

Future of manufacturing
**New tasks in old jobs:
Drivers of change and
implications for
job quality**



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Introduction

The task content of occupations is continuously changing, reflecting the introduction of new production technologies and new forms of work organisation. Such changes pose important challenges for society.

- Workers whose skills have become obsolete may find it difficult to update them, and face unemployment or downward mobility within the job market as a result.
- Education systems may struggle to keep up with the changing requirements of the economy.
- Existing employment regulations and industrial relations systems may be less effective and unsuitable for new working environments and conditions.

For these reasons, it is critical to monitor and understand changes in the task content of occupations.

There is abundant literature suggesting that a ‘task’ approach to labour market analysis can contribute to a better understanding of employment trends (Acemoglu and Autor, 2011; Autor, 2013; Eurofound, 2016a). The approach clearly focuses on demand for skills in the labour market rather than supply of it and focuses on the tasks carried out within a job and the related performance capabilities. With this approach, tasks¹ can be used to help understand the effect of technology on labour demand, recent key developments in labour markets, and skills needs in the context of the work automation debate.

A quantitative research approach provides a broad overview of the task content of occupations across Europe. However, the need to standardise results removes most of the richer contextual information that is needed to understand the drivers and implications of change. An alternative qualitative approach can help to fill some of the gaps in the existing quantitative information.

The main goal of this study is to look at the changing nature of work within the manufacturing sector from a qualitative perspective by analysing five manufacturing occupations in four European countries (Germany, Italy, Sweden and the United Kingdom (UK), which were chosen in order to cover different European regions). The study offers a contextualised and detailed analysis of recent changes in the task content and nature of these occupations due to factors such as technology, market changes, policy and regulation. It also discusses the implications of these changes for task profiles, job quality and industrial relations. This initiative is one element of the Future of Manufacturing in Europe pilot project, funded by the EU and implemented by Eurofound, which tries to identify and evaluate vectors of change, opportunities and challenges within the EU manufacturing sector.

This overview report is structured in three different sections. After a brief description of the scope of the work and methodology used to conduct the study, **Section 1** discusses the main drivers affecting the nature and task content of the selected manufacturing occupations (e.g. digitalisation, globalisation and competition from emerging economies).

Section 2 analyses the content of the five occupations and discusses tasks that are typically carried out as part of those roles, following the framework developed by Eurofound in 2016 (Eurofound, 2016a; Fernández-Macías and Bisello, 2016a). The framework differentiates between physical, intellectual and social tasks (task content); autonomy, teamwork and routine (methods); and machinery and ICT (tools).

Section 3 discusses job quality within the occupations, following Eurofound’s 2016 framework. This includes the intrinsic quality of work, risks, working time/work-life balance and employment quality. The section also presents information on wages and industrial relations for the selected occupations.

Scope of the work and methodology

The five occupations were selected based on the following criteria.

- They should be numerically significant in different European countries.
- They should represent different manufacturing subsectors and skills levels.
- They should reflect different levels of exposure to technical change.

The following occupations in the manufacturing sector were selected after a review of the European Skills, Competences, Qualifications and Occupations (ESCO)² framework and an inspection of European Jobs Monitor (EJM)³ data:

Car assembler:⁴ A key occupation within car manufacturing, which is one of the manufacturing subsectors most subject to technological change and most strategically important for several European economies. This occupational group normally works for car manufacturers or within their supplier network. The tasks of a car assembler include assembling and installing prefabricated parts or components to form mechanical machinery, engines and finished motor vehicles; reviewing

1 Tasks can be defined as units of work activity that produce an actual output (Autor, 2013).

2 ESCO is part of the Europe 2020 strategy.

3 The EJM tracks structural change in European labour markets. It analyses shifts in the employment structure in the EU in terms of occupation and sector, and gives a qualitative assessment of these shifts using various proxies of job quality (wages, skills level, etc.). The EJM covers all EU Member States and is based primarily on analysis of European Labour Force Survey data.

4 ‘Car assembler’ is defined as ISCO 82 by NACE 29. ISCO refers to the International Standard Classification of Occupations and NACE refers to the Statistical Classification of Economic Activities.

work orders and specifications; and inspecting and testing completed components.

Meat processing worker:⁵ One of the main occupations within the food manufacturing industry, which itself makes up a large share of the total employment in manufacturing in Europe. This occupational group is part of the meat processing industry⁶ and works in slaughterhouses (abattoirs), meat packing companies and wholesale establishments. They perform precision functions involving the preparation of meat and their typical work may include specialised slaughtering tasks, cutting standard or premium cuts of meat, making sausages or wrapping meats.

Chemical products plant and machine operator:⁷ An important industrial occupation within the high-value chemical industry. These operators use chemical processes to produce a wide variety of solid, liquid and gaseous materials. Their tasks usually include operating and monitoring machines and equipment that blend, mix, package and otherwise process chemicals and chemical products either for further industrial production or to make finished products.

Hand-packer:⁸ A general manufacturing occupation that can be found in many different manufacturing subsectors and includes hand-labellers and hand-wrappers. While packaging is still an in-house activity in some companies, it is also frequently outsourced to specialised logistics companies and coupled with complementary services (e.g. storing, repacking, labelling and general

optimisation logistics processes). The tasks of this occupational group include manual actions such as weighing, selling and wrapping material and packages; filling up cans, bottles, boxes and other containers; and labelling packages and products.

Inspection engineer:⁹ A general occupation that spans manufacturing subsectors, but with a higher educational profile and set of skills requirements. Unlike the other occupations selected for this study, inspection engineers are typically salaried graduates who are part of the management responsible for overseeing and optimising the organisation and quality of manufacturing processes. Inspection engineers who are responsible for quality handle a wide range of tasks related to organising and controlling manufacturing processes, as well as overseeing the quality of products, supplies, working conditions and installations/equipment.

These five occupations were analysed in the four target countries (Germany, Italy, Sweden and the UK) via particular companies. A total of 20 case studies have been produced, each based upon extensive desk research and in-depth interviews with workers, line managers, trade association representatives and trade union representatives.

Each occupational case study at national level combines an analysis of the contextual factors that affect the task content of the occupation in a specific country with information at a company level.

5 'Meat processing worker' is defined as ISCO 81 by NACE 10.

6 The broader term 'meat industry' includes primary (agriculture) and secondary (industry) activity, and is hard to characterise in terms of either one alone. In this context, the study focuses on the secondary segment – the meat processing industry – which handles the slaughtering, processing, packaging and distribution of meat from animals such as cattle, pigs, sheep, poultry and other livestock.

