeholders engaged to establish standards for call centres along with the South African Bureau of Standards. The SANS 990 1 – three standards were released to be adopted by the sector in 2008 with an aim of increasing quality and service delivery for BPO service providers and contact centres. These standards were later presented to international delegates at an event in Indonesia and fed into the ISO 18295-1 (relating to the contact centre) and ISO 18295-2 (relating to the client) Global ISO Contact Centre Service Standards which are now implemented globally.

Demographic change

A large young labour force in the country represents a pool of talent that can be tapped to meet growing demand for GBS. A practice identified as 'inclusive hiring' by interviewees is in place in the sector. Candidates aged between 18 and 35 years of age, who are South African citizens, and live in a poor household and community with low or no levels of employment - who are

therefore often excluded from the formal economy - are targeted for employment in the sector. Approximately 87% (15,020) of new hires in 2020 were young people (aged 18 to 35 years) while the share of inclusive hiring positions increased from 14% (2,390) in 2020 to 22% (1,123) in the second quarter of 2022.

With respect to gender, female workers comprise approximately two-thirds of frontline, voice-based agents and non-voice, specialist workers in 2020 with the remainder (36%) being male. The percentage split was maintained in the overall jobs recorded between 2018 to 2022Q2. The distribution of the GBS sector's workforce by race remained relatively consistent between 2018 and 2022Q2 with African workers accounting for just over half of all employees, followed by Coloured (25%), Indian (13%), and White (3%) employees.

The Masterplan sets out the following objective: 80% of jobs created need to be inclusive hires in order to access the Business Processing Outsourcing and Offshoring Incentive discussed previously. While traditional hiring practices have put up barriers in the form of qualification or work experience requirements, young people are an asset to the GBS sector as they are often familiar with digital technologies. In addition, they are found to have other favourable qualities such as enthusiasm, problem-solving skills, empathy, and a keenness to help others. The Masterplan also sets out a target of 30% of jobs created being occupied by individuals that have never had a job before.

However, while the sector is well suited to provide employment to young people, there are some real challenges. Many new entrants are lacking in confidence and are not properly prepared for the role. BPESA has teamed up with the dtic as well as Harambee, a non-profit organisation, to run programmes to provide unemployed individuals with work-readiness skills that are also transferable across industries. While these workers may be ready for work, they still require training to work; therefore, they need to go through a work integrated training programme. The length and complexity of these training programmes is based on the specific campaigns that they will be working on.

Technology use

Technological change is expected to drive major changes in the sector in the future. Roles in the sector are expected to become increasingly more complex in line with such changes. While traditionally, roles available in the sector were not too demanding in terms of skills requirements, across the industry there is a monumental task to re- and up-skill employees as technology becomes increasingly important in offshore delivery. According to a survey by the

National Electronic Media Institute of South Africa (NEMISA), overall, managers, employees, and HR managers have a good to excellent understanding of digital technology and technological readiness to adopt 4IR technologies is in place (Twinomurizi, Msweli & Phukubje, 2020). BPESA is in the process of implementing its second five-year skills strategy in partnership with national, provincial, and local government as well as firms operating in the industry and educational stakeholders to develop the required future skills. According to a senior member of BPESA's Skills Project Management office, entry level roles are

'starting to shift towards what we call omni-channel delivery and that would be in addition to voice chatting to a customer over the phone or via a headset, they would also have to engage with web chats and possibly even emailing.'

This has implications for the type of training offered – 'brick and mortar' training just won't cut it if South Africa wants to entrench itself as a leader of GBS. The big difference now is the emphasis on building 'digital skills' in the workforce.

With regard to infrastructure and technology use, plans are in place to address the physical barriers to entry that pose a threat to the growth of the South African GBS sector. These include developing broadband infrastructure in the country's non-metro cities⁴⁷ and towns where there is already a small presence of GBS sector activity with a small amount of support in the enabling environment such as skills and infrastructure. In these cities attention should be paid to potential hybrid work-from-home arrangements and other ways to decrease the cost of working for new entrants.

Interrelated changes

The objectives laid out in the sector's Masterplan are envisioned to be achieved through a combination of attracting demand from increased globalisation, scaling the supply of workers with the required skills, and developing technology-based infrastructure. For a sector which is by definition part of the global value chain, the aim is to capture a greater share of the demand for GBS services by bringing new offshore work into South Africa and expanding current GBS operations within the country.

The Masterplan creates a framework within which to leverage both globalisation and demographic change in the GBS sector. There has been a push to stimulate global demand for South Africa's GBS on the basis of the country's attractive value proposition and cost

⁴⁷ South Africa's major metropolitan areas are situated around the cities of Durban, Johannesburg, and Cape Town.

effectiveness. On the supply side, the intentional focus on hiring young people and those from marginalised communities builds on the country's demographic assets and on the challenges presented by a young, diverse and unequal, and severely underemployed population. For the young in particular, this has necessitated work-readiness training as well as campaign-specific training. The requisite skills are ever-changing in response to a growing global demand for more digital-skill intensive roles. The Masterplan also makes it clear that infrastructure and technology must be leveraged to achieve the Plan's goals.

On the demand side, the Plan aims to market South Africa as a high-quality provider of GBS and attract operators and companies to set up GBS delivery operations in the country. In this regard, the Plan notes that the next phase of furthering the sector's growth will require a

'more targeted approach to investment facilitation and marketing that addresses the particular challenges and capabilities required by buyers and global operators in the country's major source markets and vertical industries.'

On the supply side, the Plan focuses primarily on the creation of new jobs. In addition, it sets out skill interventions that create and sustain more entry-level talent, managerial skills, and also aims to reduce attrition in the sector. In so doing, the sector becomes more attractive. The industry is well-supported by South Africa's niche domain skills such as insurance, financial services, healthcare, and legal services.

Spatial inequality in major urban centres and lack of connectivity and access to economic opportunities throughout much of the rest of the country are major barriers that may limit the entry of individuals to work in the sector. It is thus important to ensure not only that demand is stimulated for GBS, but also that individuals obtain the required skills, and further still that individuals are supported to access work in the sector. However, the Masterplan does not specifically address challenges faced by individuals in accessing work such as transport costs and the safety of public transport.

Infrastructure and technology are particularly important to supporting access to work in the sector. Such support may either take the form of ensuring that individuals in marginalised communities are able to physically reach workplaces or providing individuals with the technological tools that they require to do such work remotely.

4.2.4. Impacts

Employment & job quality

Through stimulating the demand for outsourced services and aligning the local supply of labour and skills with this demand, the GBS industry has been a vehicle for job creation in recent years, creating 70,533 jobs between January 2018 and June 2022. Currently, there are in between 25 to 10,000 employees per contact centre, with a typical size of 250 to 3,000 employees per centre. BPESA is aware of 50 employers engaging in GBS in South Africa, many of which are start-ups. Three-quarters of employment in the industry is found in contact centres (BPESA & Everest Group, 2019).

The Department of Trade, Industry, and Competition (dtic) has provided a large share of the government support in the sector through an employment incentive scheme. Firms are eligible for this incentive if they meet certain criteria such as being a registered South African firm, with at least a three-year fixed-term contract for offshore activities and involvement in either starting or expanding an existing operation. The legislation also outlines a minimum wage structure. There is a framework governing the size of the incentive based on factors such as the number of young people employed and the complexity of the jobs created. Underpinning the growth in job creation in the GBS sector, the incentive scheme has supported approximately 80% of recorded new jobs.

In 2018, 11,167 new jobs were logged as well as a 180 million USD contribution to export revenue. The following year, this contribution to export revenue increased by 35% (243 million USD) accompanied by the creation of an additional 15,086 jobs. Export revenue continued to grow in 2020, but at a decreased rate of 15% year-on-year which may be due, in part, to the contraction of the global economy in the face of the COVID-19 pandemic. Despite these challenges, the GBS sector still contributed 17,354 new jobs to the economy. A key enabler of this employment growth was South Africa's easing of lockdown regulations in order to enable call centres to operate to support global and local business services.

While concerns have been raised about the nature of jobs in the sector and whether these can be seen as jobs that can lead to careers,⁴⁸ interviewees indicated to us that the sector provides many avenues to advance the careers of its workers such as promotion to managerial positions

⁴⁸ See for example, <https://theconversation.com/most-call-centre-jobs-are-a-dead-end-for-south-africas-youth-117516>

or specialising in specific types of GBS such as finance, accounting, legal, or transformation. In addition, opportunities exist in the fields of data science, software development, testing, and architecture. They also emphasised the transferability of the skills individuals obtained in the GBS sector. The skills acquired there can open up avenues for other employment in services outside of the sector. There are also opportunities for individuals to get involved as entrepreneurs in the sector as either BPO service providers or running companies that provide other services to the sector (such as training, security, and catering).

A great challenge faced by the sector is high rates of attrition at approximately 20% per annum. In start-up BPO companies it can be as high as 100%. According to some of our interviewees, the factors impacting rates of attrition in the sector include the working hours and shift schedules, with higher attrition in companies where workers are expected to work at night. In particular, one interviewee stated that *'the pathway into work affects attrition as well.'* They explained that a staggering 95% of those employees that had gone through work-readiness training were retained in the first year. Having said that, contact centres are reported to offer safe and healthy working environments, however, there are no set standards that define the working environment (Anwar & Graham, 2019). In South Africa there is a minimum wage, with call centres being required to follow this protocol. It is commonplace to have contract workers in call centres, but there is potential for these workers to move into permanent positions.

To be successful in finding and retaining young workers it is important to look for those young people with the potential and inform them of the potential career pathways available through entering into the GBS sector. One interviewer commented that organisations need to understand that unemployed youth have talent, but may need to be treated differently to other workers at the initial stages. The next section explores some of the interventions that have been taking place to close the gap between the skill set of new entrants and the skills required to advance in the sector or beyond.

Skills

The GBS sector provides many opportunities to absorb the young labour force who are inexperienced and without many skills, as most opportunities in the sector only require a grade 12 certificate for new entrants. The varied nature of the services provided by the South African GBS sector has resulted in skills in the sector that are among the most highly transferable across industries in South Africa. Within the BPO industry employees have the opportunity to upskill and become team leaders and managers, among other functions. For those workers wishing to

leave the industry, skills in customer service, customer engagement and project management may set them up for success in many other sectors including tourism, hospitality, and management consulting.

As the sector grows, the development of skills to meet a growing demand for GBS is becoming increasingly important. This entails a shift toward more complex and highly complex roles in the sector. A senior staff member at BPESA stated that

‘When the master plan speaks about demand, we also speak about how do we shift from the contact centre type of work to the more complex and highly complex roles. And how do we position ourselves for that?’

BPESA developed a 120-page concept note which describes how South Africa can remain competitive in GBS. The paper emphasises that digital skills are important – not just technical skills, such as cloud, cyber, VR (virtual reality), but also the professional skills complementing and enabling technology-based operations.

In terms of skill supply, a focus on future skills training is of high importance. An initiative called the Future Skills Platform looks at upskilling, reskilling, and future skilling talents – not just for unemployed youth entering the GBS sector, but also for incumbent staff. In the GBS sector there is a need for not just entry-level positions, but also for capable team leaders, middle management, and executive roles. For this reason, BPESA is looking to professionalise the sector and are busy developing a GBS qualification with the University of Cape Town’s Business School.

Inequality

By targeting inclusive growth, the sector can contribute towards reducing inequality and poverty in the country. However, for the potential of the sector to be realised, it is imperative that all stakeholders recognise this as a key outcome for success in the sector, alongside its overall growth.

The introduction of the Business Processing Outsourcing and Offshoring Incentive and inclusive hiring practices discussed previously have had a measurable impact on the number of young people employed in the GBS sector. The concerted effort to hire individuals from previously disadvantaged backgrounds has contributed to the fact that since 2015, 80% of the new jobs created are for young workers and 64% of those youth recruited are women. The Masterplan outlines a target of 30% of jobs to be occupied by new labour market entrants by 2030. By increasing the share of new labour market entrants there is potential to address unemployment challenges faced in South Africa.

In addition, the Masterplan outlines cross-cutting actions needed to make the sector resilient, impactful, and also a contributor to South Africa's Broad-based Black Economic Empowerment (B-BBEE) and special development targets. Specifically, the Masterplan pays attention to the transformation of the sector in terms of increasing Black company ownership, management roles, and connections with local Black-owned enterprises supplying services to GBS companies. In addition, the plan focuses on promoting decent working conditions, skills training, and impact sourcing and location.

The regional distribution of GBS jobs is another issue of inequality in labour market access. As of 2020, the most recent year of reliable geographic data, most workers in the GBS sector resided in either the Western Cape (53%) or KwaZulu-Natal (28%). According to input from BPESA, the Western Cape is the most established player in the BPO sector, while KwaZulu-Natal has the fastest growing BPO sector. Gauteng was home to 18% of workers, while the majority of the remaining workers were located in the Eastern Cape. Currently, the potential of shifting call centre operations outside the metropolitan areas to the country's poorest regions is limited by a lack of infrastructure, such as network access. The Masterplan explores various approaches to overcoming this challenge, primarily making use of its existing Special Economic Zone⁴⁹ structure to create digital hubs in these areas. It also discusses infrastructure upgrades in some Tier 2 and Tier 3 areas located outside of the major urban areas. However, this will require considerable infrastructure development to ensure internet access in some of the more remote areas in the country.

Building up broadband infrastructure and distributing work spatially would also lower the barriers created by high travel costs for workers and potential safety issues for employees working night shifts due to time zone differences. Spatial divisions in South Africa that persist as a legacy of Apartheid planning often mean that those most in need of employment are situated far away from the economic hubs where opportunities remain concentrated. A senior member of BPESA stated that they want to *'get opportunities for communities to be online so that they can take the jobs closer to the people.'*

4.2.5. Conclusions

The Business Process Outsourcing (BPO) services sector has seen remarkable growth in South Africa in recent years and this growth is expected to continue in the future. The country is

⁴⁹ A Special Economic Zone is a geographically designated area set aside for targeted economic activities, which are then supported via special arrangements and support systems to encourage industrial development.

attractive for various reasons including a cost advantage, high-quality service and staff, cultural affinity with other English-speaking countries, and a favourable time zone. However, positive outcomes in the sector are however not only driven by these factors. Importantly, relationships and understanding between employers, the government and relevant social partners and NGOs have shaped demand for these services in South Africa, as well as the supply of skills to meet this demand. This collaboration has been concretised in a Masterplan for the sector which sets out a plan for stakeholders to stimulate demand for GBS, develop skills that are needed to meet this demand, improve job quality, and leverage the use of key infrastructure and technology to achieve growth in the sector.

Spatial inequality in major urban centres and lack of connectivity and access to economic opportunities throughout much of the rest of the country are however major barriers. These factors may limit the access of individuals to work in the sector in the face of growing demand for these services. It is thus important to ensure not only that demand is stimulated for GBS, but also that potential employees obtain the skills to meet this demand, and further, that transport and digital infrastructures support them in accessing work in the sector.

While some raise concerns about the nature of jobs in the sector and whether these can be seen as jobs that can lead to careers, interviewees indicated to us that the sector provides many avenues to advance the careers of its workers within and beyond the sector.

By targeting inclusive growth, the sector can contribute towards reducing inequality in the country. However, for the potential of the sector in this regard to be realised, it is imperative that all stakeholders recognise this as a key outcome for success in the sector, alongside its overall growth, and that equal opportunities are sustained throughout careers in the sector.

An important component of achieving a sector that is inclusive and able to grow sustainably well into the future will be to expand the operations of the sector outside the country's main urban areas. In this regard, the Masterplan discusses infrastructure upgrades. However, beyond this, creating an ecosystem for the GBS sector to thrive outside of the core urban areas may present considerable challenges which may be beyond the scope of the current Plans. It will be important to engage with provincial and local governments and bring them on board as collaborative partners as well (in addition to the current partners with clearly defined roles in the Masterplan) with a clear mandate and plans of action to enable inclusive and sustainable growth of the sector beyond the areas in which they are currently concentrated.

The overall view on the potential of the sector to support inclusive growth is that globalisation does present opportunities for growth in services in a developing country such as South Africa. A number of gaps remain in the sector's current strategy to support job creation, access to work and career progression in the sector for South Africans. These include:

- Taking account of spatial inequality in the country to ensure that opportunities are accessible not only within certain pockets of the country and ensuring that individuals are able to access safe and reliable transport to places of work whenever it is required, locating job opportunities closer to where those in need of employment live, or improving the ability of individuals to work remotely through access to infrastructure and relevant support.

Consideration of a trade-off between attracting new talent for new jobs and developing skills and retaining staff within the current workforce. The sector's strategy currently seems more focused on generating jobs than on worker retention and job quality. This is understandable given South Africa's unemployment crisis but may leave gaps in terms of supporting career prospects and progression within the sector.

- The current lack of emphasis on job quality in the sector's plan and its emphasis on job creation and opportunity creation in GBS supply chains may result in poor working conditions and job quality. For the sector to attract the best talent and serve as a link to the broader labour market for many South Africans who remain locked out of economic opportunities, the jobs the sector generates must be able to support career progression and support. Sustainable careers and accumulation of experience in the sector will also enable the sector's further specialisation and acquisition of functions that add higher value (*cf. Kowalik et al. in this volume*).
- A lack of nuanced understanding of the individuals working in the sector and the challenges they face in accessing work and progressing in the sector. In particular, while women account for a considerable proportion of jobs in the sector, the current plans do not consider whether they are concentrated in specific functions and whether they would need a concerted effort to support women in accessing work and progressing across the spectrum of skills and functions required in the sector (which range from call centre jobs to an increasing need for more high-level technical skills).

To address these gaps and achieve the sector's job creation goals in a manner that is sustainable and supports equitable inclusion in the economy, it is imperative that stakeholders extend their coordinated approach to job quality and the wider ecosystem of infrastructure, education and training provision, to be able to take new technologies on board and remain competitive and innovative on sustainable terms.

