



Future of manufacturing

Car assemblers: Occupational report

*New tasks in old jobs: drivers of change
and implications for job quality*

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Related reports: This occupational report is one of the five occupational reports (Car assemblers, Chemical products plant and machine operators, Hand packers, Inspection engineers, Meat processing workers) conducted in the framework of the project Future of Manufacturing in Europe and produced by Martin Eggert Hansen (Danish Technological Institute) and Simone Rosini (Fondazione Giacomo Brodolini).

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Introduction

About the study

The overall purpose of the study is to provide a comparative, qualitative, contextualised and detailed analysis of five specific manufacturing occupations, listed below with their International Standard Classification of Occupations (ISCO-08) code:

- meat processing worker (ISCO 8160);
- chemical products plant and machine operator (ISCO 8131);
- hand packer (ISCO 9321);
- car assembler (ISCO 8211);
- inspection engineer (ISCO 2141).

The study is based on a comparative, qualitative analysis of five key occupations in four countries (Germany, Italy, Sweden and the UK), each covering different European regions (continental Europe, the Mediterranean, Scandinavia, and Ireland and the UK). The study focuses on how job content, tasks, applied technologies and working conditions are changing the jobs and their content.

The five occupations were selected as case *examples* of classical occupations in manufacturing, and how the occupations and their content are changing due to many different factors at contextual and company level. Many other occupations in manufacturing could have been chosen. Hence, the main purpose of these comparative occupational studies is not to analyse the occupations as an end in themselves, but rather to use them to illustrate how manufacturing in Europe is changing and how this affects European jobs.

Each case study combines a contextual level (for example, industry developments) and a company level. Each case study thus analyses the occupation in a specific country (for example, car assembler in Germany) and how industry developments, company strategies and other contextual factors affect the work tasks and job content of the occupation. In each country, the case study was based on desk research and interviews with employees in the occupation and employers in a case study company. In addition, interviews were conducted with relevant social partner organisations.

At company level, the main focus of the interviews was to analyse the contents and work tasks of the occupation. This analysis is based on a framework developed by Eurofound, which divides the job content and tasks of occupations into three broad categories (Eurofound, 2016):

- physical/manual tasks;
- intellectual tasks – such as processing and transformation of information;
- social tasks – such as interaction with other people (colleagues, customers and so on).

The information gathered from the case studies suggests that the framework is robust and applicable across all the occupations of this study.

The occupation of this working paper

This working paper focuses on the occupation ‘car assembler’. This occupational group works in the secondary sector of the economy, normally at car producers or their supplier network. The tasks of a car assembler are a subgroup of the broader assembler occupational group, including:

- assembly and installation of prefabricated parts or components to form subassemblies, mechanical machinery, engines and finished motor vehicles;
- review of work orders, specifications, diagrams and drawings to determine the materials needed and to prepare assembly instructions;
- recording of production and operational data on specified forms;
- inspection and testing of completed components and assemblies;
- rejection of faulty assemblies and components.

Comparative analysis of the case studies: Contextual factors

This chapter discusses the main findings of a comparative analysis of the four case studies for the occupation, one from each selected country. It analyses the contextual factors and drivers of change affecting the car assembly industry, and how they influence the occupation's job content and working conditions. Contextual factors include:

- global megatrends;
- industry developments;
- policy context;
- market conditions;
- technological developments;
- industrial relations;
- other factors that influence the industry and the occupation.

The factors affecting the evolution of the sector depend on country-specific economies, which differ substantially between the four countries in which the case studies were conducted.

Market changes: Falling domestic sales and increasing exports to developing markets

Over the past decade, the European automotive industry has faced global market changes that involve a shift in sales and production numbers from developed into developing markets such as Brazil, China and India. This shift means that European car manufacturers have had to adapt to a structural crisis, where they had to handle the challenges of falling domestic sales and growing overcapacity issues (Gajdos, 2012). The downturn in sales due to 2008 financial crisis intensified the structural challenge.