7 'Chemical products plant and machine operator' is defined as ISCO 81 by NACE 20.

8 'Hand-packer' is defined as ISCO 9321.

9 'Inspection engineer' is defined as ISCO 2141.

Section 1

Main factors affecting the development of manufacturing industries

This section discusses the main factors that have substantially changed the nature of the selected manufacturing occupations in Europe in recent years. These include technological changes (digital transformation trends in manufacturing), market changes (such as competition from emerging countries, global value chains, offshoring and outsourcing) and policy and regulation changes related to increasing demand for quality standards and a greater focus on sustainability.

These factors are often interlinked and can be expected to have a different impact across the five occupations. They are also likely to have various implications in terms of skills requirements, tasks performed by workers, types of work organisation, working conditions and industrial relations.

Technological changes: Digital transformation trends in manufacturing

Digitalisation is rapidly changing the way in which European manufacturing is operating by making some business models redundant while paving the way for new ones. Factories are becoming 'smart', with machines and components communicating amongst themselves, and moving towards self-regulating production that can be adapted to individual customer demands. The Internet of Things involves products that are equipped with sensors and inbuilt systems connected to the internet, enabling them to communicate with their surroundings. These technological developments are relevant in the context of this study considering their implied impact on tasks performed by workers, working conditions and skills requirements. In another publication from the Future of Manufacturing in Europe pilot project, Eurofound (2018a) describes the impact of these game-changing technologies on production processes and work.

Among the five key occupations analysed, the work of car assemblers has been the most significantly affected by digitalisation in recent decades. In fact, the digitalisation of both manufacturing processes and customer relationships is a key factor driving change in the automotive industry as a whole. The former includes the development of digital factories that use sensors, algorithms and robots to boost the efficiency of car production, while the latter consists of the new technological innovations that are shaping business models in the automotive industry.

Digital technologies are increasingly embedded in new vehicles, enabling innovative solutions in areas such as connected vehicles, autonomous cars, electrification and smart cities. Cars are becoming more digitised,¹⁰ allowing users to interact with them and evaluate the information collected through specialised applications. In addition, digitisation has facilitated new business models like car sharing and created possibilities for autonomous cars that can make their own decisions. Technological progress has also enabled customisation and made it more cost-efficient for companies. This can be seen in the car industry, where production is largely based on modularisation¹¹ as it can better accommodate increasing demand for specific features or technical requirements.

Many companies in the chemical industry have also invested significantly in automation and information technology over the last few years. The automation and digitalisation of production has often led to clear productivity gains: for example, the Swedish case study company described how a chemical products plant and machine operator would have handled the production of fewer than 5 different recipes a decade ago, but is now able to handle 15–20.

While the increased use of automation in the chemical industry has led to a decrease in the level of human labour required in the production process, it has also improved working and safety conditions for line operators. At the Italian case study company, the automated bottling and labelling lines are equipped with optical and weight sensors, which allows non-compliant products to be automatically eliminated.

Compared to the automotive and chemical industries, the meat processing industry is still highly labour-intensive. New technologies have automated some tasks, making work less physically stressful, more ergonomic, safer and more hygienic, but the sector has been slow to introduce advanced automation technologies as they are expensive relative to semi-skilled manual labour.

Furthermore, the accuracy of robots when performing complex movements and cutting different animal carcasses still needs refinement, despite recent developments in imaging technology that mimic human touch and sight.

The four packaging case study companies had also experienced the impact of technological changes. The main changes described were digitally automated

10 In the context of this report, the word 'digitisation' is used when speaking about the specific introduction of digital technologies in a specific process. The term 'digitalisation' refers to the general social process that is increasing the use of digital technologies in the economy (see Eurofound, 2017 for a detailed discussion).

11 This means that the main components of a vehicle include a standard set of subcomponents that can be pre-assembled at one work station before being integrated with the main components.

packaging machinery (such as filling, sealing, wrapping, strapping, labelling and coding machines that can complete various stages of the packaging process) and new forms of packaging materials (for example, aseptic paper-based packaging technology for food in Sweden). Indeed, there is little actual packaging work being carried out by hand anymore.

In manufacturing industries, the packing of products and materials to be shipped to customers is a complex process requiring meticulous management and documentation procedures to ensure quality and efficiency. Over the past decade, the digitalisation of the logistics of this process has become a key driver of efficiency and quality. In particular, the use of information and communication technologies (ICTs) such as barcodes, radio frequency identification technology and mobile devices to track the process has become an important way of capturing and transmitting data.

The use of ICTs in packaging has led to a gradual shift in the tasks being performed by hand-packers. Being able to manage and monitor is becoming more important at the expense of physical skills. The use of digital tools leads to error-free order validation, the optimisation of packaging materials, and a reduction in worker involvement in tasks such as weighing and measuring. The adoption of these technologies has also had a visible effect on streamlining the information flow across the production circle.

Finally, the use of digital technologies is considerably changing the task content of the inspection engineer role. Many repetitive testing tasks are being removed and more tasks requiring advanced ICT skills, such as data management, are being introduced.

Market changes: Competition from emerging economies, global value chains, offshoring and outsourcing

Technological advances have decreased the cost of communication and economic transactions, facilitating economic interactions on a global scale, as well as fragmenting production processes and value chains. While European manufacturing has benefited from globalisation in terms of accessing low-wage labour supply due to outsourcing and reaching new markets, it has also faced strong price competition from emerging economies. In turn, this has forced many European companies to focus more on advanced, knowledge-based products and the development of related services.

Among the most significant global market changes that the European automotive industry has faced over the past few decades are falling domestic sales and increasing exports to developing markets, particularly Asia. The downturn in sales due to the 2008 financial crisis and weak internal market performance intensified this trend. All the target countries analysed as part of this study have experienced a growing export share and some companies have relocated their production to low-wage countries in order to be closer to their end markets. The four car manufacturer case study companies also reported

undergoing a process of international mergers and acquisitions, with large parts of the industry now under foreign ownership and increasingly global supply chains.

Hand-packers have also been significantly affected by global market changes. The growing interdependence of markets has resulted in packaging and logistics being increasingly outsourced, with some companies offering this service to others as their core activity, rather than dealt with as part of internal production. Outsourcing hand-packing allows companies to focus on those parts of production processes where they are more specialised. In addition, lower labour costs in other countries and lower transaction costs make outsourcing a viable strategy. Over the past decade, the packaging sector has experienced remarkable growth in all four case study countries.