4.3. A case study of the blockchain industry in Ireland by Seamus McGuinness, Paul Redmond, and Klavs Ciprikis

4.3.1. Introduction

Blockchain is one of the fastest growing emerging technologies. Although it is still relatively new, its popularity is growing fast among different companies, industries, and governments around the world due to its unique features in efficient, safe, and secure transfer of information. This is evidenced by the recent European Blockchain Partnership (EBP), which is an initiative to develop an EU strategy on blockchain.⁵⁰

A non-technical definition of blockchain technology is that it is a shared and fixed distributed ledger that facilitates the process of recording transactions in a business network which is available to all permitted network members. The ledger is immutable and only authorised members can see all details of end-to-end transactions. This improves efficiency in information transfer and provides greater confidence to stakeholders.

The European Union wants to be a leader in blockchain technology, and therefore, one of the key strategies of the European Commission is to provide support to blockchain developments in Europe.⁵¹ Ireland has experienced strong growth in the number of companies and industries incorporating blockchain technology in their operations, as well as an increase in the number of blockchain workers over the past five years. Therefore, we study the blockchain sector in Ireland in the context of the UNTANGLED project's 'triangle' by examining it in the context of technological change, globalisation, and demographic change to explore previously unavailable information on inequality, employment, and skill developments in this sector.

To gather appropriate information for the analysis we interviewed three experts from the blockchain sector in Ireland. The interviewees include an employer utilising blockchain technology (Interviewee 1); an engineer in blockchain technology (Interviewee 2); and a

⁵⁰ See <https://digital-strategy.ec.europa.eu/en/policies/blockchain-partnership>

⁵¹ See <https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy>

representative of a national blockchain consortium in Ireland (Interviewee 3). These provide us with diverse viewpoints of the blockchain sector in Ireland.

In terms of blockchain skills among the workforce, our results indicate that many blockchain workers come from more general ICT degrees. There appears to be scope for blockchain-specific courses or modules within the higher education system. Significant developments are under way in this area, with a dedicated blockchain master's programme recently being implemented in Ireland, namely the MSc in Computing (Blockchain – Distributed Ledger Technologies) at Dublin City University. In terms of gender inequality, like most high-tech sectors, blockchain employees are predominantly male. However, there is optimism for the future, as there is a group operating in Ireland dedicated to promoting female participation and involvement in blockchain technology. Blockchain may also have a role to play with respect to inequality in access to credit and financial resources. Some recent innovative applications of blockchain include helping homeless people access appropriate resources and providing opportunities to marginalised groups to bypass the traditional banking sector. Blockchain also appears to have a role to play in an increasingly globalised world, as it provides a way for companies, and their customers to trace the product from production to distribution.

In the next section of the report the story of the case will be discussed to provide the context and methodology for our analysis. Section 4.3.3 presents the case study findings in the context of the UNTANGLED 'triangle'. Section 4.3.4 discusses the impacts of the triangle on skills, employment and inequality. The final Section 4.3.5 highlights the key findings and provides concluding remarks.

The case and its context

Blockchain technology is projected to play a significant role in a variety of sectors globally. In Ireland, over the last five years this has been reflected in the growing number of organisations utilising blockchain technology in everyday business. Sectors that are adopting blockchain in their business include financial services, of which many are large multinational corporations, energy, healthcare, and businesses reliant on efficient supply chain management. An inflow of foreign direct investment used to finance blockchain operations in Ireland has helped businesses of different scales to expand their involvement in innovative technology applications and to establish new organisations with a specific focus on blockchain development and applications. Government's interest and willingness to work with emerging technology

providers has also increased confidence in the technology in Ireland and sent positive signals to global finance providers.

In the blockchain sector in Ireland, there are over 100 organisations that are working with blockchain and approximately 1,400 people actively involved in the blockchain scene.⁵² Most workers in blockchain are either blockchain developers, architects, or managers. However, the skills necessary to work with blockchain technology in a business setting are often hard to find. The case of the blockchain sector in Ireland is an important one, due to the rapid expansion of blockchain technology and the country's position to become a European blockchain hub. This is due to country's historically high foreign direct investment, especially in the technology sector, as well as increasing financial support by government agencies, such as Enterprise Ireland, to fund blockchain start-ups.⁵³ The country is also positioned well in terms of the skills needed in the blockchain sector and continues to invest in blockchain-related education and training, for example in ICT fields of study. Therefore, we interviewed three experts in the area of blockchain to gain insights in the inequality, employment, and skill developments in this sector. We also explore the potential impact on supply chains and globalisation.

How does it fit into the triangle of technological change/globalisation/demographic change?

Blockchain technology is growing in popularity in a variety of sectors and industries around the world. The blockchain market is also expected to experience significant expansion over the next five years, as its market size is forecasted to increase from 4.9 billion USD in 2021 to 67.4 billion USD in 2026,⁵⁴ as public, business and government interest in the blockchain technology grows internationally. In Ireland, the government is supportive of emerging and innovative technologies such as blockchain that may underpin employment and finance strategies to maintain an internationally competitive advantage as a prime location for investment. Therefore, many of the global leaders in financial services that apply technologically innovative practices come from Ireland. Further, the technological and financial innovation is reflected in the growing number of companies working with blockchain that have been established or incorporated in Ireland over the last five years.

⁵² See <https://www.blockchainireland.ie/wp-content/uploads/2022/05/Blockchain-Ireland-Strategy-20221.pdf>

⁵³ See <https://irishadvantage.us/ireland-global-blockchain-hub/>

⁵⁴ See https://www.marketsandmarkets.com/Market-Reports/blockchain-technology-market-90100890.html?gclid=CjwKCAjwTlaVBhBkEiwAsr7-c6ZLgwDk7EKb0Ki-cWW3I-0AhXxETb1QkpZCu_Rqu2tZKBmZpLWN8xoCBVsQAvD_BwE

Blockchain technology is an international technology which connects people and businesses from all around the world. For example, it alleviates some of the common global supply chain management problems (Saberi *et al.*, 2019), it can facilitate an efficient transfer of medical records in the healthcare sector (Hasselgren *et al.*, 2020), and it can positively affect accounting and auditing practices, as well as cybersecurity, in a business setting (Demirkan *et al.*, 2020). Blockchain can be used to facilitate payments, conduct audits, track inventory, and monitor assets and liabilities to provide greater supply chain transparency. This is evident from one of our interviewees, whose company relies on blockchain technology to track their product from production to distribution. There are also other similar examples. For example, an Irish coffee company uses blockchain to make payments and to collect and record information on all transactions in the supply chain, from farmers growing coffee in Ethiopia to the final cup of coffee in Ireland. The number of companies in Ireland incorporating blockchain technology in supply chain management is growing, which suggests that the technology is a valuable addition to their operations. With respect to globalisation, the blockchain technology may facilitate the development of more transparent and effective supply chains, it will also allow consumers to access product information and identify the carbon footprints of goods, which may incentivise a move away from geographically remote supply chain agents.

The expansion in adaptation of blockchain technology may also have an effect on demographic change in Ireland. The blockchain sector in Ireland is primarily comprised of young workers from computer science and ICT fields of study that are in high demand. Most of the blockchain workers are men while approximately 20% of the sector are women (Brunner & Ehlers, 2021). This underrepresentation extends from the traditional STEM fields that are largely dominated by men, as approximately 17% of all persons employed in ICT in the EU are women (Eurostat, 2018). Further, women account for fewer than 20% of new entrants into third level computer science and engineering programmes in OECD countries (OECD, 2017). At the same time, the demand for blockchain workers in Ireland is increasing and companies often find it hard to attract appropriate staff domestically. Therefore, they rely on workers from other countries to satisfy demand for blockchain skills, which also results in a more diverse and highly skilled labour force in Ireland. Past experiences of outsourcing and offshoring of ICT jobs will influence the future organisation of work (Erickson & Norlander, 2022).

Key impacts and ways these are being addressed or shaped

Blockchain technology is considered an emerging technology that requires a variety of technical, business, and transversal skills in its application and use. However, the skills necessary to

implement or apply blockchain in a business are often in short supply. Although some blockchain related education and training is available across Europe, the supply of individuals with appropriate blockchain skills remains low. Companies using blockchain in Ireland facing recruitment difficulties often rely on people with more general ICT and computer science backgrounds to fill the vacancies (Whelan *et al.*, 2021). Individuals with a background in business or project management but with no previous blockchain knowledge are also employed. These individuals are then trained in blockchain in-house or attend specialised external training programmes. Hiring and training individuals on the job is an expensive task. Therefore, there appears to be scope for more targeted blockchain education and training in Ireland, and this is an area that is specifically mentioned by our interviewees. There appears to be further scope for dedicated courses in blockchain, additional modules in existing courses, or short micro-credential courses relating to blockchain technology. There have been recent developments in Ireland with regard to the provision of blockchain related education, with the introduction of Ireland's first dedicated master's programme in blockchain in Dublin City University. Furthermore, Skillnet has introduced micro-credential courses on blockchain.

Regarding employment, it is difficult to assess long term labour market developments given that blockchain technology is a relatively new, and niche sector. However, recent interest in the technology means that many more multinational companies that use blockchain are incorporated in Ireland. Foreign direct investment in blockchain has increased the number of companies operating in Ireland and the demand for workers in this area. In terms of future labour market outcomes, the number of workers in blockchain in Ireland is expected to grow moderately from 2021 to 2026 and the skill supply is overall likely to satisfy the demand for blockchain work (McGuinness *et al.*, 2022).⁵⁵

As with most STEM fields blockchain work is dominated by men as only 20% of workers in the blockchain sector are women (Whelan *et al.*, 2021).⁵⁶ However, in Ireland additional steps are taken to encourage and incentivise more women to enter the blockchain space. To raise awareness and to encourage female participation in blockchain a female-centred group, namely BlockW, has been established in Ireland to advocate and promote women's representation in the Irish blockchain scene. This is mainly done through meetings, conferences, and training for women in blockchain. The other focus of this group is to aid marginalised groups to learn and

⁵⁵ See https://chaise-blockchainskills.eu/wp-content/uploads/2022/06/CHAISE_WP3_D3.2.1-Annual-Blockchain-Skills-Forecasts_2022.pdf

⁵⁶ See https://chaise-blockchainskills.eu/wp-content/uploads/2021/09/CHAISE_D2.3.1_Study-on-Blockchain-Skill-Demand.pdf

upskill in blockchain and to feel welcome in the blockchain community. Increase in the awareness of women and minority groups of opportunities in the blockchain sector may further improve the supply of blockchain skills. Many blockchain employers are aware of the gender divide in the sector and are making conscious efforts to attract more people from a variety of backgrounds and genders.

4.3.2. Methodology

Data for this report comes from semi-structured interviews with three national experts in the blockchain sector in Ireland. Interviews were conducted in February 2022 via Zoom. We interview an employer utilising blockchain technology for their business (Interviewee 1); an engineer in blockchain technology (Interviewee 2); and a representative of a national blockchain consortium in Ireland (Interviewee 3). All interviewees are experts in their fields with multiple years of experience or excellent knowledge of blockchain activity in Ireland. Interviewees are anonymised in this report. They thus represent a user, a service and tech provider, and an industry/professional association perspective.

Interviewee 1 runs a craft beer export company. The firm partners with local breweries and creates export routes and channels all over the world. Interviewee 2 is a principal blockchain engineer and a director of a multinational blockchain infrastructure provider based in a subsidiary in Ireland. The company provides software, hardware, security solutions and maintenance that businesses can use to interact with blockchain. Interviewee 3 represents a women-led blockchain advocacy group in Ireland. In addition, she is part of a national industry network of blockchain companies and professionals in Ireland. The core mission of the women in blockchain group is to develop women-led networks that focus on raising awareness of the wider applications of blockchain. The key objective of the industry network is to address industry, employment and skills issues related to blockchain in Ireland.

Each interview was approximately 60 minutes long. Interviewees consented to the recording of their interviews which were then transcribed, analysed, and presented in a coherent report. Each interview was based on a specific set of questions, which can be found in Appendix 1. The following topics were discussed in detail:

- Personal information and role in the organisation
- Policy developments related to blockchain
- Blockchain labour market skills
- Blockchain, globalisation and supply chain developments

- Blockchain and inequality

In-depth discussions on these topics enabled us to collect extensive information on technological change and its impact on globalisation and demographic change. By utilising a semi-structured interview approach, we were able to discuss inequality issues, employment outcomes, and skills requirements in the blockchain sector in Ireland in detail. We were able to gather extensive information on the developments in the blockchain sector that enabled us to provide a unique analysis of this sector in Ireland. In addition to the interviews, we carried out desk-based research to gather information on the blockchain sector in Ireland, and internationally. Our research was also informed by recent work from the Erasmus+ funded CHAISE project on the blockchain sector in Europe.⁵⁷ We liaised with our CHAISE partners to provide informative statistics relating to, for example, the percentage of women in the sector.

4.3.3. Case study findings

The sector/subsector

Our focus is on the blockchain sector in Ireland. Our interviews consisted of two industry professionals as well as the chairperson of blockchain Ireland, an industry network that works to promote blockchain technology in Ireland. We provide a description of the organisations/companies of each interviewee below.

Interviewee 1

A craft beverage exporter, established in 2014, that partners with small microbreweries in Ireland to create export chains throughout the world. They use blockchain technology to track and trace beer from production to the final product. The company consists of three executives with backgrounds in accounting, finance and marketing, backed up by three non-executive directors with experience in global sales and logistics. The company operates from two main distribution hubs in Belfast and London. It uses blockchain technology to enable consumers, suppliers and other stakeholders to verify where their craft beer product came from and to provide information on the processes involved in its production. It provides detailed information on the producer, resources and ingredients contained in the product. More recently, it has also been used to provide information on the carbon footprint of the product. The interviewee notes that *'every single can is tracked and traced from its production facility to the*

⁵⁷ <https://chaise-blockchainskills.eu>

fulfilment centre'. It is the first company in the world to roll out this type of blockchain application.

An innovation of this technology is that, while providing end-users with the ability to trace the product through the production and supply process, it can allow the end-user to see the carbon footprint associated with the product as it moves across a global supply chain. This type of transparency is likely to become even more important in future years, with an increased focus on climate change. The interviewee notes that the degree of transparency with this technology, *'really allows you to hone in on the producer's carbon footprint'*. With regard to the interaction with regulation and European institutions, the interviewee notes that,

'I think the piece that is missing for us at the moment is an actual mandate around how carbon footprint is calculated from an EU level, but also from an Irish government level.'

However, while blockchain technology may provide solutions for transparency regarding carbon footprint, the interviewee also raises the issue of energy usage associated with blockchain. The interviewee notes that in general mining on the blockchain is very energy intensive, and this is a negative side to the technology that the interviewee is aware of, even more so in the light of the company's business model.

Interviewee 2

Interviewee 2 is based in a venture capital backed start-up company, founded in 2017 in the United States, providing blockchain infrastructure to organisations around the world. They also provide hardware, software, and security solutions and maintenance to its clients so that they can interact with blockchain technology. The company provides services across a wide variety of blockchain protocols including bitcoin providers. The interviewee states that their clients are typically *'financial institutions, as well as family offices that want to invest money'*. Since the company works with blockchain and cryptocurrencies it *'also holds cryptocurrency tokens themselves as a company, and those legally live or are held in Ireland'*. The company was legally incorporated in Ireland in 2018 and operates largely by remote working.

The company 'is a "remote first" company, so it doesn't really matter where people live, and where people sit, so they aren't huge differences in how we work in America or Ireland or we have people in the UK as well, we all work remotely.'

The company's leadership team consists of approximately 50% female and male managers each, and they are actively encouraging and looking for employees from a variety of diverse backgrounds.

Interviewee 3

Interviewee 3 is a representative of a blockchain expert group which consists of developers of blockchain technology, legal and regulatory professionals, enterprising and start-up experts, and educational and training providers and managers in Ireland. Their focus is on the promotion and sharing of information on blockchain and distributed ledger technology in Ireland. To achieve its goals, the group organises information-sharing events and collaborates in research activities to advance the visibility and sustainability of the blockchain sector. The interviewee highlights that one of the current goals is to

'make a proposal to government to create a national level framework for blockchain and to have a multi-institutional collaboration to deliver skills in an appropriate fashion with regulation covering all the issues that are there in blockchain around regulation, standards, skills, infrastructure and around government services'

Since its formation in 2015, the expert group is involving more than 100 organisations nationally and it is connected to other major industry networks internationally. The expert group's governance team consists of nine steering group members from the following working groups within the organisation: Developer, Enterprise & Foreign Direct Investment, Start-up & Venture Capital, Skills, Education & Innovation, Legal & Regulatory, Public Relations & Communication, and Blockchain Events.

Interviewee 3 is also involved in a national group which aims to promoting female participation and involvement in the technology and blockchain field. The main goal of that group is to raise awareness and foster inclusivity in the blockchain and disruptive technologies scene. The group aims to provide an inclusive space for women and marginalised groups to showcase their work on blockchain applications and to demonstrate to the wider sector the relevance and unique elements that are brought to the blockchain space. The interviewee states that

'The main mission (of the group) is to increase awareness about blockchain technology and other technologies but also to look at the issue of inclusivity and equity within that and to look at pathways, in terms of education, training, development for people, so that it opens up the opportunity for people to see in their own careers what blockchain is'

The group was founded in 2018 by seven members from a variety of backgrounds, including policymakers, entrepreneurs and education and training providers, with a special interest in the blockchain technology. It currently consists of approximately 1,000 members fostering inclusivity in the blockchain sector across genders, ages, and societal barriers. The group strives to highlight domestic and international experts, as well as organisations, and projects involving and advocating for marginalised groups in the blockchain scene.