These factors mean that the car industry in the four case study countries has increased its focus on exports, responding to three different needs:

- a need to diversify the customer portfolios of the car companies;
- a need to react to weak internal market performance after the financial crisis;
- a strategic aim determined by the decision to penetrate foreign markets with the installation of production sites.

All the four countries analysed in the case studies have experienced a growing export share. In 2015, Germany and the UK both sold 77% of their production abroad. In the same year, Sweden exported 85% of the cars it produced as well as 95% of heavy vehicles. Although data for Italy are not available, exports by the case study company (producing luxury cars) amounted to 98.7% of its sales in 2013.¹

Exports are led by Asian and Oceanian markets aggregated (34%), followed by North America (28%), and EFTA/Eastern Europe (21%). The differences in taste and climatic conditions in the different countries have created pressures in the car design centres (e.g., the Italian super-premium car company mentioned specific and strange requests from Asian customers). This has led to a new worldwide market where the companies have had to address customers' request across many countries and cultures. Investments in production lines were therefore needed as well as in the supply chains and staff training.

Resurgence and globalisation of European automotive industry after the crisis

The downturn created by the financial crisis hit the European automotive industry hard and forced the industry to make adaptive changes to remain competitive. Over the last decade, the industry has

¹ The share of internal sales collapsed in the aftermath of the crisis due to Italian families losing their purchasing power across the board, and a national campaign to tackle tax avoidance that led to a substantial reduction in the number of super-premium cars in the country.

undergone a resurgence based on increasing export sales, a focus on premium markets, digitalisation of production and increased customisation. The automotive industries in the four case countries have also undergone a process of international mergers and acquisitions which means that large parts of the automotive industry are under foreign ownership and supply chains have become global. Some of the production has moved to low-wage countries. With a declining home market share and increasing exports, the automotive industry in the four countries has changed market strategies to focus on premium cars and customisation.

Different trends in the four case studies can be observed. In Germany and Italy, there was a concentration of production and an aggressive campaign of acquisitions towards foreign companies especially in the late 1990s,² while the opposite happened in Sweden and the UK. In Sweden, Volvo was first sold to the American Ford Motor Company in 1999 and later to the Chinese Zhejiang Geely Holding Group in 2009. In the UK, Jaguar Land Rover was also bought by the Ford Motor Company, before being bought by the Indian company Tata in 2017.

The resurgence and the new strategy have been accompanied by:

- an influx of foreign investment in research and development (R&D);
- greater government–industry collaboration to enhance the industry’s framework conditions and development.

For example, the UK is the world’s leading R&D investor in the automotive sector. Here the state has played an important role by launching in 2009 the Automotive Council through which leading UK universities and research centres contribute to the sector’s R&D.

Companies forced to make production more flexible

To adapt to market changes, the car industry in the four case study countries has been forced to introduce elements that make its production more flexible and thus able to adapt more quickly to changes in market demand. The general trend is that car manufacturing companies have introduced more modularisation. This means that the main components of a vehicle include a standard set of subcomponents that can be pre-assembled at one workstation before being integrated with other main components. This in turn means that the assembly line needs fewer workstations.

The reorganisation of the supply chain is characterised by modularisation and globalisation, including the vertical de-integration of production and the development of new forms of relationships with suppliers. Typically, suppliers have become more integrated with the car manufacturer with respect to modularisation and just-in-time logistics.

Modular development of vehicle systems allows car manufacturers to rely on the collective expertise of their component suppliers. For example, rather than having a supplier provide just seats, the supplier may be asked to supply the entire interior, including cockpit modules (incorporating the instrument panel, air bags, gauges, console and pedals), seat systems, door inners and the headliner. The idea is that the economies of scale inherent in modular component supply will be achieved through an increase in engineering efficiency and labour productivity, lower material costs, investment costs and greater speed to market (Lunani and Kalmach, 2005).