The chemical industry is facing the market challenges of internationalisation and competition from low-cost economies. These challenges have forced European companies to adopt new strategies that focus on their core competencies, product specialisation and product innovation. The 2008 financial crisis accelerated this trend.

Chemical industry companies now tend to outsource their production of basic chemical materials to low-wage countries abroad and keep the production of advanced chemical products in their home country. The key to future competitiveness and value creation in high-cost countries is to focus on innovation and the development of complex products that require skilled production and application.

The main trend characterising the meat processing industry across the target countries is an increasing number of large companies and an emphasis on mass production (driven by factors such as price pressure, competition, imports from low-wage countries and increasing regulatory costs). However, not all meat processing companies have responded to these pressures by expanding. Parallel trends of small-scale production that focuses on quality, eco-friendly production and animal welfare can also be seen.

Finally, regarding inspection engineers, the growing importance of complex value chains spanning many countries has increased the necessity for effective quality control and standardisation – an essential element when it comes to coordinating the quality control of production on a global scale.

Policy and regulation: Increasing demand for high quality standards and sustainability

In recent decades, increasing consumer demand for high quality standards and a growing focus on sustainability have considerably influenced the way production is organised and regulated in manufacturing sectors. Many industries face increasing pressure from customers to comply with national and international quality management and environmental standards. All the occupations covered by this study have been affected by this trend to some degree.

Increasing demand for quality standards has particularly affected the work of inspection engineers, an occupation that spans different manufacturing subsectors. Looking at the four country case studies, the need to comply with quality standards has led to the development of more comprehensive and centralised quality control systems that cover all of a company's functions.

Cooperating with employees in production units (horizontal) and with managers (vertical) are key responsibilities of inspection engineers, together with continuously developing the company's quality management systems and procedures. A quality management system such as ISO 9001 includes organisational charts and information that determine quality and output standards and the functions and responsibilities of workers and work units. Typically, the inspection engineer oversees the procedures designed to ensure that production processes, and their inputs and outputs, fulfil the standards specified in the system. In the case of customer complaints concerning product quality, it may be the responsibility of the inspection engineer to follow up and launch corrective action within the production process.

The meat processing industry has also been affected by increasing quality standards, especially in relation to food safety and traceability. Regular scandals related to animal welfare, contamination of meat, fraudulent labelling,

diseases and hygiene issues have led to greater political focus and new food safety regulations. Consumers are increasingly interested in traceability, quality and animal welfare. The meat processing industry has responded by placing greater emphasis on technologies that enable traceability and quality control. This directly influences the task content of meat processing workers, who operate traceability systems that control, tag and label all incoming animals and meat.

Modern consumers are not only expecting high-quality products, but also high-quality packing and delivery. The work of hand-packers has evolved in response, particularly in relation to product traceability, where the use of barcodes and other electronic labelling technologies has become much more widespread. An increasing focus on sustainability has also translated into a request for less waste and more environmentally friendly packaging.

The growing consumer focus on sustainability has also affected the chemical and automotive industries, where it has become a driver for innovation and collaboration. The chemical industry has collaborated with the construction and automotive industries to create advanced products that have a smaller environmental impact. Similarly, the car industry faces pressure to adapt to legislation that limits CO₂ emissions and is investing more in the development of electric cars.

Section 2

The task content across occupations: What workers do and how

In this section, we present the core findings of this study with respect to the task content, methods and tools of the five manufacturing occupations. These findings are the result of an analysis that was carried out within the structure of the Eurofound 2016 framework for studying task content, methods and tools within occupations.

Developed by Eurofound in 2016, the tasks framework for occupational analysis is a tool for understanding the changing nature of work, assessing the impact of digitalisation and other factors, and understanding the implications of such factors for skills and job quality. Most of the task categories and dimensions included in the framework were identified following a careful review of the relevant literature, although the structure and underlying

logic of the framework is original (Fernández-Macías and Bisello, 2016a). This structure is shown in Table 1 below.

To characterise the nature and content of work for the different occupations, this framework contains three broad criteria for classifying tasks.

- **Content of work**, which classifies tasks based on their type (physical, intellectual or social).
- **Methods of work**, which classifies tasks according to how the work is organised (degree of autonomy, teamwork and routine, including repetitiveness and standardisation).
- **Tools used**, which classifies what is used to carry out the work (non-ICT machinery or ICT tools).

Table 1: Classification of tasks

<p>Content of work</p> <p>Physical tasks: The physical manipulation and transformation of material things:</p> <ul style="list-style-type: none"> ○ strength ○ dexterity <p>Intellectual tasks: The manipulation and transformation of information and the active resolution of complex problems:</p> <ul style="list-style-type: none"> ○ information processing: <ul style="list-style-type: none"> ○ literacy: <ul style="list-style-type: none"> ○ business ○ technical ○ humanities ○ numeracy: <ul style="list-style-type: none"> ○ accounting ○ analytical ○ problem solving: <ul style="list-style-type: none"> ○ information gathering and evaluation of complex information ○ creativity and resolution <p>Social tasks: Interaction with other people:</p> <ul style="list-style-type: none"> ○ serving/attending ○ teaching/training/coaching ○ selling/influencing ○ managing/coordinating 	<p>Methods of work</p> <p>Forms of work organisation used when performing tasks:</p> <ul style="list-style-type: none"> ○ degree of autonomy ○ teamwork ○ routine: <ul style="list-style-type: none"> ○ repetitiveness ○ standardisation <p>Tools used</p> <p>Type of technology used at work:</p> <ul style="list-style-type: none"> ○ machines (excluding ICT) ○ ICT: <ul style="list-style-type: none"> ○ basic ICT ○ programming
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Quantitative analysis

So far, this framework has mostly been used for quantitative analysis of how task content, methods and tools differ across occupations and change over time (Eurofound, 2016a; Fernández-Macías and Bisello, 2016b). Using different international sources on working conditions, skills demand and occupational information, a set of standardised indicators for task content, methods and tools was constructed, which allows the creation of task profiles for detailed occupations. Figure 1 below shows such profiles for the five occupations that are included in this study (two of them are approximations, as indicated in the note).