Globalisation

Interviewee 1

The company operates from two main distribution hubs in Belfast and London and works with local regional suppliers. However, the company has strong links with the global supply chain, and this forms part of the key innovation behind their product. By using blockchain technology to track the entire production and supply process, the end product is traced from the regional supplier, through the international fulfilment centre, and on to the customer. The business model recognises the inter-related and often complex global supply chains and seeks to provide the end-user with easily accessible information about the route the end-product has taken through the production and supply process. In that sense, it has strong regional links with local producers, as well as links with international fulfilment and delivery centres.

The complexities of the global supply chain can make product recalls difficult. The interviewee points out the potential benefits of blockchain in this regard:

'A big issue for large retailers, when they're doing both food and beverage is in recalls, so if you have, for instance in our industry if you have a box of bad beer and it goes on shelf, whether the yeast is impacted or whether something happened along the supply chain, you can instantaneously pinpoint that batch from the shelf to the consumer. At the moment [without BC], it takes, from when we have been told, somewhere between five to six days to get the same audit trail. So that's a huge benefit to large buyers, it's definitely advantageous when you're putting that level of transparency and it just allows real time decision making and real time action to happen a lot quicker.'

Therefore, in addition to providing end-users with information on the provenance of their product, an additional value of this technology relates to food safety. Again, the company takes account of the intricacies of global supply chains and comes up with solutions to address that complexity. There appears to be significant scope for applying this technology more broadly in global supply chains.

While not the focus of his business, the interviewee notes the potential role of blockchain technology in detecting fraud. He notes that there is a lot of parallel trading occurring where *'large brands are traded in certain areas of the world fraudulently'*. Implementing this type of technology would allow companies to have transparency in where their product ends up.

The respondent also indicated that while globalisation has been hugely beneficial to the world economy, it can also be associated with environmental damage, particularly if supply chains involve importing inputs over very long distances. Blockchain technology allows consumers to

see the carbon footprints of their purchases, which will have consequences for the extent to which global markets are integrated.

Interviewee 2

An interesting feature of the company that Interviewee 2 represents is that it does not appear to have much of a physical presence in Ireland or internationally. A large motivation for the company's registration in Ireland relates to the country's institutional framework for facilitating the holding of cryptocurrencies. The respondent states that

'At the moment there is a lot more regulatory uncertainty (in the US), it's not really clear what's going to happen in the next year, they are putting out laws they're discussing it, but it's a lot less clear. In Ireland, at least for now, I think the path for the next one or two years is clearer.'

Furthermore, the company is spreading its activities across several different countries in order to hedge against the regulatory uncertainty and the changes that may occur in the cryptocurrency space. The respondent felt that the uncertain regulatory environment was the biggest issue currently facing the company and the blockchain sector overall:

'We are thinking a lot about how we navigate that [cryptocurrency] regulatory landscape and especially now with bigger institutions from the world of finance coming in, and they all need some sort of regulatory certainty. They need to know what's going to happen, and they need to have some sort of safety in knowing what the next year looks like.'

This is one of the main reasons for legally incorporating the company and working from Ireland. At the same time, due to the remote working structure in the company, they are attracting blockchain workers from around the globe. Due to the largely digital nature of blockchain operations, the company is working across borders and in different jurisdictions. Therefore, the highly space-independent nature of blockchain operations allows developer companies to locate in the jurisdictions with the most preferable regulatory framework without incurring punitive costs.

Interviewee 3

Interviewee 3 states that the blockchain community is an international community and that major countries and regions around the world are interested in this technology and future blockchain related developments. They say that

'Europe has decided to be a leader here (in the blockchain sector), they're putting a lot of investment through the digital agenda but linked it also the green agenda.'

However, blockchain-related policy is critical for this sector to develop in Ireland and Europe and to become more sustainable. The interviewee provides an example; *'Singapore is probably leading in blockchain developments, where the state, the industry and everybody's working together'* through appropriate policy aimed to attract more investment, talent and to advances the digital and blockchain sector in the country. As a result, an Irish blockchain company is *'going to be incorporated in Singapore, because they got the investment there'*. To grow the blockchain sector in Ireland and to adapt to changes in digital technology, the interviewee states that, *'Ireland has to be really competitive and create that infrastructure, regulation, skills, the capacity for growth, the capacity to bring in expertise and make it easier'* to operate in this country. It is important to note that blockchain is a global technology linking many different organisations and associations around the world, which in turn is creating a sustainable global sector. Ireland is well positioned to reap economic and social benefits of this technology due to its innovative advancements in digital technologies and its highly skilled labour force. Finally, the respondent again emphasised the critical importance of the technology for increasing consumer awareness about the nature of the global supply chains involved in their purchases.

Main themes

Blockchain technology is an international technology that connects stakeholders across the globe (Belu, 2019). Due to the largely digital nature of this technology, like globalised business services at large, it makes it easy for people to work across borders, and this may enable further globalisation of labour markets. This is reflected in interviewee experiences, but they also highlight that appropriate public policy and regulation is necessary to maintain a competitive edge in attracting investment and talent. Further, the CHAISE project (CHAISE, 2021) states that a regulated and secure blockchain sector sends a positive message to the market which in turn attracts further investment. To reap the rewards of this technology, the Irish government is considering blockchain in its relevant future economic policy, which is already evident in the digital technologies plan (Government of Ireland, 2022a) and the regulation of financial securities (Government of Ireland, 2019).

Technology use

Interviewee 1

Interviewee 1 (craft beer exporter) is the first company in the world to use blockchain technology to allow customers to trace the origins of their beer all through the production process. This is done via a QR code on the can that customers can scan, and this will allow them

to see all the links in the supply chain from barley to beer. The point of blockchain here in to create an immutable ledger that tracks the production of beer from raw resources to the final product in an efficient and transparent way. The provision of the blockchain technology is outsourced from an IT company, rather than being developed in-house. The company explored blockchain technology provision across providers and noted that some of the services were not commercially viable for a small business. However, eventually they partnered with a subsidiary of Microsoft, which has worked well.

Regarding the cost of implementing this innovation to the production process, the interviewee notes that, *'it comes down to about a penny per label to put this technology in behind your product'*. Speaking about the general use of this type of technology, the interviewee notes that *'people are moving more into this smart contract space, where I do see huge advantages to that. Rather than using paper receipts, we can have digital receipts'*. However, the interviewee comments that, as with most technologies, he thinks *'there are a lot of failures that need to be made before the big success stories come through'*.

Interviewee 2

Interviewee 2 suggests that blockchain technology has the potential to play a significant role in a variety of sectors and businesses. They say that *'blockchain technology is good technology to use in situations where there isn't inherent trust by the participants'*. The respondent emphasises that the whole idea behind blockchain to build a decentralised trust system that different people can use to interact with one another safely and securely. A prominent use of blockchain technology can be found in the finance sector, *'you know, sending money back and forth, but we don't want to rely on banks as our trusted points that navigate the system'*, so blockchain enables users to bypass the traditional banking system. Supply chain management is another pathway to incorporate blockchain technology because it often involves different companies and actors interacting with each other and across different jurisdictions. The interviewee believes that

'Blockchain can make that (supply chain management) easier, faster and cheaper because you can essentially codify ownership, you can codify contracts where you typically need to spend a lot of time with lawyers to figure that out.'

However, they state, that

'In the market (in relation to supply chain management) at the moment, unfortunately, (blockchain technology) is mostly a proof of concepts. I'm still waiting for what I see in the market that's beneficial and can be used at a bigger scale.'

Interviewee 2 indicates that blockchain technology is currently also used by some of the public. For example, ‘decentralised autonomous organisations, like groups of people coming together, working together towards some goal that is governed by a smart contract on a blockchain’. In terms of a wider societal use of blockchain technology the interviewee states that, although blockchain is currently open to a lot of opportunities for societal integration, ‘I think we are still years away from that, I think the technology isn't ready yet, it's not as user friendly as it can be, and it's not as fast as it can be’. The interviewee hopes that blockchain technology ‘will help different groups in the society to interact with each other in a fairer way’.

Interviewee 3

Interviewee 3 suggests that the use of blockchain technology largely depends on its adoption in any number of areas where information needs to be transferred securely and quickly. For example, blockchain technology is already in use in the beverages industry, financial services sector, health, education, and manufacturing. However, it is still considered a disruptive but innovative technology. Since blockchain technology is already ‘*moving from proof of concept to proof of stake, and if we can get people investing in it rather than having to prove the concept*’ then its adoptability will improve. For example, some of the innovative applications of blockchain include helping homeless access appropriate resources, working with domestic violence victims, and providing opportunities to marginalised people to bypass the traditional banking sector to give them control over their money. The interviewee highlights that ‘*it is important to show [to policymakers] what is possible with blockchain for societal change*’, and that this technology is not just used to facilitate cryptocurrency exchange.

Main themes

Interviewees note that blockchain technology can help improve the supply chain process, by making it more transparent, secure and efficient. More generally, interview respondents agree that blockchain technology is useful when information needs to be transferred efficiently and securely, especially when there is no inherent trust between stakeholders. It has also facilitated improvements in negotiation and agreements between many ‘untrustworthy’ parties through the implementation of smart contracts (Khan *et al.*, 2021). Interviewees see great potential of blockchain utilisation in the smart contracts space in the future. In terms of the cost of blockchain, it is relatively inexpensive to implement and maintain, and it can significantly improve the efficiency of transactions yielding further benefits to an organisation (Zheng *et al.*, 2018). This is supported by our interviewees who believe that overall benefit will outweigh the costs of running blockchain. However, security risk and legal issues may still be an issue (Khan

et al., 2021), and further attention is needed to build a safer exchange of information. Adoptability of this technology will also depend on the public's perceptions and understanding what it does. Interviewees state that it will take some time for people to become familiar with blockchain technology and its applications in the future.

4.3.4. Impacts

Skills

Interviewee 1 (craft beer exporter) notes that, while there is a lot of talk about labour and skills shortages with regard to blockchain technology,

'I don't actually see this as being a massive issue. I do think that there are a lot of very skilled computer scientists and there are a lot of skilled people that are very versed in technology, it's almost second nature and there is an incredible amount of transferable skills.'

However, while the interviewee believes that general computer science degrees provide a lot of transferable skills necessary for blockchain, he points out that there is a lot of demand for blockchain specific diplomas. The interview is of the opinion that there is a

'Hunger to get diplomas that say, "I have skills in blockchain", and I've had a number of people reach out to me that are from a technology background, but they would prefer to have that extra degree or course in blockchain, so that's definitely a huge gap.'

The respondent was aware of some blockchain specific diplomas but believes there is a gap in terms of the provision of such courses. This gap could possibly be filled by inserting modules into existing courses.

Interviewee 2 indicated that the entire blockchain space is only twelve years old and that it became interesting to businesses around five years ago, so it is difficult to find people with blockchain experience and specific blockchain skills. As a consequence, the company has developed their own training platform.

'We started what we internally called (company name) University, which is our internal onboarding and kind of training tool that we use within the company, because we did see that there isn't that many people out there that have a lot of blockchain experience, so we need to also look at hiring non-blockchain people and then train them.'

Due to increased industry demand for blockchain skills, the interviewee states that in relation to future blockchain skills, 'universities are adding (blockchain) courses, and so my gut feeling is that we are going in the right direction, whether it's enough that I can't really tell you'. They are positive that with increased public awareness about blockchain's potential and the

availability of blockchain education and training resources 'more people will jump on the blockchain wagon, and more people will be available'. The current lack of blockchain skills is limiting sector growth in the short term, and the interviewee states that 'we can try to train people internally but that only goes so far' as an increased supply of blockchain graduates from higher education institutions is likely to satisfy the growing demand for blockchain skills in Ireland and worldwide.

Interviewee 3 states that the development of the blockchain sector in Ireland is negatively impacted by the lack of qualified workers with blockchain skills. Due to this shortage of blockchain skills, companies '*bring in people and train them themselves, so it is quite competitive to get people in this area*'. Blockchain companies in Ireland rely on computer science graduates who can be trained in blockchain development but '*it's nearly like a sticking plaster, they're managing to get on but if you want to develop something (the sector) you have to have a long-term plan*'. To mitigate the shortages of blockchain skills, the interviewee states that '*a policy of how we approach the development of (blockchain) skills through the traditional higher-level education in this area is very important*'. Policymakers should be '*working with the industry to be very responsive (and) to look at what skills are needed and how they can be delivered*'. Many of the more experienced blockchain developers come from overseas, and that it is also important to consider skills inflow from abroad and to make it easy for them to integrate and work in the blockchain sector in Ireland.

Main themes

The blockchain sector has experienced significant growth over the last decade. However, blockchain skills supply has been slow to adjust. Interviewees state that due to the lack of appropriate blockchain skills in Ireland companies often rely on employing people with ICT or computer science background to fill the vacancies and then training them in blockchain technologies internally. This is also observed across the EU (Whelan *et al.*, 2021), as education and training providers have only recently increased their focus on blockchain teaching and training. Interviewees indicate that further investment in blockchain education and training programmes at a national level is likely to address the skills mismatches in the labour market. Further, strong education and training and industry links contribute significantly to the development of blockchain skills in Ireland. For example, the blockchain community network in Ireland, represented by Interviewee 3, is working towards linking industry demands to education provision and inform policymakers and educators on labour market developments in Ireland.

Employment

Interviewee 1 (craft beer exporter) contributes to employment within the region as well as internationally as part of the global supply chain. For example, they recently worked with one of the oldest regional microbreweries in Ireland, whereby every can is traced from the regional production facility to an international fulfilment centre in the UK where they have a large commerce seller.

Interviewee 2 states that the lack of appropriate blockchain skills in the Irish labour market can have an effect on the blockchain sector in the country but this is not the case for their organisation. Due to the company's model by which employees work almost exclusively remotely it tends to insulate them to a large extent from country-specific blockchain skills shortages. They state that

'We would have loved to hire more people in Ireland, we just can't find them and that's one of the reasons why we are hiring worldwide. Just because there is a limited number of people, and if we restrict ourselves to trust one country, you know that limits the amount of people... So that forced us to look for employees in other places other than Ireland.'

Even around the world blockchain employees are scarce, and the interviewee indicates that because of this *'we cannot grow as fast as we would like to'*. However, they are optimistic about the future because of an increasing number of blockchain courses and modules at a university level, and therefore, potential blockchain graduates. They state that *'over the next five years or so, once we have like one or two cohorts who went through these [blockchain] courses that will mitigate the issue a little bit'*. The company would also like to hire people with experience in blockchain but due to the relatively recent establishment of the blockchain sector *'it's really tricky to find people who have, say, three years of (blockchain) experience'*. As a result, for now the company relies on new entrants to the sector to train them internally, *'and I think it just takes time and will change over time, but until then we are suffering with talent shortage'*.

Interviewee 3 states that the expansion of the blockchain sector internationally is likely to have a positive impact on the demand for blockchain workers in Ireland. The interviewee notes that there is *'an American company that would like to make Ireland a [blockchain development] centre, but the real issue is how they are going to get graduates and qualified people to get work in the area'*. Increased investment, national policy and setting up blockchain hubs or centres of excellence across Ireland *'would create Ireland as a domestic and international hub'*, which would improve the overall labour market share and expansion of the digital technologies sector. However, the lack of dedicated policies and of blockchain-specific training in higher education,

and the disconnect between the sector and higher education institutions means *'that there are lots of jobs available, mainly [blockchain] developer jobs, that are of course competing with other technologies in that area as well'*. As a result, the expansion of the blockchain sector in Ireland and the increased demand for computer science graduates is likely to attract workers from other digital technologies sectors.

Main themes

Due to the international nature of the blockchain technology many employers seek workers from outside of their country of origin. As indicated by our interviewees, this is mainly driven by the lack of appropriate skills in the domestic economy, but the digital nature of the technology and business environment means that companies can rely on remote work of their employees. Further, blockchain jobs are regarded as good quality jobs with relatively high wages, as the average blockchain developer earns approximately 45,000 euros per year (Brunner & Ehlers, 2021). The transferable nature of blockchain skills means that persons with ICT or computer science background can be employed in the blockchain sector. However, this may influence skill supply in other technology-intensive sectors and industries as the blockchain sector attracts more workers.

Inequality

Interviewee 1 noted that there appears to be a gender disparity in the number of workers in this type of sector, with relatively few women. However, the interviewee notes that this appears to be a broader issue with the 'tech space' rather than a blockchain-specific issue. Commenting on the tech sector, the interviewee notes that, *'I have noticed that unfortunately there is gender inequality there, but I don't necessarily know why.'*

Interviewee 2 also acknowledges that there is a gender gap in the blockchain sector. Their company is trying to hire more women but *'we don't have enough women applying for jobs, that's a challenge'*. The interviewee feels that the blockchain space is more open to women but also other minority groups than other ICT sectors. They see a lot of minority groups working in blockchain, such as people from the LGBT+ community, and state that the *'reason is because blockchain is pretty much a grassroots movement [... the creators of blockchain] always had in mind [...] these concepts of equality, censorship resistance and so on'*. They also feel that *'again it [gender and minority group equality] is a little bit better in blockchain than in other STEM fields, but we are definitely feeling it, we are trying to actively work towards more diversified teams'*. As a result, their company's leadership team is close to 50% split between female and male leaders.

Interviewee 3 states that gender inequality in the blockchain sector is prominent. In support, a recent study on blockchain skills demand show that approximately 20% of the blockchain labour market across Europe is represented by women. The interviewee suggests that *'it goes back to the original STEM issue'*, as women continue to be underrepresented in STEM. They also suggest that

'Creating awareness, starting in primary school, and getting primary teachers and involving these (blockchain) technologies in education degrees, and that it's a more inclusive understanding of this technology.'

may positively affect women's labour market participation in blockchain. They also state that *'it comes down to individuals in the school, and not just the teachers in schools, but the curriculum and parents are critically important, as well as young people themselves are critically important'* to gain a better understanding of the blockchain technology and improve gender equality in the sector. The interviewee emphasises that

'Our approach (to education) is very traditional, I think you have to be a little bit more creative now, look at civil society and involve them, show the voluntary sector, not for profit (sector) and what can be done with them.'