The case studies show that the car manufacturers tend to increase their use of temporary workers who work on short contracts. This enhances the company’s flexibility to adapt quickly to fluctuations in market demand by firing the temporary workers and keeping on their permanently employed staff. Typically, the use of temporary workers has been agreed with trade unions at company level to increase the competitiveness of the company and hence the employment stability for the permanently employed.

² Over the years, the German company Volkswagen has acquired Audi, Bugatti, Lamborghini, NSU, Porsche, SEAT and Skoda. The Italian company Fiat gained absolute dominance in the Italian market with the acquisition of Autobianchi, Lancia, Alfa Romeo, Maserati, Ferrari and Abarth. In 2014, it merged with Chrysler reinforcing its role as global player in the industry.

German car manufacturers pursue a strategy of flexibilisation based on both internal and external flexibility. Internal flexibility is largely based on flexible working hours, external flexibility on temporary agency work and service contracts; the automotive industry is the biggest user of temporary agency workers in Germany. Moreover, car manufacturers and their suppliers have developed a new model for outsourcing through service contracts, whereby service companies take over certain activities in the production process such as logistics or certain parts of production such pre-assembly.

Technology changes: Digitalisation of manufacturing and vehicles

Digitalisation is a key influential technological change for the automotive industry as it affects the automotive industry in two ways: the digitalisation of manufacturing processes, and the digitalisation of connected vehicles and customer relationships.

The digitalisation of manufacturing offers many opportunities to increase efficiency and reduce costs; the savings potential spans the full value chain from manufacturing to logistics and maintenance costs. Digitised factories can produce a higher number of derivatives and varieties on the same assembly line than traditional automotive manufacturing plants without major changeover costs and with a faster time-to-market and a higher quality.

The case studies indicate that the digitalisation of manufacturing is an ongoing process. Looking to the future, it is expected that application of digital technologies can improve the efficiency of all processes along the value chain such as:

- designing production lines more quickly and with greater certainty, using virtual reality and analytics to optimise the flow of materials and movable assets;
- better execution of new vehicle model launches using sensors and exchange of product development and pre-production data;
- better plant maintenance using sensors on machinery and algorithms to predict future usage, substantially reducing unplanned machine downtime;
- reducing inventories and lead times using track-and-trace inbound supplies which give real-time estimated times of arrival.

The application of digital technologies in manufacturing often involves the creation of the ‘digital twin’ of a physical product. Once the digital twin is created it can be analysed for many purposes. As well as enhancing the design of production lines, a digital twin makes it possible to optimise throughput by simulating the adoption of alternative production processes and techniques.

Digital technologies are also increasingly embedded in new vehicles, enabling innovative solutions especially related to connected vehicles, autonomous cars, electrification and Smart City solutions. Digital technologies and connected vehicles also create new business opportunities for car manufacturers to develop new services. For example, the Swedish company Scania considers the development of electronic control systems to be a core business activity and the information from connected vehicles as a strategic asset. Today, Scania’s connected customers in more than 50 countries have access to services to follow up and evaluate the performance and fuel efficiency of their vehicles. Hence, the company is moving along the value chain from its traditional role as a producer of vehicles towards becoming a service provider of ‘transport solutions’.

Policy and regulation: Increased focus on sustainability and emission levels

Due to the climate change agenda and environmental issues, the European car industry is faced with increasing political demands and regulations to produce vehicles that reduce the use of fossil fuels and their associated emissions. EU legislation and standards aim to reduce carbon dioxide and nitrogen dioxide emissions. In addition, the European Commission is working on noise reduction and eliminating the use of fluorinated greenhouse gases in mobile air conditioning systems (European Commission, undated).

Since 2009, passenger cars and light commercial vehicles in the EU have been subject to carbon dioxide regulations. The average emissions of all newly registered vehicles from a manufacturer in

one year must not exceed a statutorily defined limit in grams of carbon dioxide per kilometre travelled (g/km). For passenger cars, the target for 2015 was 130 g/km and the aim is that this will drop to 95 g/km by 2021 (VDA, undated).