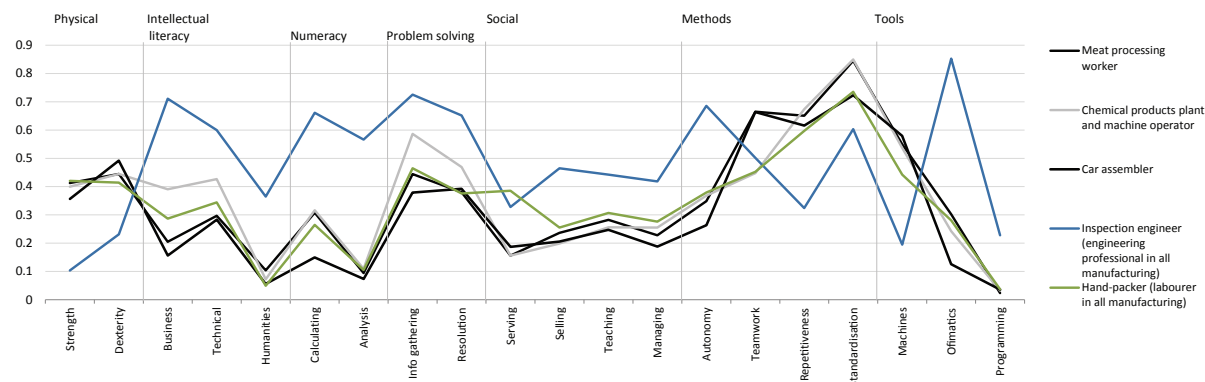
The occupation that stands out the most is inspection engineer, which involves a large number of intellectual tasks (business and technical literacy, numeracy and problem solving), high autonomy and ICT use, and less routine. The other four occupations have a relatively similar task profile according to this quantitative approach, although there are some interesting differences in the details. They all involve the following:

- a relatively high number of physical tasks (with slightly more emphasis on dexterity for car assemblers and chemical products plant and machine operators)

- a relatively low number of intellectual tasks (although chemical products plant and machine operators have slightly higher values for technical literacy and problem-solving tasks)
- a relatively low number of social tasks (although hand-packers score slightly more highly for serving)
- a low level of autonomy and high level of repetitiveness and standardisation (with higher teamwork values for car assemblers and meat processing workers)
- a high level of machine use and low use of ICT

Overall, the four shop floor occupations display a similar task profile, typical of semi-skilled industrial workers doing routine manual work that requires dexterity and problem-solving skills (with chemical products plant and machine operators having slightly more intellectual and problem-solving tasks, and hand-packers slightly fewer). In contrast, the inspection engineer displays a much more highly skilled task profile, with significant intellectual task content, much less routine and more ICT use.

Figure 1: Quantitative task profiles of the five key occupations



Note: The first three jobs refer to a specific occupation within a specific manufacturing sector, while the last two refer to a specific occupation within all manufacturing, and are therefore just an approximation. Meat processing worker: ISCO 81 NACE 10; chemical products plant and machine operator: ISCO 81 NACE 20; car assembler: ISCO 82 NACE 29; inspection engineer: ISCO 21 NACE 10 to 32; hand-packer: ISCO 93 NACE 10 to 32. EU-LFS 2012 employment data were used as weights.

Source: EJM tasks database (Eurofound, 2016a; Fernández-Macías and Bisello, 2016a).

Qualitative analysis

As previously mentioned, the focus of this study is the qualitative analysis of the changing nature of work within the five occupations. This is the first time that the Eurofound 2016 tasks framework has been used for a qualitative study and so this section not only provides the qualitative analysis, but also serves as an alternative and complementary validation of a framework that was originally designed for quantitative analysis. The main results of this qualitative data collection are presented in Table 2 and follow the structure of the tasks framework presented in Table 1 and Figure 1 to allow comparison.

However, as the information presented in Table 2 is of a qualitative nature, it also incorporates information on two dimensions that are missing in the quantitative approach shown in Figure 1: contextual information and trend information.

Table 2: A summary of the main findings from the case studies in terms of task content, methods and tools

	Car assembler	Meat processing worker	Chemical products plant and machine operator	Hand-packer	Inspection engineer
Physical tasks	Declining because of digitalisation	Still very important Little automation yet (difficult and costly)	Declining because of automation and sensors	Declining because of automation, but very diverse and changing	Very minor role and declining with digitalisation
Strength	Very minor role	Declining, but still important Increasing automation	Very minor role	Decreasing because of automation	Nothing
Dexterity	Declining, but still important (troubleshooting, customisation, etc.)	Very important Little automation	Declining, but still important (inspection, preparation, etc.)	Declining, but still important (machine operation)	Inspections and tests Declining because of digitalisation
Intellectual tasks	Increasing importance with digitalisation and standardisation	Remain secondary, but increasing importance Standardisation	Increasing importance with digitalisation and standardisation	Remain secondary, but increasing importance Standardisation	Core task category Increasingly digitised
Information processing	Quality control and documentation ICT tasks for digitally controlled equipment	Quality control and traceability Documentation standards	ICT tasks for digitally controlled equipment Quality control and documentation	Quality control and traceability Documentation standards In some cases, ICT tasks for digital control of machinery	Organising collection of quality data (increasingly digital) Analysing it and improving production processes
Problem solving	Troubleshooting production lines	Flexibility in production Troubleshooting	Error handling Troubleshooting production	Error handling Troubleshooting	Dealing with errors and complaints
Social tasks	Cooperation within team and supervision depending on position Coaching of new staff	Secondary, individual work Still some coordination and coaching	Secondary, individual work Increasing cooperation Coaching	Cooperation within team and supervision depending on position	Cooperation with production workers and other departments Supervision of processes Dealing with customers
Work organisation	Routine work Teamwork increasingly important	Routine work Individual Little autonomy	Routine work Mostly individual Little autonomy	Routine work Teamwork Some autonomy	Some routine tasks, but not predominant High level of autonomy
Technology	Electronically controlled machinery Increasingly ICT-controlled	More traditional machinery, although increasingly ICT-controlled	Electronically controlled machinery Increasingly ICT-controlled	Electronically controlled machinery Increasingly ICT-controlled	Intensive use of ICT Some machinery for testing and quality control

Physical tasks

Four of the five jobs included in this study involve a relatively high number of physical tasks, particularly in terms of manual dexterity. However, the cases analysed show that the importance of physical tasks is generally decreasing, mainly because of increasing automation.

Dexterity-related tasks are also declining, but the findings of this study suggest that they remain an important part of the four shop floor jobs. In fact, the increasing use of machinery on the shop floor contributes to the continuing importance of manual dexterity, because machines often require users with a high level of dexterity to operate them (this was specifically mentioned as increasingly important for hand-packers).

Although inspection engineers have fewer physical tasks (almost nothing in terms of strength), they do perform some tasks requiring manual dexterity for quality inspections and testing – even if digitalisation is increasingly automating most of these tasks, according to the case studies.