Interviewee 3 provides additional example of blockchain technology that can be used for societal benefit. For example, an app in France uses blockchain technology to quickly communicate information about domestic violence incidence;

'about what's happening, and more importantly, they also can use it with police in recording interviews. The key thing, then, is that this information can be used by lawyers and accepted by the judiciary now in France.'

There are also examples of blockchain use that can tackle wider inequality. Blockchain technology can help disadvantaged people *'outside of a financial net and financial services and gives them control over their money and gives opportunities to make money and use money much more effectively'*. The interviewee advocates that blockchain has advantages in helping people experiencing homelessness access financial services which is often a huge barrier for them in accessing employment. Khurshid *et al.* (2020) also finds through a field experiment that blockchain allows a homeless community to overcome barriers caused by lack of housing or permanent address to securely store and share personal information in an institutional setting, such as access to healthcare. The interviewee highlights that *'generally people are inspired, you know, by these [blockchain use] stories because they don't think [about the] technology'* but about the societal benefit this technology brings about.

Main themes

The interviewees focus on the gender employment gap in the blockchain sector in Ireland, as significantly more men than women are working in this space. They state that this outcome is a direct consequence of less women in the STEM field overall. However, the number of women in STEM fields in higher level education have been increasing in Ireland (Delaney & Devereux, 2019). Therefore, it is likely that the gender employment gap in blockchain is likely to narrow as more qualified women enter the labour market. Further, as indicated by our interviewees, active efforts to employ more women and people from minority backgrounds is going to reduce the gender employment gap in this sector as well.

4.3.5. Conclusions

Blockchain is a relatively new technology that is still developing. Some of the applications of blockchain technology can be seen in the supply chain management of different firms across many sectors, transfer of information in the financial and healthcare sectors, as well as enabling marginalised groups in society to access, store and transfer personal information efficiently and safely. As the technology continues to move out of its proof-of-concept stage, its potential areas of application are almost endless.

Blockchain has important implications for Ireland as it is critical that the country remains close to the centre of the technologies development to strengthen Ireland's reputation as a leading global provider of information and communication technologies. The labour market for blockchain skills is expected to be broadly in balance for the 2022 to 2027 period in Ireland. While any future shortfalls of blockchain supply could be met from existing general ICT graduate provision, this would impose additional training costs on both blockchain provider and user organisations. It is advisable, particularly given that the demand for blockchain skills could easily exceed current forecasts, that Irish policy makers consider the merit of expanding the provision of specialist blockchain training provision beyond planned levels.

Skills and regulatory issues are seen as major policy areas facing the sector in Ireland. At a European level there are clear strategies in these areas, but that is not the case for Ireland. From a government perspective there is a plan to create an advisory committee that focuses specifically in blockchain issues. Although there is no blockchain-specific regulatory authority in Ireland the government is interested in supporting blockchain developments as outlined in

the 'International Financial Services Strategy 2025 – Ireland for Finance'⁵⁸ and the 'Harnessing Digital - The Digital Ireland Framework'.⁵⁹ There is a clear need for government leadership in the area to build trust across the wider population in the technology and develop awareness of training needs in the field among education and training bodies. The need for improved awareness of the technology among both industry and consumers requires a clear information role for government. It is also important to understand that blockchain is much broader than currently perceived.

As in all other STEM fields female representation in blockchain is low and there is a need for policy action to improve the gender balance which will also contribute to the skills supply in the sector. Stakeholders see perspectives in showcasing the wide, also socially impactful possibilities of the technology to (potential) students and teachers, also in early education.

A key aspect of the blockchain technology is that it makes the supply-chain associated with products entirely transparent to the consumers and other stakeholders. A potential implication of this increased transparency is that it can enable consumers to establish the carbon footprint of an item prior to purchase, which may well act as a disincentive for producers to supply inputs from geographically remote markets. It is highly possible for instance that, because of transparency enhancing impacts of blockchain technologies, European firms will become more reluctant to extend supply-chains to markets in Africa and Asia. Paradoxically, a space-independent technology such as blockchain has the potential to induce a radical remapping of global supply chains in the direction of regionalisation.

4.4. Digital transformation at the company level through the lens of workplace innovation by Mikkel Barlund and Karolien Lenaerts

4.4.1. Introduction

This chapter reports on a case study of a Belgian company active in the testing, inspection, and certification (TIC) sector, which has undergone a major digital transformation in the past decade. This digital transformation is mainly aimed at the standardisation of the internal processes related to the planning, execution and reporting of audits. To this end, new digital technology was introduced which came with a new way of working for those using this technology on the job. The underlying idea was that these changes would bring the company up

⁵⁸ See <https://www.gov.ie/en/publication/ireland-for-finance-strategy/#>

⁵⁹ See <https://www.gov.ie/en/publication/adf42-harnessing-digital-the-digital-ireland-framework/>

to speed on the digital front, so it could remain competitive - being one of the biggest but also most expensive players - in this growing sector. Several of its competitors have recently started, or have already completed, digital transformation processes within their companies.

Furthermore, technological transformations more generally have an impact on the types of goods and services that such companies test, inspect and certify, and consequently on their own activities. TIC is an expanding subsector of business services which is less space-independent than the previous cases as it is often physical objects or space-dependent procedures and data that are being inspected and audited. For example, new technologies may require new types of assessment procedures or new kinds of certificates (e.g. robots, Internet of Things, blockchain), but can also support testing, inspection and certification services (e.g. use of drones for inspection in hard-to-reach spaces). The company under investigation in this case study, for example, *'heavily invests in new technologies and in better ways to ensure greater safety and efficiency'*.

In addition to technological transformations, companies operating in the testing, inspection and certification sector are also exposed to other global trends. Similar to digitalisation, the greening of the economy reshapes production processes as well as the use of resources and materials, which in turn may cause changes in the testing, inspection and certification required (e.g. verifying that materials can safely be re-used and with the expected quality). As regards globalisation, companies engaged in testing, inspection and certification play a major role in supporting international trade, and therefore the sector is also affected by developments in global value chains and by changes in regulations and policies related to trade, national security, etc.

In this context, the company's digital transformation is described, focusing on the decision to move ahead with this digital transformation, the process itself and its outcomes, and the involvement of employees in this process through direct and indirect participation. This is linked to workplace innovation. More specifically, the new technology came with significant changes in the job content, the skills required and the organisation of work. Some of the autonomy and flexibility (e.g. in terms of planning, task autonomy) that employees had previously was traded off against other potential benefits (e.g. efficiency gains, less work to take home), and thus also affected their wellbeing. Alongside the introduction of the new technology and new way of working, the company has undergone an internal restructuring process, with the creation of several new departments. As will become clear below, some employees perceive this restructuring as if several companies were being set up within the larger company, since

now the different departments appear to work rather autonomously. Although these two major changes are not directly and not entirely related, it is clear from the interviews that they do affect each other and are difficult to disentangle for the workers involved.

The aim of this case study, therefore, is to investigate in depth the digital transformation process of a company operating in a sector where the use of new technologies is growing in importance, from a workplace innovation lens. The concept of workplace innovation starts from the idea of evidence-based organisational practices that enable all employees to use and develop their knowledge, skills, experience and creativity to the fullest possible extent, while enhancing business performance, engagement and wellbeing at the same time (Totterdill *et al.*, 2002). Technological transformation and organisational changes in the culture, the structure, etc. should thus go hand in hand, and the direct and/or indirect participation of employees is critical in this regard. In this case study, however, trade unions and employees were only involved when the key decisions were already made. A slow start, technical issues and the significant impact of the new way of working triggered significant resistance among the employees who had to work with the new technology, and led to social conflicts within the organisation. While the new management has worked to fix some of these issues, it remains an ongoing challenge to get everyone on board.

The structure of this case study report is as follows. This section presents a brief overview of the key aspects of the case that was analysed and the methodological approach that was used to do so. The section introduces the company and its main activities, and further discusses the most important aspects of the digital transformation process that it is going through. Section 4.4.2 outlines the methodology of this case study. Section 4.4.3 presents the main findings, going in more detail on the digital transformation process and the (lack of) involvement of workers and their representatives. Section 4.4.4 discusses various impacts of this process (mostly in terms of skills and job quality). Section 4.4.5 concludes the case study report.

The case and its context

This case study traces a digital transformation process in a testing, inspection and certification company – where a technology was introduced to standardise and harmonise service provision. Alongside this digital transformation, the company has seen some internal restructuring in the past decade. The company has a long history and is an important player in its market, in terms of the number of clients it serves, the wide range of services it provides to different types of

clients (from private households to multinational companies and everything in between) in a variety of sectors, and the number of workers it employs. The broad scope of service provision and the restructuring exercises that have taken place also mean that the company has quite a complex structure at the moment. Over time, it has undergone a series of mergers and acquisitions and it is now part of a major network of similar companies operating in Europe, consolidating its market position in Belgium and its neighbouring countries.

How does it fit into the triangle of technological change/globalisation/demographic change?

Although especially globalisation and technological change are global trends that come into play in the context of the testing, inspection and certification sector, and for the company, the case study is dedicated to a digital transformation process that was started in the past 10 years. The competing organisations in the sector, similarly, have started or already completed such processes. With the new technology, the company hoped to improve planning, execution and reporting of audits, by standardising and harmonising them through a digital tool. This resulted in large changes in the job content and the work organisation, affecting the autonomy, flexibility, workload, skills and other areas of working conditions. As the decision to go ahead with this transformation and the implementation was made top-down, without much involvement of workers and their representative organisations, and as the process was very complicated and had several significant setbacks, the company faced severe resistance from workers and trade unions. Some of the principles of workplace innovation appeared *ex negativo*, after having been largely neglected.

Key impacts and ways these are being addressed or shaped

The digital transformation process affected the skills, employment and job quality of the workers in the company. The changes in the job content and work organisation implied that some jobs became redundant (typists), while other jobs were newly introduced (planners). In principle, the knowledge and skills that are required to provide testing, inspection and certification services have not changed. Nevertheless, especially the trade unions have flagged that the new technology leads to deskilling in several ways: by simplifying the task itself, and by changing the content of the in-house training that is provided. The adoption of the technology also introduced new tasks, and takes some time to learn how best to use it. In terms of job quality, a decline in flexibility and autonomy were noted, while the impact on work-life balance was mixed. Some health, safety and well-being issues were also reported.

Several interviewees, notably the trade union representatives, pointed to the lack of involvement of workers and the trade unions as a critical issue, which, in their view, contributed to the negative impacts on health, safety and well-being that are now visible. The established power balance between management and staff became skewed, and despite efforts to restore it, in late 2022 the company is still struggling with a big internal conflict that seems difficult to resolve.

4.4.2. Methodology

The case study relied on desk research and a number of interviews with representatives from the management or the employer's side and representatives from the employees' side (i.e. trade union representatives, employees). This includes one joint interview with a change manager and an HR manager, one interview with a team leader, two interviews with workers using the new technology, and two interviews with trade union representatives. Some of these interviews were done online, others on location.

4.4.3. Case study findings

The company

This case study is centred around a Belgian company that is active in the testing, inspection and certification (TIC) sector, which launched an important digitalisation project in 2016. The company was established over 100 years ago, is active in all Belgian regions and serves a wide range of clients (from individuals, self-employed, small- and medium-size enterprises to multinationals) in a wide range of sectors. The company is a major player in the Benelux in its sector. It currently counts over 2,000 employees, most of whom are highly educated and have a formal education background in STEM (Science, Technology, Engineering or Mathematics). Given the nature of the services that the company provides, there is a clear division according to gender in the workforce: women are overrepresented in human resources, administrative and financial services, while most employees actually involved in testing, inspection and certification are men.

More generally, TIC companies provide conformity assessment services based on activities such as testing and inspection, validation and verification, certification, or surveillance, to different sectors that each come with their own legislation, regulatory framework, standards and requirements (TIC Council, 2020). These activities contribute to the protection of public health and safety, the data and privacy of consumers, the environment, etc. Globally, over one million

workers are employed in the TIC sector, of whom most are in high-skilled and high-wage jobs (TIC Council, 2020). The TIC sector, moreover, is expected to continue to grow in the future. According to the 2020 TIC Council report, the TIC sector was worth around 200 billion USD globally in 2020, and this is expected to grow to 260 billion USD in 2025.

Since it was founded, the company in scope has engaged in a number of mergers and acquisitions, and has joined a larger network of companies operating in its industry. By doing such mergers and acquisitions, it was able to expand the range of activities it provides and the range of sectors that it covers. Over time, the company also sold off departments and activities that were not profitable. According to an EY (2019) study, mergers and acquisitions are an important source of dynamics and growth in the TIC sector. One interviewee said that large parts of the company in focus in this case study had been sold off by the former CEO, with the aim to focus solely on the Benelux market and become the undisputed market leader there. However, this turned out differently, according to the interviewee, with the company actually losing market share in Belgium.

The observation that the company engages in a wide range of activities for different types of clients and in different types of sectors also implies that it has a highly complicated internal structure. This complexity reflects the different activities or tasks, work environments, locations, etc. The company serves over 60,000 clients. The vast majority are based in all three regions of Belgium, but the company also has clients in Luxembourg and the Netherlands. In the past decade, several organisational changes were introduced in the company, which resulted in a changing internal structure. One of the interviewees explained that the complex structure of activities is reflected in the business units that exist within the company. These are organised thematically. However, this means that in some cases, specialised auditors have to travel large distances to carry out an audit which could be done by someone else from another unit who is much closer by. This interviewee was, therefore, in favour of (re-)merging all business units, (as had been the case in the past) to achieve planning efficiencies and save on travel time and effort. Still, this person recognised that some kind of specialisation has advantages, too (e.g. to remain competitive on the market).

Before the digital transformation was launched, the way that auditors worked was fully adapted to the complexity of the company's activities, clients and structure. Auditors had a lot of flexibility and autonomy in terms of working time and pace, task and planning autonomy, etc. This led to different approaches and standards or quality in the work delivered. The digitisation project, therefore, had the explicit goal of bringing more uniformity to audit execution and

reporting. It largely aimed towards a standardisation of procedures in a digital form. The complexity, however, also implied that such standardisation, even if in a digital form, was a huge task. Furthermore, as will be elaborated below, some auditors were quite invested in their established mode of working. These factors explain why the digitisation project turned out to be a complicated and long process. Another key issue is the very limited involvement of employees and the trade unions in the digitalisation project, especially in the initial stages. While the current management has recognised this as a core issue and is trying to resolve it, some unions and employees are very resistant to the new technologies that were introduced and the new ways of working that accompany them.

In terms of forms and practices of workers' representation, besides the formal and informal forms of direct participation (e.g. team and staff meetings, pilot groups, etc.), all three trade unions that exist in Belgium (officially recognised by law, considered representative, with seats on the National Labour Council) are active in the company. Although the most important level of social dialogue is the sectoral level in Belgium, several company-level collective agreements have been concluded, some of which relate directly to the technological transformation in the scope of this case study. Yet not all trade unions have signed these company level agreements. More generally, social dialogue is highly institutionalised in Belgium. The social partners are important actors in the area of labour and social policy. Collective bargaining is centralised, and structured, and lower-level agreements can only improve what has been agreed upon at a higher level. As a result, collective bargaining coverage is among the highest in Europe and relatively stable over time. Trade union membership is also rather high and quite stable. All three trade unions cover the entire country and (almost) all sectors. The two largest trade unions each count around 1,5 million members. The third trade union is significantly smaller, but still has around 300,000 members in late 2022.

Globalisation

Testing, inspection and certification companies have a key role when it comes to globalisation and to international trade in particular. The sector has facilitated the globalisation of value chains and production processes and contributed to international trade. In turn, the sector is also influenced by developments that happen on this front.

Table 11. Benefits of TIC services

Benefits for consumers	<ul style="list-style-type: none"> • Safer, true to their advertised claims, and consistently reliable and high-quality products and services • Easier to compare products and services (lower search costs) • More competition (higher variety of products, lower prices)
Benefits for businesses	<ul style="list-style-type: none"> • Improved regulatory compliance • Cost savings through reliance on independent TIC services • Increased demand, following from the trust and confidence that the use of such services generates in the marketplace • Easier market entry and market access
Benefits for policy makers	<ul style="list-style-type: none"> • Reduced public resources as safety and security of products and services in the market improves • Assistance with designing regulations and other programmes • Ensured compliance with requirements • Increased trade volume

Source TIC Council (2020), p. 7

As explained above, testing, inspection and certification services are aimed at ensuring that products, services, processes, etc. are safe and fully compliant with national and international standards, legislation and regulations (TIC Council, 2020; Wood, 2021).

Often, such compliance checks are a precondition for being allowed to enter and trade on a specific market. The rise of globalisation and international trade have, therefore, also increased the demand for TIC services (e.g. as manufacturing moved into different regions of the world).

Over time, the requirements imposed on traded products and services have become stricter, as regulations on health, safety, the environmental impact, etc. have been tightened (e.g. to combat counterfeit, etc.) (Wood, 2021). Related to this, the demand for TIC services is likely to increase further as client companies are also focusing on addressing societal challenges (e.g. companies themselves are getting more interested in the greening of production processes, etc. or taking social inclusion into account when hiring, *cf.* Whitehead *et al.*, in this volume). More generally, according to the TIC Council (2020), the main benefits for consumers, businesses and policy makers are as shown in Table 11.

Technology use

The case study itself centres around the introduction of a new technology that aimed to improve the planning, execution and reporting of audits. Sales and billing were not affected by the exercise. In the past, an auditor would have a lot of autonomy in all these areas, as, for example, notes were taken on paper during an inspection and then later typed up in a report. Auditors relied on a paper checklist during the inspections.