The increasing political regulation of emissions and sustainability is an important driver for innovation and the development of more fuel-efficient vehicles and hybrid electric vehicles. Car manufacturers that can provide sustainable vehicles which are customised to meet the preferences of specific customer segments in terms of design, functionality, price level and image will be able to develop new markets. The car manufacturers interviewed for this study stressed that future market success will be achieved by those companies that are best at knowing their customers' preferences and needs for transport solutions. In other words, they think that car manufacturing companies need to focus more on data-driven customer relations and services. In addition, the increase in the prevalence of shared economy also means that many new forms of car ownership are appearing. Instead of buying and owning the same car for many years, more flexible forms of ownership or leasing are expected within the next few years. The increase in the prevalence of the shared economy also means new internet-based and innovative business models of sharing vehicles for transport.

The transition to manufacturing more sustainable vehicles requires new skills in the workforce and investment in R&D. The case studies show that the car industries in the four countries have launched industrywide initiatives and industry–government partnerships to enhance the development of more sustainable vehicles.

In Sweden, the Swedish government and the automotive industry has launched the Strategic Vehicle Research and Innovation (FFI) partnership. FFI's overarching mission is to:

- reduce the environmental impact of transportation;
- minimise the number of traffic accidents;
- preserve and strengthen Sweden's leadership position in the automotive sector.

Similarly, in the UK, the Automotive Council has launched targeted actions aimed at:

- strengthening the UK automotive supply chain;
- achieving co-investment in the development of the next generation of low-carbon vehicles;
- maintaining and developing the UK's competitive business environment.

Joint investments between government and the automotive industry have been made to research, develop and commercialise the next generation of low-carbon propulsion technologies.

In Germany, the automotive industry has launched an industrywide strategy to develop an energy-efficient vehicles and infrastructure ready for a mass market launch in 2020. The automotive sector itself has set the goal of becoming a lead provider of electromobility solutions by 2020.

Workforce changes: Increasing use of temporary workers

The introduction of digitalisation and more flexible, modularised assembly processes in response to market changes means that work organisation in car manufacturing companies is also undergoing significant change. The digitalisation of manufacturing processes and the increasing use of equipment managed by information and communication technologies (ICT) and ICT embedded in vehicles has also increased the need for experienced workers with digital skills and intellectual problem-solving skills, who can handle the documentation and information processing in relation to quality control and the continuous optimisation of production processes.

Despite the changes in work organisation, the car assembler workforce is not characterised by an upgrading of the formally required skills. In all four case study countries, people working as car assemblers are mainly unskilled workers as there are no formal qualification requirements for assembly line work in car manufacturing. Indeed, the car industry has increased its use in production of unskilled, temporary workers hired by external agencies. In Germany, for example, car manufacturing companies tended to recruit young, skilled workers in the 1980s and 1990 for assembly line work. However, these workers were too highly skilled for assembly line work and expectations to upgrade assembly work based on innovative group concepts with higher skill demands did not meet

with reality. The upgrading of assembly line work has now stopped, the number of apprenticeships has fallen, and more and more temporary agency workers are being used.

But while no formal qualifications are needed to work as a car assembler, the occupation is not undergoing a process of de-skilling. Instead, car manufacturers have increased systematic on-the-job training based on introductory training for new car assemblers and their mentors.

The increasing automation of car manufacturing is expected to reduce future demand for car assemblers as robots take over some of their work. This is anticipated by the Swedish Employment Service's assessment of the future job prospects for car assemblers. However, international research finds no clear evidence that the installation of robots in car manufacturing has led to job losses. Indeed, data suggest that the arrival of robots has tended to increase the employment and pay of skilled workers even as it seemed to 'crowd out' the employment of low-skilled and, to a lesser extent, middle-skilled workers. Hence, while robots do not seem to be causing net job losses, they do seem to change the type of workers that are in demand (Muro and Andes, 2015).