The case of meat processing workers is a little unusual. Although the cases studied suggest that automation is affecting meat processing work by reducing strength-related tasks, they also show that the effect of automation on manual dexterity tasks has so far been limited. The reason for this is that some meat processing manual tasks require a type of dexterity that remains difficult to automate (the processing of meat is difficult to standardise because of its inherent variability) and still too expensive relative to the cost of human labour.

Intellectual tasks

As shown in Figure 1 and Table 2, the four manual, semi-skilled occupations analysed in this study have traditionally involved fewer intellectual tasks than the inspection engineer role. However, it is important to acknowledge that some intellectual tasks do play a significant role in the manual, semi-skilled occupations, particularly problem-solving and technical literacy tasks (to a lesser extent).

On this point, the companies analysed as part of this study all indicated a similar trend: the importance of intellectual tasks is generally increasing, both in terms of information processing and problem solving. There are two main reasons given for this. First, the increasing use of digital technologies in production, which requires not only workers with more developed ICT skills in most occupations (including the manual, semi-skilled occupations studied here), but also a general increase in literacy and numeracy-related tasks, such as reading technical documentation or dealing with numerical information. Second, the increasing importance of quality control and standards in production processes. This second factor is institutional rather than technical, since it is driven by regulation, consumer demand and the increasing institutional complexity of productive processes (e.g. expanding the subcontracting of tasks and processes). Quality standards impose a certain degree of formalisation on the production process, with the use of detailed planning, indicators, benchmarking,

documentation, etc. Many of these quality procedures are at least partly carried out by shop floor operators, who have to fill in forms, document problems, assess numerical benchmarks, etc. Therefore, this increasing emphasis on quality results in a growing number of intellectual tasks for manual industrial workers.

For inspection engineers themselves, the main change in this respect is the increasing use of digital tools for the collection of quality data. This requires not only technical literacy skills, but also advanced numerical skills to analyse the resulting data and use the findings to improve production processes.

A final point worth mentioning is that, for most of the occupations, interviewees mentioned that increasing automation and the use of advanced production machinery was increasing the importance of intellectual tasks involving problem solving. Automation relieves the worker of some direct production tasks, but is often relatively rigid and cannot deal with errors or variations by itself. Therefore, shop floor workers are increasingly tasked with troubleshooting production lines, handling errors and providing flexibility when needed.

Social tasks

Social tasks are generally more important for services than for manufacturing. The occupations within this study have very little contact with customers or people outside the shop floor, and the social tasks within their jobs are restricted to cooperation with co-workers and some coaching of new or less experienced colleagues. The case studies suggested that both meat processing workers and chemical products plant and machine operators tend to work alone, so even cooperative task content is relatively limited within these roles.

As for inspection engineers, they often have to deal with workers from other departments and carry out some managerial types of tasks (such as supervising specific processes or even organising them). They also have to deal with external people more often than the other occupations, for instance handling complaints (which often involves social tasks similar to those of selling or convincing) or problems with suppliers.

The case studies did not highlight many changes in terms of this category of task in recent years, nor are any changes expected in the near future.

Work methods and work organisation

Although the four semi-skilled, manual jobs are relatively similar in their task content, there are some differences between them in terms of work organisation. Hand-packers are characterised by a relatively high degree of autonomy in the cases studied, whereas car assemblers, meat processing workers and chemical products plant and machine operators all have little autonomy within their work tasks. Inspection engineering, as could be expected, is characterised as a job with a high level of autonomy.

There were also some significant differences in terms of teamwork. Meat processing workers and chemical products plant and machine operators work alone more often, whereas hand-packers tend to work in teams and

car assemblers increasingly so. Inspection engineers often carry out their tasks alone, although as previously mentioned they also often interact with colleagues from other departments.

Finally, the four manual occupations studied were considered to have a significant amount of routine task content, in terms of both repetitiveness and standardisation. It is interesting to note that, despite the argument often found in the relevant literature that computers and automation are increasingly replacing routine tasks, the case studies did not necessarily support this view within these four occupations. It could be, of course, that automation replaces entire jobs rather than changing the task content of existing jobs, but that is not what the recent literature suggests (Arntz et al,

2016). It may also be that digitisation and the increasing importance of quality standards may, in fact, be adding new routine tasks to work (especially in terms of standardisation), even if they displace some routine tasks and/or jobs simultaneously (Fernández-Macías and Bisello, 2016b).

Tools and technology

As could be expected, in all case studies there was a clear increase in the use of digital tools at work, both in terms of electronically controlled machinery (especially on the shop floor) and computers. The least digitally enabled job was that of meat processing worker, but even in that case the use of digital tools is growing quickly according to the case studies.

Section 3

Job quality and industrial relations in the key occupations

This final section presents and discusses the key findings relating to job quality across the five occupations, based on the case studies. The job quality framework developed by Eurofound in the EJM 2013 has been used (Eurofound, 2013),¹² which includes the following main elements of job quality:

- intrinsic quality of work (autonomy, skills and social support)
- employment quality (development opportunities and contractual stability)
- health and safety (workplace-based physical and psychosocial risks)
- working time and work–life balance (duration, scheduling, flexibility and intensity)

An additional dimension related to wages is included in the analysis to complement and enrich the original framework with relevant information that was collected during the interviews and desk research. Finally, some information on industrial relations in the selected occupations is also presented and discussed.

Intrinsic quality of work

The intrinsic quality of work has three main components: autonomy, skills and social support. ‘Autonomy’ concerns the degree to which workers work autonomously and can decide the pace of the work and how to carry out tasks. ‘Skills’ concerns how varied and stimulating the skills required for the job are. ‘Social support’ concerns how stimulating and enriching the social environment of the job is. Therefore, in the approach taken here, intrinsic job quality can be understood as a measure of the richness of work as a creative human activity.

The case studies clearly indicate that, among the occupations under study, inspection engineers are enjoying the highest levels of intrinsic job quality. In contrast to the other cases, inspection engineers are in charge of organising and optimising production and manufacturing processes rather than being directly involved in them. Their work therefore involves an enriching variety of intellectual tasks that are often carried out with a high degree of autonomy, and fewer routine tasks. Furthermore, because inspection engineers have a key role in the continuous optimisation of production, they collaborate closely with colleagues from production units and management. For example, the UK case study highlights how following up on customers’ complaints often involves launching corrective actions in the

production of a specific batch of goods. The horizontal cooperation with other departments requires inspection engineers to have good social and communication skills to facilitate a process of continuous improvement.