The new technology itself consists of two apps that communicate with each other. One of the apps provides an overview of the tasks to execute during the audit, while the other app contains detailed checklists. As a result, to effectively perform an audit, auditors need to access both apps. The interaction and synchronisation of information between the apps is thus critical (as well as the synchronisation of data coming from other sources and applications that the company uses). Especially when the new technology was introduced, this led to failures and breakdowns, as will be elaborated on below.

With the new technology, there was a switch from autonomous planning of assignments by the auditors to a planning process controlled 100% by a separate planning department. In the past, auditors were provided with a list of audits they had to carry out, and were able to choose the order, route, etc. themselves. For auditors, there was also a switch from working freely on paper during the audit and when drawing up the auditing report, to working on a standardised, structured checklist, using two separate apps while working on a mobile phone or tablet. This reduces the autonomy that auditors had in the past to some extent, and some feel that their expertise is being taken away (according to several interviewees). Another important change is that the beginning and end times of audits are recorded using geo-ping technology, which also makes it possible to record and monitor the travel time between auditing locations. Before the technology was introduced, auditors themselves had to keep track of the time spent and report this back to the company. Especially the time stamping spurred strong discussions with the unions, and a collective bargaining agreement was drawn up to lay down the rules. However, this agreement was only signed by two out of the four trade unions operating in the company. In sum, the technology mainly affected job content and work organisation.

Motivation to introduce the technology

Management decided to introduce the technology for several reasons. A first reason relates to the *external environment*. Management argued that the turnaround time of audits was too long, which was detrimental to service delivery. In the past, auditors would have to write their report on paper, type it up on their computer, finalise and print the report and then send it to the client company that was audited via post. This process could easily take 1.5 months. Under the new system, the auditor completes the report on a tablet while at the client's premises, doing the inspection. As soon as the auditor finishes the report (which is before moving on to the next audit), the report generated and sent automatically to the client. Clients thus receive the report on the same day that the audit takes place. Currently, in those activities where the technology is used, around 250 auditors use it on a daily basis, and 90% of clients receive the auditing report

on the same day. From that perspective, the technology aims to improve and in effect, automate back office processes. It does, however, also lead to a significant intensification of work for the auditor and has affected some of those in supporting roles in the organisation (e.g. typists, planners), as will be discussed below. A second reason relates to the optimisation of internal processes in the front office. Prior to the introduction of the technology, auditors themselves planned the audits. Management argues that this did not always result in the most efficient planning. Moreover, some interviewed managers suggested that in some cases, too close relationships developed between auditor and client, so that the objectivity of the audits was no longer guaranteed. A similar point was raised by an interviewed team leader, who viewed the fact that the company no longer assigns the same auditor to the same client on repeat audits as an advantage of the new approach. One interviewed worker, however, disagreed and pointed out that the advantages of knowing a specific client well were also lost (e.g. accessibility of elevators, specific characteristics).

Decision to introduce the technology and the technology adoption process

The decision to introduce such a digital technology was made by the previous CEO of the company, who according to interviewees from both the management and the employee side, generally had a rather authoritarian view on management. The former CEO's view, moreover, aligned well with the vision of the then IT manager. Together, they drew the outline of this transformation, with neither involvement nor input from other members of the management team, nor the trade unions. One interviewee explained that

'They assumed that everything would to be finalised within three months. That's not how it went. [...] The process took not three months, not six months either, but quickly became a year, then two years and finally over five years. Only last year the first pilots were implemented.'

A trade union representative similarly said that the CEO wanted a radical break from the paper-based administration system in place at the time and a complete and rapid changeover to digital work processes.

The team leader added that the project manager initially tasked with the roll-out of the new technology had little to no experience with what happens on the ground. They gave the example of the difference between clients where auditors have to check equipment that moves around and cannot necessarily be checked when the auditor visits the client's premises (e.g. cranes deployed on construction sites) and clients where the equipment is fixed and can be checked each time the auditor visits the premises (e.g. elevator). The digital technology, at first, did not

appropriately account for this distinction. Another core issue that was flagged in the interviews was that the technology initially focussed only on planning, execution and reporting of audits, but did not account for the data that feed into this system. This implied that the new apps were not designed to link up with the databases that the customer support team was actually using to input work orders or prepare invoices after audits were completed. These critical parts of service provision were outside of the scope of the new technology. This caused serious issues in the field that were often left to the auditors themselves to deal with. For example, when items had been forgotten in the work order, it is very difficult to add them to the checklists available in the apps. In some cases, this meant that those could not be audited and a new appointment had to be made, or the auditor had to call the company in the hope that someone could still add them to the checklist and that all data would synchronise in time, or items in question were audited and reported on paper. In other words, this made communication between different departments necessary but also difficult (as one could not access the data or tools of the other and vice versa). One interviewee said that this also affected the quality of service provision towards the clients. Interviewed employees similarly explained that the apps were initially designed with specific types of audits in mind, rolled out, and then revised based on the feedback received. However, when these apps were rolled out on a larger scale across more business units and teams, making adjustments did not appear to be straightforward. This resulted in a lot of lost time, increasing frustration and a decline in the goodwill of employees. Meanwhile, the project manager was replaced and no less than four different technology suppliers were involved. The entire process was very difficult, with lots of problems popping up, and it even led to lawsuits. This not only made the transformation very slow, but also very expensive. It was only when the CEO was replaced in December 2019, that there was more room for the involvement of the trade unions and other departments within the company. As one management interviewee noted,

'In the beginning no one was involved at all, we know that too, but we can't change that anymore. The project now has become too big to fail.' Another manager corroborated that *'The project is long past its start-up phase. It will be unstoppable, so the unions should not count on that. [...] We have to work with what's already there.'*

One of the workers who was interviewed stated that differences in involvement across departments and regions also appear to affect how the changes are received by different teams. Representatives from both the management and the employee side underlined that the implementation of the technology was certainly not flawless. In the beginning, when the

technology was not entirely ready yet, there was a lot of trial and error. This led to errors and mistakes, which caused frustration and a general distrust of employees in the system, and created resistance to the technology (e.g. due to errors in time registration). The data quality was not on point (e.g. items were missing from the search lists, it was impossible for an auditor to add an item that needed to be audited, the order of the list of items did not match up with how these should be checked, etc.). Data synchronisation also proved a difficult issue, but is a critical part of the system and the technology. The underlying IT infrastructure also needed, and still needs, improvements.

Moreover, the technical issues presented real challenges to the auditors using the technology in the field. One interviewee noted that especially at first, auditors were more occupied with making phone calls to the company because of an issue with the apps, than with the audit they had to carry out. Since auditors needed both apps to function to be able to do their work, any failure or breakdown led to significant waiting times. Interviewees, furthermore, noted that this was an issue especially when such failures occurred at the end of a shift, as an audit could not be concluded unless all information was registered in the app.

Several employees also stated that these issues affect the clients' perception of the company. One employee said that the company is one of the most expensive players in the market, which can only be justified by delivery high quality service in an efficient way. However, the new technology and the new ways of working have had a detrimental impact on both areas, according to this person. They also raised the issue that auditors themselves, as they visit the client at their premises, are the ones who have to deal with clients' complaints on top of the technical challenges (e.g. when a visit takes a long time because the app freezes, when auditors are late because the planning was too tight, etc.).

The new technology was implemented in different teams at different times. One of the team leaders noted that their team had been selected as one of the first to start working with the apps, because the team leader was highly experienced, had been with the company for a very long time, and was known for an open, positive attitude to change. This team leader noted,

'You can't get stuck; you have to go along, or you put yourself out of business. I was relatively positive towards that change, and also realised that it would take me some time while the rest of your service still has to run, of course.'

They also confirmed that increasingly, the input of the users of the technology is being asked and taken into account in improving the apps. Some of the initial issues have been addressed (e.g. better search function), while others are still present (e.g. synchronisation).

The length of the process and the many setbacks meant that the auditors who had to use the digital technology were reluctant to do so. It started weighing on their psychological well-being, according to representatives of both management and trade unions. Interviewees noted that auditors typically are detail-oriented perfectionists - these are critical attributes for them to be able to do their job - who have very high standards not only for the equipment, installations, etc. they audit, but also for the tools that they themselves must use when doing so. This point was also underscored by one of the interviewed trade union representatives who felt that the former CEO (who had put the digital transformation process in motion) preferred speed and efficiency over quality. This was generally at odds with the auditors' sense of standards and went against their professional pride, said the interviewee.

Changes to the technology and the underlying IT infrastructure are communicated via e-mail and through team meetings. Auditors, in turn, have the responsibility to report any technical issue in a timely manner, so it can be followed up swiftly by the IT department. The interviewed employees, however, found that communication on changes was poor, and that progress is slow.

Demographic change

The topic of demographic change does not figure much in the TIC sector as a whole, and to the company in scope of the case study more specifically. Some reports highlight the link between demographic changes and changes in the demand for specific products and services, which in turn also affect international trade and may be related to technological change. Further information on this is also provided in the following sections of this report.

Interrelated changes

As already discussed above, the TIC sector as a whole and the company under investigation here, on the one hand, are critical players in fostering international trade, globalisation and technological transformations, and, on the other hand, are strongly affected by these global trends themselves. The sector is also heavily impacted by (changes in the) international and EU legislation, regulatory frameworks, and standards in different areas. These changes both expand their business and render their work more complex, increasing the pressure to automate parts of it, but very likely not the ease of doing so.

4.4.4. Impacts

This section addresses the main impacts of this digital transformation process at the company level. It highlights the consequences in terms of skills and employment, job quality and

inequality. None of the interviewees reported any major issues related to the COVID-19 pandemic (besides having to move some on-site training online, respecting the mitigation measures in place, and also engaging in the provision of (extra) services related to COVID-19 crisis, e.g. urgent inspections in hospitals that should help increase their capacity to accept and treat patients). As the services provided by the company were deemed essential and critical, the company did not go into lockdown.

Skills and employment

As explained above, the new technology and new way of working alter the job content and the skills required for auditors using the new technology. One of the interviewees explained that the new technology and way of working comes with new tasks, which may require new or additional skills, such as setting up appointments with clients. A trade union representative highlighted instead that the new technology led to deskilling of the workers using it. The use of checklists - even though it made the applications more user-friendly and was introduced at the request of the unions - could seem to suggest that anyone can do any audit. This reduces the motivation of auditors. The digital transformation also shifted the focus of the in-house training that is offered from the content and procedures of the audits to using the technology. According to this interviewee, in the past, workers could start working without any formal training in testing, inspection and certification and would receive their training within the company. This training not only covered the necessary skills to do the job, but also the core values that the company wants to represent (e.g. high quality standards). This initial training was further enriched through the knowledge, skills and experience employees gained on the job. However, the focus on in-house training also implied that auditors had few outside job opportunities besides taking on a similar job at a competing company or setting up their own businesses. The trade union representative further flagged that when the technology was introduced, some workers lost their jobs (e.g. typists), and the company did not provide reskilling opportunities for them. Management representatives disagreed with the remark on deskilling, and indicated that this was a wrong perception.

'We always rely on the skills and expertise of the auditors to conduct their tasks; we only ask them to report on the findings in a structured and standardised way. The inspection itself does not change with this new technology.'

The technology in itself also requires some efforts to learn how to work with it. As one interviewee noted, *'it is not Facebook either'*. In terms of training, all auditors received a one-day course to learn how to work with the new applications. This seemed sufficient at first, but

several interviewees pointed out that updates to the technology are not adequately explained, so that new colleagues who received more recent training often know more options and functionalities than colleagues who have been at the company for a longer time. This is perceived as frustrating. With auditing work taking pace on clients' site, there is little room for knowledge exchange and circulation either. In addition, through exchanges between colleagues it became clear that some functionalities of the apps are not always well understood by the users.

Management representatives noticed that most of the errors and mistakes that are made are not necessarily linked to the technology as such, but rather are human errors that can be addressed through training and coaching of the auditors, or process-related issues, that should be tackled at the organisational level. Working on the skills of those using the technology has the advantage that once they get more familiar with it, the resistance goes down.

Due to the difficulties that auditors encountered when using the technology and in light of the new ways of working, the company has established a number of 'help lines' that auditors can call upon: team leaders, the planning department, the IT service desk (which now has a team dedicated to providing support relating to the technology that was introduced), and one business unit also has a 'priority help line' that auditors can contact to get immediate help with the technology. The company is also putting a lot of effort into coaching of auditors and appointed 'ambassadors' who are superusers (e.g. team leaders, very experienced auditors) of the technology and accompany auditors during the first days of use in the field. The trade unions are involved in the training of the auditors, yet some noted that while training is offered, the number of available training slots is low. Several interviewees noted that especially older workers still struggled with the new technology.

Interviewees identified still another bottleneck in terms of knowledge and skills related to the planning department. They mentioned that not only are there too few planners, but that planners also receive insufficient training and are neither familiar with the clients nor the activities that they have to schedule.

Job quality

The introduction of the technology and the new way of working that comes with it, has led to severe discussion in the company, with trade unions stipulating that job quality has deteriorated for those employees who are working with the technology now. The unions also linked cases of burn-out to the new technology and new way of working. The lack of

involvement of unions and employees in the project - especially at the initial stages - has complicated the situation. Trade unions argue that the initial design and the top-down approach to technology adoption is problematic, with severe negative effects. Especially from two of the four unions, there is still very strong opposition to the technology and the new ways of working. However, according to some managers who were interviewed, the reason why some unions are so opposed is that the technology and the new way of working increase the transparency of service delivery, and bring to light differences in work ethics and in some case even malpractices among the employees (e.g. in the past, auditors could cut corners by not going to the site but writing up the report as if they had; this is no longer possible). At the same time, this approach to transparency can be interpreted as a sign of mistrust by management.

In the company, there is an ongoing discussion on whether these job changes and organisational changes (e.g. planning team) should be seen as connected with or separate from the introduction of the digital technology. According to the change manager, the changes should be seen as separate. *'It's actually not about the technology, but about the changing way of working [...] The new way of working creates problems.'* This interviewee later adds that there are also technical issues that cause problems with acceptance of the technology among the staff. It is interesting to note here that some of the interviewed managers do not support the current changes in job content and work organisation either. They acknowledge that auditors now have less autonomy than in the past. The change manager and HR manager reported they had raised this with both the former and the current CEO but with limited success. Their concerns fell on deaf ears with the former CEO, and when the new CEO started in December 2019, the project had been going on for such a long time and with such sizeable investments that the scope of intervention had become very small, and there was no more room for making fundamental adjustments.

Some adjustments were made, however. For example, with regard to planning, each auditor was appointed their own planner and can reach out to them to adjust their schedules when needed. This should allow some more flexibility in terms of time, e.g. to improve the work-life balance. As the interviewed team leader explained, initially, the schedules that were suggested by the technology were based on an estimated timing that was unrealistic (too much time for some audits and too little time for others). This has now been changed by adding a personal contact point within the planning department for each auditor, to whom auditors can indicate when they are available and how much time a certain activity would actually require. Nevertheless, one union representative indicated that especially employees who are single parents appear to

struggle in this new system, as they have fewer options than in the past to determine their own schedule. For this group, new issues in work-life balance have been reported. One interviewed worker felt that since the new technology is in use, there is less human contact and that the team spirit is disappearing. On this point, it has to be noted that the job of auditor in itself is quite solitary, with a high level of independence.

At the time of writing (in autumn 2022), the distribution of auditors across business units and regions is also under discussion (e.g. for planning to be able to take the locations of auditors into account). The team leader who was interviewed for this case study highlighted that many of the adjustments came from testing out the technology in the field. This person noticed that this was taken much more seriously in the past six months than previously, and has resulted in significant fixes and improvements.

The company has conducted a number of risk assessments to get further insight into the wellbeing, health and safety aspects of the technology and new way of working. This involves assessments of the ergonomic risks and physical health risks, psychological impacts and stress, etc. Especially the unions had urged to have such assessments done. Concerns are the reduced autonomy and flexibility, the possible impact on motivation, and the ambiguous impacts on work-life balance. This could improve as auditors with the automatic generation and submission of reports do not have to take work home or worsen, as auditors have less influence over their schedules. Some interviewed workers also flagged that working on a smartphone with the apps involves a lot of looking down, clicking (ticking boxes, switching between tabs and functions) and much more screen time than in the past, which is tiring and causes strain. One person said *'You can't imagine how much I have to click and look at that screen in a day. It gives me a headache.'* Another measure that was recently introduced is the creation of a well-being committee, which handles concerns on health and well-being. This initiative is welcomed by both workers and trade unions.

As there have been some changes to the technology and the new way of working more recently, the initial resistance from trade unions and employees appears to be diminishing somewhat. A worker who was interviewed for this case study, for example, said that any changes in the working method have always caused and will also cause some resistance in the beginning until workers get used to it. Digitalisation is the way of the future. This worker also believes that *'as soon as the technology will be improved and adapted, the system will be optimal, and it will really save working time.'*

However, from two of the unions, there is still very strong opposition. In order to deal with this, the company has sought the support of an expert (social mediator) from the Federal Public Service Employment, Labour and Social Dialogue, who weighed in on the issue and advised that the company must jump on the digital train, and that the new technology is an indispensable part of that effort. The issue, however, has not been resolved to date. This is also evidenced in some worker interviewees, with one person noting *'You don't have control over anything at any point.'*

Inequality

Several of the interviewees, and notably those who are trade union representatives, pointed to the lack of involvement of workers and trade unions as a critical issue. One person said,

'The whole implementation [of the new technology and the new way of working] has been without social dialogue, without respect for procedures and has radically soured social relations. Social relations in the workplace are now below the freezing point.'

This person then added that *'... the union has no problem with digitalisation, but the human being has to take the centre stage once again. Social dialogue is a prerequisite for this.'* With social dialogue, this interviewee means real and meaningful participation where trade unions are actually involved and can make decisions.