Industrial relations: Compromise and consensus

The case studies show that most car assemblers are covered by collective agreements and that trade union density in the automotive industry tends to be high. In recent decades, the trade unions in the industry have undergone a process of mergers and unifications that may have strengthened workers' representation. By uniting with other trade unions, each trade union achieves a stronger position in the negotiation of collective agreements. An example is Unite in the UK, which covers agency workers, apprentices, trainees, supervisors and managers in vehicle manufacturing companies. It now represents workers along the whole supply chain of the UK automotive industry and has some 95,000 members in the industry.

The automotive industry is a traditional union stronghold. Again taking the UK as an example, a comparative analysis from 2003 found that trade union density in the UK automotive sector was 44% (Eurofound, 2003). This figure is well above the national average, which dropped about 9% between 1995 (32.4%) and 2016 (23.5%) (Statistica, undated).

Industrial relations in the automotive industry have evolved to a style of compromise and consensus in order to achieve employment stability. The consensus is based on the perception that assembly line workers have common interests with company management when it comes to ensuring that the company remains competitive. Car assemblers' representatives are therefore actively involved in the continuous optimisation of work organisation and the launch of training programmes that maintain car assemblers' skills and employability.

Employee representatives on works councils at company level also accept that the company uses temporary agency workers to ensure that it company can adapt to changes in demand with flexibility. This is because the use of temporary workers can increase the company's competitiveness and contribute to better employment stability for permanently employed workers on the production line. The use of temporary workers is typically restricted to a certain quota (that is, a percentage of all workers in production), which is part of an agreement made in the works council at company level.

Although industrial relations are generally characterised by consensus, trade unions may still maintain an attentive and confrontational approach at industry level to safeguard workers' interests and rights. In the UK, for example, Unite is currently urging workers in the automotive industry to 'sound the alarm' if their rights and interests are threatened by Brexit (Burke, 2017).

The occupation’s job content and tasks

The contextual factors discussed in the previous chapter affect the strategies, manufacturing processes and work organisation adopted at company level, and hence the content and work tasks of the occupation. Overall, the contextual analysis indicates that car manufacturing companies are increasingly attempting to boost efficiency by using digitalised production equipment, automation and robots. Furthermore, companies are introducing modularisation and new ways of organising assembly line work to increase flexibility in order to be able to adapt rapidly to market changes.

Based on interviews in the case study companies, this chapter examines how the contextual changes are affecting the job content and tasks of the occupation. The approach taken is to look at the four case study companies to deduce the main generic tasks and job content. Table 1 presents a summary of the occupation’s tasks, following the task framework developed by Eurofound researchers, which distinguishes between physical, intellectual and social tasks (Eurofound, 2016; Fernández-Macías and Bisello, 2016).

Table 1: Summary of job content and tasks performed by car assemblers

Category	Task content and subcategories
Physical/manual tasks	<p>Physical strength</p> <ul style="list-style-type: none"> • Heavy lifting • Gathering parts and tools for assembly • Assembling, subassembling, placing, inserting, fitting, tightening and placing car parts (for example, engine bonnet, doors, electrical parts, seat wirings, suspensions) • Welding and/or gluing car parts and panels • Using lifters (for example, for lift and ground vehicles) and electronic screwdrivers • Cleaning up working areas <p>Dexterity</p> <ul style="list-style-type: none"> • Habituation, learning the language of the body • Painting and coating car bodies • Storing controlled substances and components into correct trackside location • Adding noise vibration harshness materials to the inner parts and components of the vehicles • Testing and setting anomalies in the functioning of mechanical and electrical parts • Intervening to alter the process – also through computer-aided diagnostic terminal • Handling minor troubleshooting issues relating to production line robots
Intellectual tasks	<p>Information processing</p> <ul style="list-style-type: none"> • Following instructions, specification cards and blueprints to learn about components and related assembly procedures • Visual control of gathered parts • Identifying which type of car/car part is running on the line • Verifying and reporting non-standard items • Deciding which tools are needed and which operations have to be performed accordingly • Scanning the components used and the level remaining so as to order spare parts running low from the logistics departments (also through diagrams and drawings) • Monitoring the machines • Quality assessment and control • Writing a description of observed defects on documents attached to vehicle bodies

Disclaimer: This working paper has not been subject to the full Eurofound evaluation, editorial and publication process.