At the other extreme of the spectrum, the intrinsic job quality of meat processing workers is relatively poor. This is because the autonomy of the job tends to be low and most of the work is routine. Quick-paced, repetitive tasks are mostly carried out individually, with limited social interaction. At the same time, the skills level required to perform the job is rather low.

For other manual-intensive jobs like hand-packers and car assemblers, the intrinsic job quality has improved somewhat over time. The case studies show that although the job of hand-packers involves standardised routine tasks, the more experienced and qualified workers now have to be able to perform complex logistical and coordination tasks too (e.g. packing and shipping products on time to many different customers). Teamwork is also an important element and social interactions with colleagues enrich the quality of the job. Regarding skills requirements, while the simplest routine tasks can be carried out by low-skilled (often temporary) workers, there is an increasing need for qualified workers who are able to handle ICT systems and keep track of all packing and shipment processes. For example, the UK case study shows that the recruitment of skilled hand-packers can be challenging, despite there being no formal educational requirements. Candidates lack the necessary skills, and the retention rate after only a few months is quite low.

Similarly, the study’s findings suggest that the intrinsic job quality of car assemblers has also improved with the introduction of more flexible and advanced manufacturing processes. While many tasks are still routine due to the introduction of strict quality standards, car assemblers now also perform more problem-solving tasks related, for instance, to monitoring production.

In all four case study countries, a number of those working as car assemblers are temporary workers hired by external agencies. This enables greater flexibility in the workforce when demand fluctuates. Typically, works councils at local level have made an agreement with the management as to how high the percentage of temporary workers is allowed to be (about 10–20%). Temporary workers are not usually given work tasks that require very much experience. These are instead performed by more experienced car assemblers who are permanently employed.

As with hand-packers, the social support component of the job is becoming more relevant. While car assemblers

12 This framework is itself based on the proposal by Muñoz de Bustillo et al (2011).

tended to perform tasks individually along an assembly line in the past, it is now more common to have work stations where individual workers cooperate in teams.

Finally, in the case of chemical products plant and machine operators, increases in the number of intellectual tasks (analytical skills related to problem solving and quality management) have made the job more varied and stimulating than in the past. Some autonomy is required to handle, monitor and document all stages of the chemical production process. The skills requirements of the job are becoming broader as chemical products plant and machine operators have wider areas of responsibility and are required to regularly update their ICT skills in order to monitor digital production equipment. Regarding social support, although the operators handle many processes individually, they also regularly cooperate with technical staff responsible for maintenance and laboratories, and give feedback on test samples and quality issues.

Employment quality

The second dimension of job quality discussed here is employment quality, which refers to the characteristics of the contract binding the worker and their employer. This dimension includes two elements: one measuring the degree of contractual stability for the worker and the other assessing the prospects that the job provides for further employee development.

In general, the case studies indicate that employment quality in all five occupations depends greatly on industrial relations and, in particular, coverage by collective agreements. This is especially true for the hand-packer role, for which employment quality is also affected by increased outsourcing, and car assemblers. These two occupations are experiencing growing segmentation between permanent employees, who are strongly represented by trade unions, and temporary agency workers, who have less contractual stability. This kind of dualism is also reflected in different opportunities for career development, as the Italian case study on hand-packers illustrates. In Italy, the grading system differentiates between hand-packers performing more advanced tasks that involve using ICT tools and coordinating colleagues and those in charge of simple sorting work, who have fewer opportunities for career progression.

The case studies on meat processing workers confirm that employment quality varies significantly depending on whether workers are covered by collective agreements, while also highlighting how the protection offered by such agreements varies between countries. In Italy and Sweden, the working conditions of meat processors are covered by collective agreements at industry level. In Germany, on the other hand, the meat industry is not covered by collective agreements and the use of temporary agency workers is increasing. There is also a high number of non-unionised workers in the meat industry in the UK.

In the case of chemical products plant and machine operators, the occupation is usually characterised by stable employment relationships based on centralised

bargaining and cooperation between social partners at industry and company level. The case studies suggest that both employer and employee representatives are interested in ensuring that employment conditions are attractive and staff turnover low. In difficult times, when redundancies are necessary to ensure the long-term survival of the company, employee representatives and the company management often work together to handle redundancies and launch programmes to retrain redundant workers and help them to find a new job. The occupation also offers good development opportunities. While no formal qualification is required to obtain the job, further studies can qualify an operator to be a process technician or chemical engineering technician.

Contractual stability is usually higher for inspection engineers than for the blue-collar production workers discussed so far. Inspection engineers also enjoy better career prospects and more development opportunities. Typically, they can start as part of a team of engineers in the company and gradually move upwards, becoming a team coordinator or project manager with responsibility for implementing new technologies and quality control procedures.

Workplace risks

The third dimension of job quality is the one related to health and safety in the workplace, in terms of both physical and psychosocial risks. In general, the analysis reveals that health and safety has improved significantly over the last few decades in most of the five occupations, mainly because of the introduction of automation technologies, but also because of increased standards and regulations, which decreased exposure to physical risks. For example, the case studies on chemical products plant and machine operators and car assemblers indicate that safety regulations have become more restrictive in recent years in the chemical and automotive industries. The chemical substances that employees are allowed to handle are more tightly governed, while there are stricter regulations regarding how employees must be protected and the safe handling of machines. However, because the pace of work has increased in many cases, the job has also become more stressful, potentially creating issues in terms of mental well-being.

Among hand-packers, automation technologies – and in particular the introduction of conveyor belts, anthropomorphic arms and lift trucks – have improved ergonomics and reduced physical risks. Safety has also improved among chemical products plant and machine operators because of automated production machinery as the operators now have much less contact with dangerous substances or machinery than before. Similarly, the job of car assemblers has become much less physically demanding due to automation technologies.

Meat processing workers have probably benefited less than the others, with their hard and repetitive physical work still being regarded as risky. This is because the adoption of technology in the meat industry is very slow due to high costs and companies still prefer to rely on cheap labour rather than automation.

Inspection engineers are the least exposed to workplace risks, especially physical ones. Their work does not typically involve the same health and safety risks as production workers, and their tasks have become safer due to less direct contact with machines.

Working time and work–life balance

The fourth dimension refers to working time, a key part of the employment contract, and its impact on the work–life balance (which ultimately affects the well-being of individuals). The main aspects of working time at job level are the duration, scheduling, flexibility and intensity of work.