Especially under the previous management, the power balance between management and workers radically shifted in favour of the former, and the digital transformation process was started without much regard for the core principles of workplace innovation. Although the current management is taking serious efforts to rectify this (as is also clear from the measures that they have taken), and to address the main challenges both in terms of the technology itself and in terms of the new way of working (e.g. planning issues), there are still clear dividing lines within the company. While some workers and unions are willing to look ahead and give these efforts a chance, in other cases there is still significant resistance, and the outlook is bleak. These dividing lines appear to run across the different departments, regions, and workers (depending on their age, the length of their career within the company, their openness and willingness to accept change and their personal situation).

4.4.5. Conclusions

The present case study clearly reveals that the top-down adoption of a technology and the new ways of working that came with it, without the involvement of workers and trade unions, can have detrimental effects. Even now, when the former management has been replaced and the

new management is undertaking significant efforts to improve the technology and way of working and to better involve workers and trade unions (e.g. with a new well-being committee, by carrying out additional risk assessments, by introducing a planning team, etc.), it is very difficult to turn the ship around. Industrial relations within the company have been shaken up, and many workers lost confidence in what is ahead. Nevertheless, some of the unions and workers recognise that there is no turning back and that it is high time to start looking to the future, to make the modifications that are needed to the technology and the way of working, and to jump on the digital train. In order to do so, it is vital to safeguard all workers' health, safety and well-being, and to ensure that the values instilled in the workers and in the company are respected.

The case study presented here highlights the critical importance of workplace innovation, and its interrelation with technological change, as companies undergo technological transformation process. As the concept of workplace innovation underlines, technological transformations and changes in the organisational practices, culture, structure, etc. need to be well aligned to ensure that both the company and its employees benefit from it. Attention for both the company goals (e.g. becoming more efficient, enhancing the overall performance) and workers' goals (e.g. improving well-being, motivation and professionalism) must go together. In order to achieve this, literature on workplace innovation stresses the role of direct and indirect participation of workers in technological transformation processes. The case also shows how 'speed kills': consultations neglected at an early stage of a project to speed up a transformation may lead to higher time losses and more expensive mitigation efforts at a later point in time.

References

ABBL (2020). *The Luxembourg banking sector—Cloudy with a chance of sunshine*. ABBL.

Retrieved from:

https://abbl.lu/media/file/global/dynamic/ef9740cfea469cda814907085c2e66976ce7a56b/21%20April%202021_AGO.pdf

ABSL (2021). *Colliers | Business Services Sector in Poland 2021*. Association of Business Services Leaders. Retrieved from: <https://www.colliers.com/en-pl/research/absl-sektor-nowoczesnych-uslug-biznesowych-w-polsce-2021>

Acciarini, C., & Pompei, F. (2023). The case of machinery manufacturing and food industry in Italy. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.

Acemoglu, D., & Restrepo, P. (2019). Automation and New Tasks: How Technology Displaces and Reinstates Labor. *Journal of Economic Perspectives*, 33(2), 3–30.

<https://doi.org/10.1257/jep.33.2.3>

Acemoglu, D., & Restrepo, P. (2020). *Unpacking Skill Bias: Automation and New Tasks* (NBER Working Paper 26681). National Bureau of Economic Research.

<https://doi.org/10.3386/w26681>

ADEM (2020). *Rapport annuel 2020*. ADEM. Retrieved from: <https://adem.public.lu/dam-assets/fr/publications/adem/2021/rapport-activites-2020/ADEM-Rapport-annuel-2020-Web.pdf>

ADEM (2021). *Sectoral study: Finance*. ADEM. Retrieved from:

<https://adem.public.lu/content/dam/adem/fr/publications/adem/etudes-sectorielles/ADEM-etudes-sectorielles-Secteur-financier-vff-ENG.pdf>

Ali-Yrkkö, J., & Rouvinen, P. (2015). Slicing Up Global Value Chains: A Micro View. *Journal of Industry, Competition and Trade*, 15(1), 69–85.

<https://doi.org/10.1007/s10842-014-0192-2>

Allen, D. W. E., Berg, C., Davidson, S., Novak, M., & Potts, J. (2019). International policy coordination for blockchain supply chains. *Asia & the Pacific Policy Studies*, 6(3), 367–380. <https://doi.org/10.1002/app5.281>

- Al-Megren, S., Alsalamah, S., Altoaimy, L., Alsalamah, H., Soltanisehat, L., Almutairi, E., & Sandy Pentland, A. (2018). Blockchain Use Cases in Digital Sectors: A Review of the Literature. *2018 IEEE International Conference on Internet of Things (IThings) and IEEE Green Computing and Communications (GreenCom) and IEEE Cyber, Physical and Social Computing (CPSCom) and IEEE Smart Data (SmartData)*, 1417–1424.
<https://doi.org/10.1109/Cybermatics.2018.2018.00242>
- Anwar, M. A., & Graham, M. (2019). Does economic upgrading lead to social upgrading in contact centers? Evidence from South Africa. *African Geographical Review*, 38(3), 209226. <https://doi.org/10.1080/19376812.2019.1589730>
- Apostel, A., Vandekerckhove, S., Desiere, S., Lenaerts, K., & Walter, C. (2023). *Wat is de welzijnsimpact van atypische arbeidstijden onder ABVV-leden in de metaalsector en de sectoren van ABVV algemene centrale. Onderzoeksrapport*. HIVA-KU Leuven.
- Arntz, M., Gregory, T., & Zierahn, U. (2016). *The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis* (OECD Social, Employment and Migration Working Papers No. 189). <https://doi.org/10.1787/5jlz9h56dvq7-en>
- Artuc, E., Bastos, P., & Rijkers, B. (2018). Robots, Tasks and Trade (World Bank Policy Research Working Paper 8674). World Bank. <https://doi.org/10.1596/1813-9450-8674>
- Arzbächer, S., Holtgrewe, U., & Kerst, C. (2002). Call centres: Constructing flexibility. In U. Holtgrewe, C. Kerst, & K. A. Shire (Eds.), *Re-Organizing Service Work. Call Centres in Germany and Britain* (pp. 19–41). Ashgate.
- Asmal, Z., Bhorat, H., Martin, L.-C., & Whitehead, C. A. (2023). Technological change and workplace innovation in the insurance Sector in South Africa: Disruption with the potential for social good in a developing country context? In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- Augustyniak, B., Ebeke, C., Klein, N., & Zhao, H. (2013). German-Central European Supply Chain—Cluster Report—First Background Note—Trade Linkages. *IMF Multi-Country Report*, 13, 263.
- Automobile Association (2020, December 7). *Don't take the insurance bait – Cheaper is not always better*. Retrieved from: <https://aa.co.za/dont-take-the-insurance-bait-cheaper-is-not-always-better-2/>

- Autor, D. H., & Dorn, D. (2013). The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market. *American Economic Review*, 103(5), 1553–1597.
<https://doi.org/10.1257/aer.103.5.1553>
- Autor, D. H., Dorn, D., & Hanson, G. H. (2015). Untangling trade and technology: Evidence from local labour markets. *The Economic Journal*, 125(584), 621–646.
- Bachmann, R., & Gonschor, M. (2022). *Technological Progress, Occupational Structure and Gender Gaps in the German Labour Market (IZA DP No. 15419)*. IZA. Retrieved from: <https://projectuntangled.eu/bachmann-and-gonschors-paper-published-in-iza-dp-series/>
- Bachmann, R., & Storm, E. (2023). Case study: The German machinery industry. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- Bachmann, R., Cim, M., & Green, C. (2019). Long-Run Patterns of Labour Market Polarization: Evidence from German Micro Data. *British Journal of Industrial Relations*, 57(2), 350-376.
- Bachmann, R., Gonschor, M., Lewandowski, P., & Madoń, K. (2022). The Impact of Robots on Labour Market Transitions in Europe. *SSRN Electronic Journal*.
<https://doi.org/10.2139/ssrn.4114890>
- Baldwin, R. (2019a). EAEA16 Keynote Address: The Future of Globalization., *Asian Economic Journal*, 33(1), 3–12.
- Baldwin, R. (2019b). *The globotics upheaval: Globalization, robotics, and the future of work*. Oxford UP.
- Baldwin, R. (2006). *Globalisation: The great unbundling(s)*. Economic Council of Finland.
- Baldwin, R., & Lopez-Gonzalez, J. (2015). Supply-chain trade: A portrait of global patterns and several testable hypotheses. *The World Economy*, 38(11), 1682-1721.
- Banque Centrale du Luxembourg. (2021). *Revue de stabilité financière*. Luxembourg. Retrieved from: https://www.bcl.lu/fr/publications/revue_stabilite/rfs-2021/BCL_RSFS_2021_03.pdf

- Barslund, M., & Lenaerts, K. (2023). The biotech ecosystem in Belgium: From research and development to production. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- Batt, R., Holman, D., & Holtgrewe, U. (2009). The Globalization of Service Work: Comparative Institutional Perspectives on Call Centers. Introduction to the ILRR special issue. *Industrial & Labor Relations Review*, 62(4), 453–488.
- Battisti, M., Dustmann, C., & Schonberg, U. (2022). *Technological and organizational change and the careers of workers* (CESifo Working Paper no. 10130). Retrieved from: https://www.cesifo.org/DocDL/cesifo1_wp10130.pdf
- Beblavý, M., Maselli, I., & Martellucci, E. (2012). *Workplace innovation and technological change* (CEPS Special Reports). CEPS. Retrieved from: <https://www.ceps.eu/wp-content/uploads/2012/09/Workplace%20Innovation%20final.pdf>
- Beckert, J. (2016). *Imagined futures: Fictional expectations and capitalist dynamics*. Harvard UP.
- Bedada, W. B., Ahmadli, I., & Palli, G. (2022). Robotized Laundry Manipulation With Appliance User Interface Interpretation. In *Springer Proceedings in Advanced Robotics Book Series. Human-Friendly Robotics 2021* (pp. 91–106). Springer.
- Belu, M. G. (2019). Application of Blockchain in International Trade: An Overview. *The Romanian Economic Journal*, 71.
- Benner, C. (2006). ‘South Africa On-call’: Information Technology and Labour Market Restructuring in South African Call Centres. *Regional Studies*, 40(9), 1025-1040. <https://doi.org/10.1080/00343400600928293>
- bio.be/essenscia. (2022, 06). *Tewerkstelling in Belgische farma en biotech groeit naar bijna 40.000 jobs*, Press release, published on 13 June 2022, Retrieved from: <https://www.essenscia.be/tewerkstelling-in-belgische-farma-en-biotech-groeit-naar-bijna-40-000-jobs/>
- Birchen, M. (2015). The Luxembourgish Steel Industry in the Cold War: Diplomacy in the Wake of Nationalizations. *Dutch Crossing: Journal of Low Countries Studies*, 39(3), 232-245.

- Bogliacino, F., & Pianta, M. (2016). The Pavitt Taxonomy, revisited: Patterns of innovation in manufacturing and services. *Economia Politica*, 33(2), 153–180.
<https://doi.org/10.1007/s40888-016-0035-1>
- Bourgain, A., & Pieretti, P. (2008). *L' économie luxembourgeoise et sa place financière: Dépendance et enjeux*. Department of Economics at the University of Luxembourg.
- Bowles, J. (2014). *The computerisation of European jobs*. Retrieved from:
<https://www.bruegel.org/blog-post/computerisation-european-jobs>
- BPESA & Everest Group. (2019). *South Africa's global business services (GBS) industry – Value proposition document*. Retrieved from: <https://capebpo.org.za/wp-content/uploads/2021/10/everest-group-south-africa-value-proposition.pdf>
- BPESA. (2022). *Global Business Services Sector Job Creation Report: April – June 2022*. Retrieved from: https://www.bpesa.org.za/invest-in-southafrica/useful-documents/useful-documents/april-to-june-2022-gbs-sector-job-creation-report_final.html
- Brunner, M., & Ehlers, U.-D. (2021). *Study on skills mismatches in the European Blockchain sector*. Retrieved from: https://chaise-blockchainskills.eu/wp-content/uploads/2021/11/CHAISE_WP2_D2.5.1_Study-on-Skills-Mismatches-in-the-blockchain-sector.pdf
- Brynjolfsson, E., Mitchell, T., & Rock, D. (2018). What Can Machines Learn and What Does It Mean for Occupations and the Economy? *AEA Papers and Proceedings*, 108, 43–47.
<https://doi.org/10.1257/pandp.20181019>
- Buhr, D., & Stehnen, T. (2018). Industry 4.0 and European Innovation Policy. Big Plans, small steps. Division of Economic and Social Policy of the Friedrich-Ebert-Stiftung. *WISO Diskurs*, 12. Retrieved from: <http://library.fes.de/pdf-files/wiso/14455.pdf>
- Business Belgium. (2022). *Investeren in België: Sleutelsectoren—Biotechnologie*. Brussels: Business Belgium. Retrieved from:
https://business.belgium.be/nl/investeren_in_belgie/sleutelsectoren/biotechnologie
- Bykova, A., Grieveson, R., Hanzl-Weiss, D., Hunya, G., Korpar, N., Podkaminer, L., Stöllinger, R. (2021). *Avoiding a Trap and Embracing the Megatrends: Proposals for a New Growth Model in EU-CEE*. Vienna: wiiw.
- Carcano, L., & Lojacono, G. (2019). *Made in Italy Industries: Managerial issues and best practices*. EGEA spa.

- Carroll, L. (1871). *Through the looking-glass and what Alice found there*. Retrieved from: <https://www.gutenberg.org/files/12/12-h/12-h.htm>
- Chang, J.-H., & Huynh, P. (2016). *ASEAN in transformation the future of jobs at risk of automation*. Geneva: International Labour Organization. Retrieved from: https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---act_emp/documents/publication/wcms_579554.pdf
- Cloots, T., & Steurts, G. (2022). *De economische waarde van de biofarmaceutische industrie – Tewerkstelling*. Retrieved from: <https://pharma.be/nl/media/nieuws/een-positieve-impact-op-de-economie>
- Collins, T., Hannah, L., & Giuliani, D. (2022). *Insurtech landscape in Africa*. Retrieved from: <https://briterbridges.com/stories/2022/2/19/insurtech-landscape-in-africa>
- Conseil économique et social. (2014). *Perspectives économiques sectorielles à moyen et long terme dans une optique de durabilité*. Luxembourg: Conseil économique et social. Retrieved from: <https://ces.public.lu/content/dam/ces/fr/avis/avis-annuels/2014-industrie-finance.pdf>
- Corrado, C., Hulten, C., & Sichel, D. (2005). Measuring capital and technology: An expanded framework. In C. Corrado, J. Haltiwanger, & D. Sichel (Eds.), *Measuring capital in the new economy* (Vol. 65, pp. 11–46). University of Chicago Press.
- Corrado, C., Hulten, C., & Sichel, D. (2009). Intangible capital and US economic growth. *Review of Income and Wealth*, 55(3), 661–685.
- Cortes, G. M., Jaimovich, N., & Siu, H. E. (2021). The growing importance of social tasks in high-paying occupations: Implications for sorting. *Journal of Human Resources*, 0121-11455R1.
- CSSF. (2021). *Circular 21/773. On the Management of Climate-related and Environmental Risks*. Retrieved from: https://www.cssf.lu/wp-content/uploads/cssf21_773eng.pdf
- CSSF. (2022). *Circular 22/804. Governance and security requirements for Supervised Entities to perform tasks or activities through Telework*. Retrieved from: https://www.cssf.lu/wp-content/uploads/cssf21_769eng.pdf
- Czarniawska, B. (2004). *Narratives in Social Science Research*. London: SAGE <https://doi.org/10.4135/9781849209502>

- Dachs, B., Kinkel, S., & Jäger, A. (2019). Bringing it all back home? Backshoring of manufacturing activities and the adoption of Industry 4.0 technologies. *Journal of World Business*, 54(6), 101017. <https://doi.org/10.1016/j.jwb.2019.101017>
- Dauth, W., Findeisen, S., & Südekum, J. (2021). Adjusting to globalization in Germany. *Journal of Labor Economics*, 39(1), 263–302.
- Dauth, W., Findeisen, S., Südekum, J., & Woessner, N. (2021). The Adjustment of Labor Markets to Robots. *Journal of the European Economic Association*, 19(6), 3104–3153. <https://doi.org/10.1093/jeea/jvab012>
- De Croo, A. (2021). *België, de 'Health & Biotech valley' van de toekomst*. Retrieved from: <https://www.premier.be/nl/belgie-de-health-biotech-valley-van-de-toekomst>
- Delaney, J. M., & Devereux, P. J. (2019). *It's not just for boys! Understanding Gender Differences in STEM* [Working Paper]. University College Dublin. School of Economics. Retrieved from: <https://researchrepository.ucd.ie/handle/10197/10632>
- Demirkan, S., Demirkan, I., & Mckee, A. (2020). Blockchain technology in the future of business cyber security. *Journal of Management Analytics*, 7(2). <https://doi.org/10.1080/23270012.2020.1731721>
- Department of Education and Training (DHET). (2022). *Skills supply and demand in South Africa*. South Africa: Pretoria.
- Department of Trade, Industry, and Competition. (2018). *Global Business Services Incentive: Programme Guidelines*. South Africa: Pretoria.
- Destatis. (2022). *Industrieproduktion im Jahr 2020 um mehr als 10 % gesunken*. Retrieved from: https://www.destatis.de/DE/Presse/Pressemitteilungen/2021/02/PD21_076_421.html
- Dexter, L. A. (1970). *Elite and Specialized Interviewing*. ECPR Press.
- DiMaggio, P. J., & Powell, W. W. (1991). The iron cage revisited: Institutional isomorphism and collective rationality. In W. W. Powell & P. J. DiMaggio (Eds.), *The New Institutionalism in Organizational Analysis* (pp. 63–82). Chicago, London: Chicago UP.