Category	Task content and subcategories
	<ul style="list-style-type: none"> • Entering or retrieving production data, using computer terminals • Drafting maintenance reports and supporting production documentation • Measuring, either manually or through coordinated measuring machines, the locations of holes, slots, studs, welding lines and other features to ensure that vehicles are built within the tolerances set by automotive manufacturers • Installing and testing embedded digital software in vehicles <p>Problem-solving</p> <ul style="list-style-type: none"> • Troubleshooting • Participating in the continuous improvement of the production chain (for example, reporting problems whose rectification would speed up the process or make it smoother) • Attending to digitally controlled machines • Carrying out preventive maintenance of equipment (for example, lubrication, changing worn out parts)
Social tasks	<p>Serving/attending</p> <ul style="list-style-type: none"> • Cooperating with technical staff responsible for maintenance • Participating in meetings on health and safety procedures <p>Teaching/training/coaching</p> <ul style="list-style-type: none"> • Training junior workers and temporary workers (if senior worker) <p>Managing/coordinating</p> <ul style="list-style-type: none"> • Communicating and cooperating with upstream and downstream functional sectors (for example, logistics to signal spare parts running low) • Reporting to management (verbally, via email or through corporate management software) in a precise and concise way, and in compliance with the organisational hierarchy • Supervising and coordinating tasks (if senior worker or head of unit)

The following sections analyse the different task categories in more detail.

Physical/manual tasks

The tasks of car assemblers have changed consistently in past decades, a trend that is likely to continue in the years to come. This is due to the gradual and constant mechanisation and digitalisation of the car industry.

The number and extent of physical tasks are decreasing due to greater automatisation and use of lifting equipment, and there is increasing focus on ergonomics. Digitally controlled equipment means that more parts can be assembled automatically. For example, when car doors and bonnets reach the assembly stations in the Italian case study company, they have already been almost completely pre-assembled, and handled through lifters. This constant process of mechanisation paves the way for higher level specialisation and manual skills. These have to be taught or improved through training initiatives targeting all car assemblers.

The level of specialisation and skills varies between the countries analysed in the four case studies. Swedish car assemblers already require high skill levels given their role in monitoring and troubleshooting production line machines and robots.³ In the other three countries, however, most of the tasks require low to medium skills.⁴ This has mostly to do with the assembly (or subassembly) of

³ This includes being able to use computer-aided diagnostic terminals.

⁴ In the Italian case study, it is explicitly mentioned that no ICT skills are going to be demanded in the near future, with 90% of future workers having attained only the compulsory level of education or having high school diplomas.

car parts, gluing or welding them and using basic machines, such as lifters. Specific subgroups of car assemblers are asked to paint and coat the car body (or supervise to ensure that machines carry out this task properly).

Manual tasks also vary according to the segment in which the individual car companies operate. For instance, in the British and Italian companies, the manual tasks when working on upper premium cars, assume an artisanal level⁵ and constitute the added value of the product. This is particularly the case when requests for customisation come directly from the final customer. The manual production of high-end luxury cars tends to be organised on an assembly line with many fewer work stations, where the main parts and electronics are assembled manually.

Intellectual tasks

The intellectual tasks of car assemblers are becoming increasingly important. The analysis below distinguishes between information processing and problem-solving.

The information processing tasks of car assemblers start with reading and understanding the production tasks/plans. This involves studying instructions and blueprints to identify the parts they are going to use during the process and learn how to assemble them. For each sub-action, the car assembler then has to decide which tool is needed and which operation(s) needs to be performed. Information processing also includes tasks related to verifying the quality of their own work and writing descriptions of observed defects on documents attached to the vehicle bodies. The car assembler may also enter and retrieve production data using computer terminals.