The case studies indicate that working hours and the work–life balance are good for hand-packers who are covered by collective agreements. However, those who are not covered often report longer working hours, higher work intensity and stressful shift work, showing that there is considerable segmentation within the industry in terms of the quality of working conditions. The same is true in the meat processing industry, where workers not covered by collective agreements often complain of long hours, high work intensity and short breaks.

Working time and the work–life balance for chemical products plant and machine operators also vary at company level, depending on whether collective agreements are in place. The chemical industry in Germany, Italy and Sweden is largely regulated by collective agreements, while these are less widespread in UK. In the German case study company, for example, the shift system was recently changed from a four-shift system with three weeks on and one week off to a five-shift system with many more days off in between shifts. Moreover, the weekly working hours were reduced by 1.6 hours to 35.9 hours. Similarly, in the Swedish company, an agreement offering each employee the right to be rotated to other work functions was reached. On the contrary, in the UK company (which was not covered by collective agreements), more dissatisfaction with working time was expressed.

Regarding car assemblers, the case studies show that workers generally have a good work–life balance, and that working time and working conditions are regulated in collective agreements at industry as well as company level. However, the working time of car assemblers may be stressful if their work involves little flexibility and rotation between assembly line tasks, or if it predominantly consists of night or weekend shifts.

Finally, the work of inspection engineers typically involves high degrees of autonomy and flexibility, which allow workers to decide how to organise their work schedule during the day. However, the level of responsibility associated with this position (e.g. solving unforeseen problems and working within tight deadlines) could result in overtime or attending meetings outside of normal working hours, which could have a detrimental effect in terms of the work–life balance.

Wages

In general, the case studies show that wage levels vary considerably depending on the level of experience a job requires, the industry and possible coverage by collective agreements. In those occupations where the workforce is more segmented and the divide between core employees and temporary workers in terms of job quality is greater (e.g. hand-packers and car assemblers), substantial wage differences can be seen. In the case of car assemblers in particular, unionised workers with higher wage levels were more likely to remain in employment during the 2008 financial crisis, while temporary workers were more easily dismissed. Indeed, a comparative analysis of the case studies for car assemblers shows that all four countries experienced increases in hourly real wages in the automotive industry from 2008 to 2011.

Wage levels in the meat processing industry also vary quite significantly across countries. Meat processing is a low-wage industry in the UK and Germany, and some cases indicate that foreign workers are even paid below minimum wage levels. In comparison, Sweden's meat processing industry is regarded as having a high wage (€33 per hour on average).

The wage statistics across the four case study countries show that the wages of chemical products plant and machine operators vary depending on the required experience and the job's content and responsibilities. Desk research for the UK found that very similar job adverts offered different wages based on required experience with batch production and ISO 9000 quality systems.

As for inspection engineers, they are typically well-paid, salaried employees as most are members of professional trade associations and covered by collective agreements that regulate minimum starting wages. However, the case studies show that the wage levels of inspection engineers can also vary considerably depending on the educational history of employees. Indeed, employees working as inspection engineers do not only include graduates from higher education, but also blue-collar employees who, based on their workplace experience and training, have qualified for the occupation.

Industrial relations

A comparative analysis from a country perspective highlights how industrial relations in the five occupations are essentially characterised by two main trends.

The first trend is that although the number of workers who are part of trade unions has declined, the trade unions themselves have undergone a process of unification across related manufacturing industries. This means that workers may have a stronger negotiating position today because they are represented by trade unions that unite workers along the whole supply chain and have better insight into sector developments, working conditions, changes in job tasks and the skills needs of employees. For example, the UK case study showed that although trade union

density in the country is quite low,¹³ most car assemblers are covered by collective agreements (European Trade Union Institute, n.d.). The trade union Unite, for instance, now represents workers along the whole UK automotive industry supply chain.

The second trend is that the negotiations between employees and employers seem to be increasingly characterised by consensus and compromise, rather than confrontation. Although conflicts still arise at times, the general picture in the five sectors is that industrial relations are characterised by the common goal of achieving employment stability for core employees and

ensuring the long-term survival of the company – in some cases, even at the expense of an increasingly segmented workforce.

For example, in Sweden and the UK, car assembly representatives on works councils have accepted that temporary agency workers allow companies to adapt to changes in demand with flexibility, increasing their competitiveness and contributing to better stability for permanent production workers. The use of temporary workers is typically restricted to a certain quota, i.e. a percentage of all workers in production.

13 The trade union density is highest in Sweden (about 70%) and lower in Italy (35%), the UK (26%) and Germany (18%).

Concluding remarks and summary of key findings

The qualitative analysis conducted as part of this study has highlighted the importance of contextual information when it comes to understanding the impact of change on the task content of occupations, including its drivers and implications. Combining existing quantitative data with case studies at company level has enabled a more thorough analysis of how job content, work organisation and technology use have changed.

The five analysed occupations have all been affected by significant technological, market and regulatory changes in recent years. These changes have inevitably influenced the way companies operate and work is organised, which in turn has affected job content, skills needs and quality requirements. The main findings for each manufacturing occupation are presented in the following paragraphs.

The work of **car assemblers** has been particularly affected by digitalisation over the last few decades. Production in the car industry is now largely based on modularisation, which allows the increasing demand for specific features or technical requirements to be better accommodated. The use of robots, sensors and automation has also radically changed the way work is organised.

In terms of task content, the number of physical tasks is declining because of new technological innovations, although manual dexterity is still important for troubleshooting or customisation. At the same time, the increasing importance of standardisation means that intellectual tasks are becoming more relevant in areas such as quality control and the use of sophisticated, digitally controlled equipment.

Altogether, although the work of car assemblers still contains a high level of routine, these developments suggest that intrinsic job quality has improved over time. This is further supported by the fact that car assemblers now tend to work in teams instead of performing individual tasks along an assembly line, boosting social interaction.

The meat processing industry is still highly labour-intensive and the adoption of robots and automation technology is far from becoming mainstream, mainly due to costs and technical challenges. This implies that **meat processing workers** still predominantly perform physical tasks.

At the same time, the introduction of rising quality standards – especially in relation to food safety and traceability – has also affected how the meat industry operates. Intellectual tasks certainly remain much less frequent, but increasing standardisation requires greater quality control and a higher level of monitoring.

Work is more often carried out individually and with little autonomy. In terms of job quality, it is interesting to note that meat processing workers have benefited less from the

development of new technologies that reduce workplace risks than the other occupations. This is mainly due to the high costs of such technologies, which mean many companies still rely on manual labour.