- Dhondt, S., Dekker, R., van Bree, T., Hulsegge, G., Oeij, P., Barnes, S.-A., ... Schrijvers, M. (2022). Regional report: Entrepreneurial ecosystems in six European countries. Retrieved from https://beyond4-0.eu/storage/publications/egional%20report:%20entrepreneurial%20ecosystems%20in%20six%20European%20countries/BEYOND4.0_D4.1_Regional%20report_six_countries-PC-18429.pdf
- Doellgast, V. (2018). Rebalancing worker power in the networked economy. In M. Neufeind, J. O'Reilly, & F. Ranft (Eds.), *Work in the digital age: Challenges of the fourth Industrial Revolution* (pp. 199–208). London: Rowman & Littlefield International. Retrieved from: https://www.progressives-zentrum.org/wp-content/uploads/2018/06/Work-in-the-Digital-Age_Challenges-of-the-4th-Industrial-Revolution_Jacqueline-O%E2%80%99Reilly-Florian-Ranft-and-Max-Neufeind.pdf
- Dosi, G., & Virgillito, M. E. (2019). Whither the evolution of the contemporary social fabric? New technologies and old socio-economic trends. *International Labour Review*, *ilr.12145*. <https://doi.org/10.1111/ilr.12145>
- Dottori, D. (2021). Robots and employment: Evidence from Italy. *Economia Politica*, *38*(2), 739–795.
- Drahokoupil, J. (Ed.). (2015). *The outsourcing challenge. Organizing workers across fragmented production networks*. Brussels: European Trade Union Institute.
- EFI: Commission of Experts for Research and Innovation. (2022). *Report on research, innovation and technological performance in Germany 2022*. Berlin: EFI.
- Eichmann, H., Nocker, M., Heinrich, M., Holtgrewe, U., Krajic, K., & Schörpf, P. (2014). *Die Zukunft der Beschäftigung in Wien – Trendanalysen auf Branchenebene*. Studie im Auftrag des Magistrats der Stadt Wien, MA 23—Wirtschaft, Arbeit und Statistik. Wien: FORBA. Retrieved from: <https://www.wien.gv.at/wirtschaft/standort/pdf/beschaeftigung-trendanalysen-branchen.pdf>
- Eichmann, H., Schönauer, A., Schörpf, P., & Jatic, A. (2019). *Soziale Risiken von Digitalisierungsprozessen. Trendanalysen im Erwerbs- und Privatleben mit Fokus auf Wien*. Wien: AK Wien.

- Eisenhardt, K. M. (1989). Building Theories From Case Study Research. *Academy of Management Review*, 14(4), 532–550.
- Elsholz, U., Jaich, R., & Neu, A. (2018). *Folgen der Akademisierung der Arbeitswelt: Wechselwirkungen von Arbeits- und Betriebsorganisation, betrieblichen Qualifizierungsstrategien und Veränderungen im Bildungssystem*. Düsseldorf: Hans-Böckler-Stiftung.
- Erickson, C. L., & Norlander, P. (2022). How the past of outsourcing and offshoring is the future of post-pandemic remote work: A typology, a model and a review. *Industrial Relations Journal*, 53(1), 71–89. <https://doi.org/10.1111/irj.12355>
- Euronews. (2021, May 26). *EU seeks huge fine in court over AstraZeneca vaccine delivery delays*. Retrieved from: <https://www.euronews.com/my-europe/2021/05/26/obviously-a-failure-eu-lawyer-slams-astrazeneca-s-vaccine-record>
- European Commission. (2008). *Restructuring and employment. the contribution of the European Union*. SEC (2008) 2154. Brussels: Directorate-General for Employment, Social Affairs and Inclusion, EMPL. Retrieved from: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008SC2154&from=EN>
- Eurostat. (2018). *Girls and women under-represented in ICT*. Retrieved from: <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20180425-1>
- Eurostat. (2022). Employment by sex, age and detailed economic activity (1998-2008, NACE Rev. 1.1 two-digit level). Retrieved from: https://ec.europa.eu/eurostat/databrowser/view/LFSQ_EGANA2D/default/table
- EY (2019). *A steeper ascent. Growth in the testing, inspection and certification (TIC) industry*. Retrieved from: https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/strategy/pdf/ey-a-steeper-ascent-growth-in-the-testing-tic-industry.pdf?download
- Fehr, H., Kallweit, M., & Kindermann, F. (2012). Pension reform with variable retirement age: A simulation analysis for Germany*. *Journal of Pension Economics and Finance*, 11(3), 389–417. Retrieved from: https://EconPapers.repec.org/RePEc:cup:jpenef:v:11:y:2012:i:03:p:389-417_00

- Fernandez-Stark, K., Bamber, P., & Gereffi, G. (2011). The offshore services value chain: Upgrading trajectories in developing countries. *International Journal of Technological Learning, Innovation and Development* 4(1/2/3).
- Financial Sector Conduct Authority (FCSA). (2022). *Financial Sector Outlook Study*. Retrieved from:
<https://www.fsca.co.za/Documents/FSCA%20Financial%20Sector%20Outlook%20Study%202022.pdf>
- Fink, M., Horvath, T., Huber, P., Huemer, U., Lorenz, C., Mahringer, H., ... Sommer, M. (2019). *Mittelfristige Beschäftigungsprognose. Berufliche und sektorale Veränderungen 2018 bis 2025 – Teilbericht Wien*. Wien: WIFO.
- Fligstein, N. (2002). Markets as Politics: A Political-Cultural Approach to Market Institutions. In N. W. Biggart (Ed.), *Readings in Economic Sociology* (pp. 197–218). Malden, Mass., Oxford: Blackwell.
- FMA. (2019). *Digitalisierung am österreichischen Finanzmarkt. Stand, Ausblick, Call for Input*. Wien: Österreichische Finanzmarktaufsicht. Retrieved from:
<https://www.fma.gv.at/publikationen/studie-digitalisierung-finanzmarkt/>
- FMA. (2020). *Digitalisierung am österreichischen Finanzmarkt. Call for Input: Ergebnisse*. Wien: Österreichische Finanzmarktaufsicht. Retrieved from:
<https://www.fma.gv.at/publikationen/studie-digitalisierung-finanzmarkt/>
- Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254–280.
<https://doi.org/10.1016/j.techfore.2016.08.019>
- Gabriele, R., Tundis, E., & Zaninotto, E. (2018). Ageing workforce and productivity: The unintended effects of retirement regulation in Italy. *Economia Politica*, 35(1), 163–182.
- Gallie, D. (2007). *Employment regimes and the quality of work*. Oxford: Oxford UP.
- Geodecki, T. (2021). The Dimensions of Territorial Embeddedness of the Business Services Sector in Central and Eastern Europe. *Zarządzanie Publiczne* 2 (56), 15–31.
- Geodecki, T., & Zawicki, M. (2021). The Business Services Sector in Central and Eastern Europe. Territorial Embeddedness, Human Capital, and Growing Complexity. *Zarządzanie Publiczne/Public Governance* 2 (56), 5–14.

- Głowacki, J. (2020). The importance of Fintech's development for the embeddedness of outsourcing and offshoring firms. In Ł. Mamica (Ed.), *Outsourcing in European Emerging Economies* (pp. 166–177). Routledge.
- Górecki, J. (2020). Krakow vs. Other Polish destinations of outsourcing, offshoring, and the global business services sector. In Ł. Mamica (Ed.), *Outsourcing in European Emerging Economies* (pp. 129–141). Routledge.
- Government of Ireland, Department of Finance. (2019). *International Financial Services Strategy 2025 – Ireland for Finance*. Retrieved from: <https://www.gov.ie/en/publication/ireland-for-finance-strategy/>
- Government of Ireland, Department of the Taoiseach. (2022). *Harnessing Digital—The Digital Ireland Framework*. Retrieved from: <https://www.gov.ie/en/publication/adf42-harnessing-digital-the-digital-ireland-framework/>
- Greenan, N., & Napolitano, S. (2021). *Why Do Employees Participate in Innovation? Skills and Organisational Design Issues and the Ongoing Technological Transformation*. Retrieved from: <https://shs.hal.science/halshs-03270141>
- Grossman, G. M., & Rossi-Hansberg, E. (2006). The rise of offshoring: It's not wine for cloth anymore. *The New Economic Geography: Effects and Policy Implications*, 59–102.
- Guarda, P., & Rouabah, A. (2015). *Is the financial sector Luxembourg's engine of growth?* Banque Centrale Du Luxembourg Working Papers Number 97.
- Gupta, S., Puranam, P., & Srikanth, K. (2006). *Services sourcing in the banking and financial services industries. Exploding Myths and Describing Emerging Best Practice*. London: London Business School and Capco Institute.
- Haager, T., & Wieser, C. (2021). *Vorstandsvergütung in den ATX Unternehmen 2020. Gehälter-Ranking, Vergütungspolitik und Vergütungsberichte Juni 2021*. Wien: Arbeiterkammer. Retrieved from: https://www.arbeiterkammer.at/interessenvertretung/wirtschaft/betriebswirtschaft/Managergagen_2021.pdf
- Haberfellner, R., & Sturm, R. (2020). *Dienstleistung 4.0—Trends und Konsequenzen der Digitalisierung am Beispiel ausgewählter Dienstleistungsbranchen*. Wien: AMS. Retrieved from: [https://www.ams-forschungsnetzwerk.at/downloadpub/AMS_report_145 - Dienstleistung 4.0.pdf](https://www.ams-forschungsnetzwerk.at/downloadpub/AMS_report_145_-_Dienstleistung_4.0.pdf)

- Hall, P. A., & Soskice, D. (2001). *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford: Oxford UP.
- Harambee. (2020). *Harambee mapping of digital and ICT roles and demand for South Africa survey: Executive summary*. Retrieved from: <https://digital.harambee.co.za/executive-summary/>
- Hasselgren, A., Krlevska, K., Gligoroski, D., Pedersen, S. A., & Faxvaag, A. (2020). Blockchain in healthcare and health sciences—A scoping review. *International Journal of Medical Informatics*, 134, 104040. <https://doi.org/10.1016/j.ijmedinf.2019.104040>
- Hermann, C. (2015). Restructuring and social dialogue in the banking Sector- Austrian experiences. In V. Kirov & P. Thill (Eds.), *Social dialogue in the financial sector in Europe: Contribution to anticipation and restructuring* (pp. 41–51). Luxembourg: LISER. Retrieved from: https://www.researchgate.net/publication/291312472_Social_dialogue_in_the_financial_sector_in_Europe_Contribution_to_anticipation_and_restructuring/link/570dfc6e08aed31341cf8887/download
- Holtgrewe, U. (2014). New new technologies: The future and the present of work in information and communication technology. *New Technology, Work and Employment*, 29(1), 9–24. <https://doi.org/10.1111/ntwe.12025>
- Holtgrewe, U., & Lindorfer, M. (2023). Innovating workplaces and hierarchies in electronics: The TRONIC case. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- Holtgrewe, U., Lindorfer, M., & Šalamon, N. (2023). The banking sector in Austria. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- Holtgrewe, U., Markova, E., & Ravn, J. R. (2015). A hard job is good to find: Comparability, contextuality and stakeholder involvement in European job quality research. In U. Holtgrewe, V. Kirov, & M. Ramioul (Eds.), *Hard work in new jobs. The quality of work and life in European growth sectors* (pp. 11–32). Houndmills, London: Palgrave.

- Holtgrewe, U., & Schörpf, P. (2017). *Understanding the impact of outsourcing in the ICT sector to strengthen the capacity of workers' organisations to address labour market changes and to improve social dialogue*. Vienna: FORBA/ZSI. Retrieved from: http://www.forba.at/data/downloads/file/1251-FB_10_2016_Final_Report.pdf
- Huws, U. (2014). *Labor in the global digital economy*. New York: Monthly Review Press. Retrieved from: <http://www.worldcat.org/oclc/900626837>
- Huws, U. (2016). Logged In. The new economy makes it harder than ever to untangle capitalism from our daily lives. *Jacobin*, (June 1, 2016). Retrieved from: <https://www.jacobinmag.com/2016/01/huws-sharing-economy-crowdsourcing-precarity-uber-workers/>
- industriAll. (2019). *Artificial Intelligence: Humans must stay in command. Policy Brief 2019-01*. Brussels: industriAll. Retrieved from: https://news.industriall-europe.eu//content/documents/upload/2019/2/636849754506900075_Policy%20Brief%20-%20Artificial%20Intelligence.pdf
- International Association for Trusted Blockchain Applications. (2021). *CHAISE*. Retrieved from: <https://chaise-blockchainskills.eu/wp-content/uploads/2021/05/D2.2.1-Study-on-Blockchain-labour-market-characteristics.pdf>
- Jaehrling, K. (2018). Prospects for Virtuous Circles? The institutional and economic embeddedness of companies' contemporary innovation strategies in Europe. In K. Jaehrling (Ed.), *Virtuous circles between innovations, job quality and employment in Europe? Case study evidence from the manufacturing sector, private and public service sector* (pp. 1–34). Retrieved from: https://www.iaq.uni-due.de/aktuell/veroeff/2018/QiInne_wp6_3_2018.pdf
- Jansen, S. (2020, April 22). Intro to open banking and data sharing | Support Centre for Data Sharing. Retrieved from: https://eudatasharing.eu/news/intro-open-banking-and-data-sharing#footnoteref6_20uilyl
- Jefferys, S. (2010). *Financial Crisis and Social Dialogue in the UK Banking Sector*. Working Paper 10. London: Working Lives Research Institute.
- Jimeno, J. F. (2019). Fewer babies and more robots: Economic growth in a new era of demographic and technological changes. *SERIEs*, 10(2), 93–114.

- Kesselring, A., Blasy, C., & Scoppetta, A. (2014). *Workplace innovation: Concepts and Indicators, European Innovation Scoreboard (EIS), 2013-2014 project.*
- Khan, S. N., Loukil, F., Ghedira-Guegan, C., Benkhelifa, E., & Bani-Hani, A. (2021). Blockchain smart contracts: Applications, challenges, and future trends. *Peer-to-Peer Networking and Applications*, 14(5), 2901–2925. <https://doi.org/10.1007/s12083-021-01127-0>
- Khurshid, A., Rajeswaren, V., & Andrews, S. (2020). Using Blockchain Technology to Mitigate Challenges in Service Access for the Homeless and Data Exchange Between Providers: Qualitative Study. *Journal of Medical Internet Research*, 22(6), e16887. <https://doi.org/10.2196/16887>
- Kinkel, S. (2018). *Industry 4.0 application and reshoring of manufacturing – evidence, limitations & policy implications.* Presented at the MAKERS Workshop ‘Industry 4.0 – Implications for an EU industrial policy’, Brussels, January 25th 2018.
- Kirov, V. N., & Thill, P. (2018). The impact of crisis and restructuring on employment relations in banking: The cases of France, Luxembourg and Romania. *European Journal of Industrial Relations*, 24(3), 297–313. <https://doi.org/10.1177/0959680117752047>
- Kirov, V., & Thill, P. (Eds.). (2015). *Social dialogue in the financial sector in Europe: Contribution to anticipation and restructuring.* Luxembourg. Retrieved from: https://www.researchgate.net/publication/291312472_Social_dialogue_in_the_financial_sector_in_Europe_Contribution_to_anticipation_and_restructuring/link/570dfc6e08aed31341cf8887/download
- Klenert, D., Fernandez-Macias, E., & Antón, J.-I. (2020). Do robots really destroy jobs? Evidence from Europe. *Economic and Industrial Democracy* 44 (1), 280 – 316, <https://doi.org/10.1177/0143831X211068891>
- Knuth, M. (2021). *Transformative Arbeitsmarktpolitik. Herausforderungen der Arbeitsmarktpolitik unter den Bedingungen der „konfluenten Digitalisierung“.* Retrieved from: https://www.boeckler.de/fpdf/HBS-008052/p_fofoe_WP_219_2021.pdf
- Kohlgrüber, M., Schröder, A., Bayón Yusta, F., & Arteaga Ayarza, A. (2019). A new innovation paradigm: Combining technological and social innovation. *Matériaux & Techniques*, 107(1), 107. <https://doi.org/10.1051/mattech/2018065>
- Kopper, C. (2020). *Europa leben. Welten verbinden. 50 Jahre Deutsche Bank in Luxemburg.* Luxembourg

- Kornelakis, A., Kirov, V., & Thill, P. (2022). The digitalisation of service work: A comparative study of restructuring of the banking sector in the United Kingdom and Luxembourg. *European Journal of Industrial Relations*, 28(3), 253–272.
<https://doi.org/10.1177/09596801211056829>
- Kowalik, Z., Lewandowski, P., Geodecki, T., & Grodzicki, M. (2023). The impact of automation on business services centres in Poland. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- KPMG Advisory. (2018). *Digitalisierung in Banken. Studie: Wie wirkt sich die Digitalisierung auf die Beschäftigung in den Banken aus?* Wien: AK. Retrieved from:
https://www.arbeiterkammer.at/interessenvertretung/arbeit_digital/industrie40/Digitalisierung_in_Banken.pdf
- Lacity, M. C., Willcocks, L. P., & Craig, A. (2014). South Africa's business process outsourcing services sector: Lessons for Western-based client firm. *South African Journal of Business Management*, 45(4).
- Linares-Navarro, E., Pedersen, T., & Pla-Barber, J. (2014). Fine slicing of the value chain and offshoring of essential activities. Empirical evidence from European multinationals. *Journal of Business Economics and Management*, 15(1), 111–134.
<https://doi.org/10.3846/16111699.2012.745817>
- Littlejohns, P. (2019). *Six South Africa insurtech firms disrupting the country's insurance market*. Retrieved from: <https://www.nsinsurance.com/analysis/south-african-insurtech-start-ups/>
- LLEE, Luiss Lab of European Economics. (2022). *The EUKLEMS & INTANProd productivity database: Methods and data description*. Retrieved from: https://euklems-intanprod-llee.luiss.it/wp-content/uploads/2022/02/EUKLEMSINTANProd_2021_Methods-and-data-description-Rev1.pdf
- Lorenz, E. (2015). Work Organisation, Forms of Employee Learning and Labour Market Structure: Accounting for International Differences in Workplace Innovation. *Journal of the Knowledge Economy*, 6(2), 437–466. <https://doi.org/10.1007/s13132-014-0233-4>
- Majerus, B. (2020). This is not a scandal in Luxembourg. *Entreprises et histoire*, 101(4), 75-87. Cairn.info. <https://doi.org/10.3917/eh.101.0075>

- Majerus, B., & Zenner, B. (2020). Too small to be of interest, too large to grasp? Histories of the Luxembourg financial centre. *European Review of History: Revue Européenne d'histoire*, 27(4), 548–562. <https://doi.org/10.1080/13507486.2020.1751587>
- Mamica, Ł. (Ed.). (2021). *Outsourcing in European Emerging Economies: Territorial Embeddedness and Global Business Services*. London, New York: Routledge. <https://doi.org/10.4324/9781003018889>
- Manning, S. (2022). From mainstream to niche: How value regimes shift in emerging economy upgrading. *Research Policy*, 51(6). <https://doi.org/10.1016/j.respol.2022.104532>
- Markusen, J. R. (2005). *Modeling the offshoring of white-collar services: From comparative advantage to the new theories of trade and FDI*. NBER Working Paper, No. 11827. National Bureau of Economic Research.
- Maurice, M., & Sorge, A. (2000). *Embedding Organizations*. Amsterdam, Philadelphia: John Benjamins.
- McGuinness, S., Redmond, P., & Ciprikis, K. (2023). A Case Study of the Blockchain Industry in Ireland. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- McGuinness, S., Whelan, A., Redmond, P., & Ciprikis, K. (2022). *Annual Blockchain Skills Forecasts*. Retrieved from: https://chaise-blockchainskills.eu/wp-content/uploads/2022/06/CHAISE_WP3_D3.2.1-Annual-Blockchain-Skills-Forecasts_2022.pdf
- McMurray, A., Muenjohn, N., & Weerakoon, C. (Eds.). (2021). *The Palgrave Handbook of Workplace Innovation*. Cham: Springer International Publishing. <https://doi.org/10.1007/978-3-030-59916-4>
- Menz, G. (2005). *Varieties of capitalism and Europeanization: National response strategies to the single European market*. Oxford; New York: Oxford UP.
- Michaux, R. (2013). *Le secteur bancaire au Luxembourg*. Luxembourg: STATEC.
- Milberg, W., & Winkler, D. (2013). *Outsourcing economics: Global value chains in capitalist development*. Cambridge: Cambridge UP.

- Ministry of Work, Employment and Social and Solidarity Economy. (2017). *Rapport d'Activités 2017*. Luxembourg: Government of Luxembourg. Retrieved from: <https://gouvernement.lu/dam-assets/fr/publications/rapport-activite/minist-travail-emploi/2017-rapport-activite-mteess/rapport-activite-mteess-2017.pdf>
- Modise, T. (2019). *Employee reskilling in the South-African short-term insurance industry with the implementation of automation, robotics and artificial intelligence*. Doctoral Dissertation, University of Pretoria.
- Moe, N. B., Šmite, D., Hanssen, G. K., & Barney, H. (2014). From offshore outsourcing to insourcing and partnerships: Four failed outsourcing attempts. *Empirical Software Engineering*, 19(5), 1225–1258.
- Molloy, L., & Ronnie, L. C. (2021). Mindset shifts for the Fourth Industrial Revolution: Insights from the life insurance sector. *SA Journal of Human Resource Management* 19. <https://doi.org/10.4102/sajhrm.v19i0.1543>
- Moodley, A. J. (2019). Digital Transformation in South Africa's Short-Term Insurance Sector: Traditional Insurers' Responses to the Internet of Things (IoT) and Insurtech. *The African Journal of Information and Communication*, 24, 1–16.
- Moyse, L., Meiers, C., & Maquil, M. (2014). *The Architects of Luxembourg's Financial Industry: Personal Accounts of the Origins and Growth of the International Financial Centre*. Éditions Saint Paul. Retrieved from: <https://books.google.at/books?id=sUvOoQEACAAJ>
- Nölke, A., & Vliegenthart, A. (2009). Enlarging the varieties of capitalism: The emergence of dependent market economies in East Central Europe. *World Politics*, 61(4), 670 – 702.
- Observatoire de la formation. (2022). *Formation en entreprise: Chiffres clés*. INFPC. Retrieved from: <https://www.lifelonglearning.lu/bookshelf/documents/formation-en-entreprise-chiffres-cles-mai-2022.pdf>
- OECD. (2002). *Biotechnology and Healthy Ageing: Policy implications of new research*. Paris: OECD. Retrieved from: <https://www.oecd.org/science/emerging-tech/2487386.pdf>
- OECD. (2005). *A framework for biotechnology statistics*. Paris: OECD. Retrieved from: <https://www.oecd.org/sti/inno/34935605.pdf>
- OECD. (2017). The under-representation of women in STEM fields. In *The Pursuit of Gender Equality: An Uphill Battle*. OECD Publishing. <https://doi.org/10.1787/9789264281318-en>

- OECD. (2022). *OECD Economic Outlook, Interim Report March 2022: Economic and Social Impacts and Policy Implications of the War in Ukraine*. OECD.
<https://doi.org/10.1787/4181d61b-en>
- OECD. (2022a). *Elderly population [Data set]*. OECD. <https://doi.org/10.1787/8d805ea1-en>
- OECD. (2022b). *Old-age dependency ratio [Data set]*. OECD.
<https://doi.org/10.1787/e0255c98-en>
- Oeij, P. R. A., Preenen, P. T. Y., & Dhondt, S. (2021). Workplace Innovation as a Process: Examples from Europe. In A. McMurray, N. Muenjohn, & C. Weerakoon (Eds.), *The Palgrave Handbook of Workplace Innovation* (pp. 199–221). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-030-59916-4_11
- Oeij, P., Žiauberytė-Jakštienė, R., Dhondt, S., Corral, A., Totterdill, P., & Preenen, P. (2015). *3rd European company survey: Workplace innovation in European companies*. Dublin: Eurofound. Retrieved from: <https://data.europa.eu/doi/10.2806/543283>
- Oliver, C. (1991). Strategic responses to institutional processes. *Academy of Management Review*, 16(1), 145-179.
- ÖNB. (2021). *Fakten zu Österreich und seinen Banken. Kennzahlen-Update Juli 2021*. Wien: Österreichische Nationalbank. Retrieved from:
https://www.oenb.at/dam/jcr:0379b390-d96e-42b4-b398-e59771d64e24/Fakten-zu-Oesterreich-April-21_update.pdf
- Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy*, 13(6), 343 - 373. [https://doi.org/10.1016/0048-7333\(84\)90018-0](https://doi.org/10.1016/0048-7333(84)90018-0)
- Perray, P. (2020). *Des performances bancaires très contrastées*. Luxembourg: STATEC.
- Perugini, C., & Pompei, F. (2022). *What drives the wage gap of vulnerable workers? Pay incentives, intangibles and gender wage inequality*, UNTANGLED research papers, D.4.2. Retrieved from: https://projectuntangled.eu/wp-content/uploads/2022/07/Perugini_Pompei_What-drives-the-wage-gap-of-vulnerable-workers.pdf
- Pfeiffer, S. (2017). Industrie 4.0 in the making—Discourse patterns and the rise of digital despotism. In K. Briken, S. Chillas, M. Krzywdzinski, & A. Marks (Eds.), *The New Digital Workplace: How New Technologies Revolutionise Work* (pp. 21–41). Houndmills, Basingstoke: Palgrave.

- Pfeiffer, S. (2020). *Arbeit im Maschinenbau. Auswertungen auf Basis der BIBB/BAuA Erwerbstätigenbefragung für die Erhebungsjahre 2006, 2012 und 2018*. Friedrich-Alexander-Universität Erlangen-Nürnberg.
- Pietrobelli, C., & Rabellotti, R. (2011). Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries? *World Development* 39(7), 1261–1269. <https://doi.org/10.1016/j.worlddev.2010.05.013>
- Piore, M. J., & Sabel, C. F. (1984). *The second industrial divide: Possibilities for prosperity*. New York: Basic Books.
- Raphael, L. (2019). *Jenseits von Kohle und Stahl: Eine Gesellschaftsgeschichte Westeuropas nach dem Boom: Frankfurter Adorno-Vorlesungen 2018*. Berlin: Suhrkamp.
- Raza, W., Grumiller, J., Grohs, H., Essletzbichler, J., & Pintar, N. (2021). *Post COVID-19 value chains: Options for reshoring production back to Europe in a globalised economy*. Brussels: European Parliament. Retrieved from: [https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU\(2021\)653626_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653626/EXPO_STU(2021)653626_EN.pdf)
- Razin, A. (2021). *Globalisation and global crises*. Retrieved from: <https://cepr.org/voxeu/columns/globalisation-and-global-crises>.
- Regini, M., Kitay, J., & Baethge, M. (Eds.). (1999). *From Tellers to Sellers. Changing Employment Relations in Banks*. Cambridge, Mass., London: MIT Press.
- Romano, S. (2021). The 2011 Crisis in Italy: A Story of Deep-Rooted (and Still Unresolved) Economic and Political Weaknesses. In B. De Souza Guilherme, C. Ghymers, S. Griffith-Jones, & A. Ribeiro Hoffmann (Eds.), *Financial Crisis Management and Democracy* (pp. 173–184). Cham: Springer, https://doi.org/10.1007/978-3-030-54895-7_10
- Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), 2117–2135. <https://doi.org/10.1080/00207543.2018.1533261>
- Schwab, K. (2015). The Fourth Industrial Revolution. *Foreign Affairs*. Retrieved from: <https://www.foreignaffairs.com/world/fourth-industrial-revolution>

- Segers, J.-P. (2016). Regional systems of innovation: Lessons from the biotechnology clusters in Belgium and Germany. *Journal of Small Business & Entrepreneurship*, 28(2), 133–149. <https://doi.org/10.1080/08276331.2015.1128256>
- Segers, J.-P. (2017). Green Biotechnology in Belgium: The Ghent Innovation District. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2986113>
- Simon, H. (1990). Hidden champions: Speerspitze der deutschen Wirtschaft. *Zeitschrift für Betriebswirtschaft (ZfB)*, 60(9), 876.
- Simons, H. (2009). *Case Study Research in Practice*. London: SAGE Publications, Ltd. <https://doi.org/10.4135/9781446268322>
- Sirilli, G., & Evangelista, R. (1998). Technological innovation in services and manufacturing: Results from Italian surveys. *Research Policy*, 27(9), 881 – 899.
- STATEC. (2022). *Les syndicats en déclin dans un monde du travail en mutation*. Retrieved from: <https://statistiques.public.lu/dam-assets/catalogue-publications/regards/2022/regards-01-22.pdf>
- Stehrer, R. (2021). *Wiiw Growth and Productivity Database*. Retrieved from: https://euklems.eu/wp-content/uploads/2022/01/wiiw_GPD_2022-01-28.pdf
- Stehrer, R. (2022). The Impact of ICT and Intangible Capital Accumulation on Labour Demand Growth and Functional Income Shares. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4174238>
- Stephan, J. (2013). *The technological role of inward foreign direct investment in Central East Europe*. Palgrave Macmillan.
- Strauss, A. L., & Corbin, J. (1991). *Basics of qualitative research. Grounded theory procedures and techniques*. Newbury Park: Sage.
- Thill, P., & Kirov, V. (2015). Comparative analysis of social dialogue on restructuring in the selected countries. In V. Kirov & P. Thill (Eds.), *Social dialogue in the financial sector in Europe: Contribution to anticipation and restructuring* (pp. 13–28). Luxembourg: LISER. Retrieved from: https://www.researchgate.net/publication/291312472_Social_dialogue_in_the_financial_sector_in_Europe_Contribution_to_anticipation_and_restructuring/link/570dfc6e08aed31341cf8887/download

- Thomas, A. (2012). Une mosaïque incomplète. La littérature sur le syndicalisme et les relations professionnelles au Luxembourg. Hémecht. *Revue d'histoire Luxembourgeoise*, 64(4), 132–153.
- Thomas, A., & Thill, P. (2023). Impacts of globalisation, technological innovation and changing demographics on the banking sector in Luxembourg. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- Thomas, A., Dörflinger, N., Yon, K., & Pletschette, M. (2022). *Under the weather. Trade union positions on COVID-19-related occupational health and safety measures in Germany, France and Luxembourg (March 2020-December 2021)* [Preprint]. SocArXiv. <https://doi.org/10.31235/osf.io/qz4b8>
- Thomas, A., Kirov, V., & Thill, P. (2019). Luxembourg: An instance of eroding stability? In T. Müller, K. Vandaele, & J. Waddington (Eds.), *Collective bargaining in Europe: Towards an endgame* (pp. 403–421). Brussels: European Trade Union Institute.
- TIC Council, & Europe Economics. (2020). *Value of the Testing, Inspection and Certification Sector. Final Report*. Retrieved from: https://www.tic-council.org/application/files/1216/2211/4719/Value_of_the_Testing_Inspection_and_Certification_Sector_-_2020-12-23_Final_report.pdf
- Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., & de Vries, G. J. (2015). An Illustrated User Guide to the World Input-Output Database: The Case of Global Automotive Production: User Guide to World Input-Output Database. *Review of International Economics*, 23(3), 575–605. <https://doi.org/10.1111/roie.12178>
- Totterdill, P. (2020). *What is Workplace Innovation?* European Workplace Innovation Network, 26–29.
- Totterdill, P., Dhondt, S., & Milsome, S. (2002). *Partners at Work? A Report to Europe's Policy Makers and Social Partners. Report of the Hi-Res Project*.
- Tullius, K. (2021). Digitalisierung im Finanzdienstleistungssektor – Folgen für Angestelltenarbeit an der Front-Line. *WSI-Mitteilungen*, 74(4), 274 – 283. <https://doi.org/10.5771/0342-300X-2021-4-274>

- Twinomurinzi, H., Msweli, N. T., & Phukubje, P. (2020). *Digital technologies and digital skills in organisations and government in South Africa: An environmental scan*. University of South Africa Press and NEMISA. Retrieved from: <https://www.nemisa.co.za/wp-content/uploads/2021/08/Digital-Technologies-and-Digital-Skills-in-Organisations-and-Government-in-SA-1.pdf>
- USDOC. (2017). *Made in China 2025: Global Ambitions Built on Local Protections*. US Chamber of Commerce. Retrieved from: https://www.uschamber.com/assets/documents/final_made_in_china_2025_report_full.pdf
- Van Niekerk, R. (2022). *EasyEquities has disrupted the SA investment market since inception*. Retrieved from: <https://www.moneyweb.co.za/moneyweb-podcasts/be-a-better-investor/easyequities-has-disrupted-the-sa-investment-market-since-inception/>
- Van Roy, V., Vértesy, D., & Vivarelli, M. (2018). Technology and employment: Mass unemployment or job creation? Empirical evidence from European patenting firms. *Research Policy*, 47(9), 1762–1776. <https://doi.org/10.1016/j.respol.2018.06.008>
- Vollaard, H., Beyers, J., & Dumont, P. (2015). *European integration and consensus politics in the Low Countries*. London: Routledge.
- Webb, M. (2020). The Impact of Artificial Intelligence on the Labor Market. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3482150>
- Whelan, A., McGuinness, S., Redmond, P., Maragkou, K., & Devlin, A. (2021). *Study on Blockchain Skills Demand*. Retrieved from: https://chaise-blockchainskills.eu/wp-content/uploads/2021/09/CHAISE_D2.3.1_Study-on-Blockchain-Skill-Demand.pdf
- Whitehead, C. A., Asmal, Z., & Bhorat, H. (2023). Co-ordination to support inclusive growth in developing countries in the context of globalization: The case of the business process outsourcing sector in South Africa. In U. Holtgrewe, M. Lindorfer, & N. Šalamon (Eds.), *Globalising, digitising and changing companies and sectors: Case studies from the UNTANGLED project*.
- Wieser, C. (2022). *Branchenreport Kreditsektor 2022*. Vienna: Arbeiterkammer. Retrieved from: <https://wien.arbeiterkammer.at/service/studien/WirtschaftundPolitik/branchenanalyse/Branchenreport.Banken.2021.pdf>

- Wood, L. (2021). *Global Testing, Inspection, and Certification Market Forecasts 2021-2028: Globalization and the Rise of Global Trade*—ResearchAndMarkets.com. Retrieved from: <https://www.businesswire.com/news/home/20210907005400/en/Global-Testing-Inspection-and-Certification-Market-Forecasts-2021-2028-Globalization-and-the-Rise-of-Global-Trade---ResearchAndMarkets.com>
- Wood, A. J., Graham, M., Lehdonvirta, V., & Hjorth, I. (2019). Networked but Commodified: The (Dis)Embeddedness of Digital Labour in the Gig Economy. *Sociology* 53(5), 931-950. <https://doi.org/10.1177/0038038519828906>
- World Bank. (2022). *Urban population (% of total population)*—Germany | Data. Retrieved from: <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=DE>
- Wrzesniewski, A., & Dutton, J. (2001). Crafting a Job, Revisioning Employees as Active Crafters of their Work. *Academy of Management Review*, 26(2), 179–201.
- Yin, R. K. (1994). *Case Study Research—Design and Methods, Second Edition*. Sage.
- Zheng, Z., Xie, S., Dai, H.-N., Chen, X., & Wang, H. (2018). Blockchain challenges and opportunities: A survey. *International Journal of Web and Grid Services*, 14(4), 352–375.

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UNTANGLED was a three-year interdisciplinary Horizon 2020 research project running from February 2021 to January 2024 that examined the interconnected trends of globalisation, demographic change and technological transformation, and their effects on labour markets in the European Union and beyond. By engaging a broad range of stakeholders, including companies and civil society organisations, it developed practical policy proposals to help governments cushion the negative impacts of these trends and ensure their benefits are enjoyed fairly across regions and sectors.

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