In the chemical industry, many companies have invested significantly in automation and ICTs. This has led to decreasing labour intensity in production, but has improved working and safety conditions for **chemical products plant and machine operators** in turn (e.g. they have much less contact with dangerous substances or machinery than before).

The increase in intellectual tasks (analytical skills related to problem solving and quality management) due to the introduction of new technologies and regulations has made the job more varied and stimulating. Some autonomy is required to handle, monitor and document all stages of the chemical production process, and while work is often carried out independently, cooperation with other staff is also part of the job. The skills requirements of the job are becoming broader as chemical products plant and machine operators have wider areas of responsibility and need to update their ICT skills regularly in order to monitor digital production equipment.

The work of **hand-packers** has also been significantly affected by recent technological, market and regulatory changes, with the digitisation of logistics becoming an important driver of efficiency and quality. The use of ICT in packaging has led to a gradual shift in the tasks performed by hand-packers: being able to operate and monitor electronically controlled machines is becoming increasingly important at the expense of physical skills. Hand-packers have also been significantly affected by global market changes, where the growing interdependence of markets has resulted in the increased outsourcing of packaging and logistics. This implies that although the job often still involves simple and routine tasks, the more experienced and qualified workers now have to be able to perform complex logistical and coordination tasks, which in turn reflects higher intrinsic job quality. Indeed, there is an increasing need to have skilled workers who are able to handle ICT systems that keep track of all packing and shipment processes.

Higher standards for product quality, packaging and delivery have also influenced the work of hand-packers when it comes to product traceability, with a more widespread use of barcodes or other forms of electronic labelling technologies.

In terms of employment stability and working conditions, the occupation has experienced increasing segmentation between permanent employees strongly represented by trade unions and temporary agency workers with less contractual stability and fewer career development opportunities.

Inspection engineer is a general occupation that spans various manufacturing subsectors, but has a higher educational profile and greater skills requirements than other sector-spanning roles like hand-packer. Coordinating complex value chains spanning many countries means that quality control and standardisation are particularly important within this role. The need to comply with quality standards has led to the development of more comprehensive and centralised quality control systems that encompass all of a company's functions to avoid fragmentation. Cooperation with production workers and other departments is therefore very important for

inspection engineers, who supervise production processes and are responsible for launching corrective actions in response to customer complaints.

The use of digital technologies has also had an impact on the task content of this job, removing many repetitive testing tasks and introducing more tasks requiring advanced ICT skills. Compared to the other four manufacturing jobs, inspection engineers display much more significant intellectual task content and a higher level of autonomy.

References

All Eurofound publications are available at www.eurofound.europa.eu

- Acemoglu, D. and Autor, D. H. (2011), 'Skills, tasks and technologies: Implications for employment and earnings', in Ashenfelter, O. and Card, D. E. (eds.), *Handbook of Labor Economics*, Vol. 4B, Elsevier, Amsterdam, pp. 1043–1171.
- Arntz, M., Gregory, T. and Zierahn, U. (2016), *The risk of automation for jobs in OECD countries: A comparative analysis*, OECD Social, Employment and Migration Working Papers, No. 189, OECD Publishing, Paris.
- Autor, D. H. (2013), 'The "task approach" to labor markets: An overview', *Journal for Labour Market Research*, Vol. 46, No. 3, pp. 185–199.
- Eurofound (2013), *Employment polarisation and job quality in the crisis: European Jobs Monitor 2013*, Dublin.
- Eurofound (2016a), *What do Europeans do at work? A task-based analysis: European Jobs Monitor 2016*, Publications Office of the European Union, Luxembourg.
- Eurofound (2016b), *Methodology for the construction of the task indices for the European Jobs Monitor*, Eurofound, Dublin.
- Eurofound (2018a), *Game changing technologies: Exploring the impact on production processes and work*, Publications Office of the European Union, Luxembourg.
- Eurofound (2018b), *Car assemblers: Occupational report*, working paper, Dublin.
- Eurofound (2018c), *Chemical products plant and machine operators: Occupational report*, working paper, Dublin.
- Eurofound (2018d), *Hand-packers: Occupational report*, working paper, Dublin.
- Eurofound (2018e), *Inspection engineers: Occupational report*, working paper, Dublin.
- Eurofound (2018f), *Meat processing workers: Occupational report*, working paper, Dublin.
- European Trade Union Institute (n.d.), *National industrial relations: Trade unions*, web page, available at <http://www.worker-participation.eu/National-Industrial-Relations/Across-Europe/Trade-Unions2>, accessed 18 June 2018.
- Fernández-Macías, E. (2017), *Automation, digitisation and platforms: Implications for work and employment*, working paper, Dublin.
- Fernández-Macías, E. and Bisello, M. (2016a), *A framework for measuring tasks across occupations*, available at <https://voxeu.org/article/framework-measuring-tasks-across-occupations>, accessed 2 August 2018.
- Fernández-Macías, E. and Bisello, M. (2016b), *Fewer routine jobs but more routine work*, available at <https://www.socialeurope.eu/fewer-routine-jobs-but-more-routine-work>, accessed 2 August 2018.
- Muñoz de Bustillo, R., Fernández-Macías, E., Antón, J.-I. and Esteve, F. (2011), *Measuring more than money: The social economics of job quality*, Edward Elgar Publishing, Cheltenham.
- Rutter, J. (2015), *Moving up and getting on: Migration, integration and social cohesion in the UK*, Policy Press and Bristol University Press, Bristol.

This overview report summarises the findings of 20 case studies looking at recent changes in the task content of five manufacturing occupations (car assemblers, meat processing workers, hand-packers, chemical products plant and machine operators and inspection engineers) as a result of factors such as digital transformations, globalisation and offshoring, increasing demand for high quality standards and sustainability. It also discusses some implications in terms of job quality and working life.

The study reveals that the importance of physical tasks in manufacturing is generally declining due to automation; that more intensive use of digitally controlled equipment, together with increasing importance of quality standards, involve instead a growing amount of intellectual tasks for manual industrial workers; and that the amount of routine task content is still high in the four manual occupations studied.

Overall, the report highlights how qualitative contextual information can complement existing quantitative data, offering a richer understanding of changes in the content and nature of jobs.

The European Foundation for the Improvement of Living and Working Conditions (Eurofound) is a tripartite European Union Agency whose role is to provide knowledge in the area of social, employment and work-related policies. Eurofound was established in 1975 by Council Regulation (EEC) No. 1365/75 to contribute to the planning and design of better living and working conditions in Europe.