The supervisors or head of units of car assemblers draft maintenance reports and contribute to the production of documentation concerning the workflow. Depending on the car assemblers' ICT experience, tasks may also include the installation and then the testing at the end of the car assembling process of digital software embedded in the vehicles. Interviews in the Swedish case company show that the use of ICT and digitally controlled equipment leads to a decrease in manual, repetitive tasks, which used to be a major health issue for car assemblers. According to the Swedish interviews, car assemblers used to work on the same work station; in recent years they have had to become more flexible to be able to rotate between different work stations and to perform a wider range of tasks and monitoring of production processes. This trend is expected to continue.

Regarding problem-solving, the main task is troubleshooting on the production line. For this reason, car assemblers need a broad understanding of how the machines and production equipment work and the typical causes of machine malfunctions. If the machines stop, car assemblers must be able to assess the likely causes of the problem and restart the machine if they can fix the problem themselves – and not call for a technician every time. Car assemblers are expected to keep the workflow smooth and to avoid bottlenecks or shortages of material along the production lines. Their tasks also include preventive maintenance of the equipment and machines.

Finally, car assemblers have a growing involvement in the continuous improvement of the production chain to speed up the process or make it smoother.

Social tasks

Although most of the work of the car assembler is carried out individually at work stations along the production line, car assemblers also have social tasks. Typically, the car assembler works as member of an assembly group and is assigned to different work stations depending on production needs. The shifts between work stations involve continuous cooperation and coordination with other car assemblers.

In terms of serving/attending, social tasks typically involve cooperating with technical staff responsible for maintenance and participating in meetings on health and safety procedures.

⁵ The UK company value proposition includes the fact that its luxury cars are handmade. This implies that even the electronic parts of the cars are assembled manually.

Teaching tasks, such as training junior workers and temporary workers, is an important social task, particularly for car assemblers with seniority. As the use of temporary workers is increasing, permanently employed car assemblers are increasingly involved in teaching, coaching and mentoring. Social tasks related to managing and coordinating include communication and cooperation with upstream and downstream functional sectors (for example, logistics to signal spare parts running low). For instance, car assemblers may have spotted some irregularities with parts they have received and liaise promptly with the functional sector upstream. Or, as is most often the case, they liaise with storehouse personnel to signal that stocks are running low on some particular parts and that they need to replenish these before they run out.

Management skills are particularly important for car assemblers who have a supervisory role over other members of the unit (as was the case for the people interviewed in the Italian company). In this case, their skill portfolios lean much more on social and intellectual skills as they supervise and coordinate the tasks within the unit. Moreover, they have reporting duties to management and so have to develop the skills needed to report in a concise and thorough way. Car assemblers must also be able to report relevant information to management verbally, via email, or using corporate management software in a precise and concise way, and in compliance with the organisational hierarchy.

Methods and tools of the work

The previous sections analyse the content of the work in terms of the occupation's physical, intellectual and social tasks. This section focuses on the methods such as the forms of work organisation used in performing the tasks. The framework developed by Eurofound differentiates between three dimensions:

- autonomy – extent to which a worker is free to carry out the task as they want;
- teamwork – extent to which the task is carried out in direct cooperation with a small group of co-workers;
- routine – extent to which the task is repetitive and standardised.

The case studies indicate that the work of car assemblers tends to be routine work in the sense that the tasks are repetitive and standardised. The assembly order/instruction and blueprint specify the parts and elements to be prepared for assembly. Furthermore, the car assembler documents all processes by entering production data as assembly operations are completed. The entering of production data must be consistent and standardised. Although most work is carried out individually as routine tasks, the work also involves a considerable element of teamwork. The introduction of new assembly line work organisation implies that there are fewer work stations and that more car assemblers work as a team in more comprehensive assembly operations. The use of teamwork as a method may therefore be increasing.

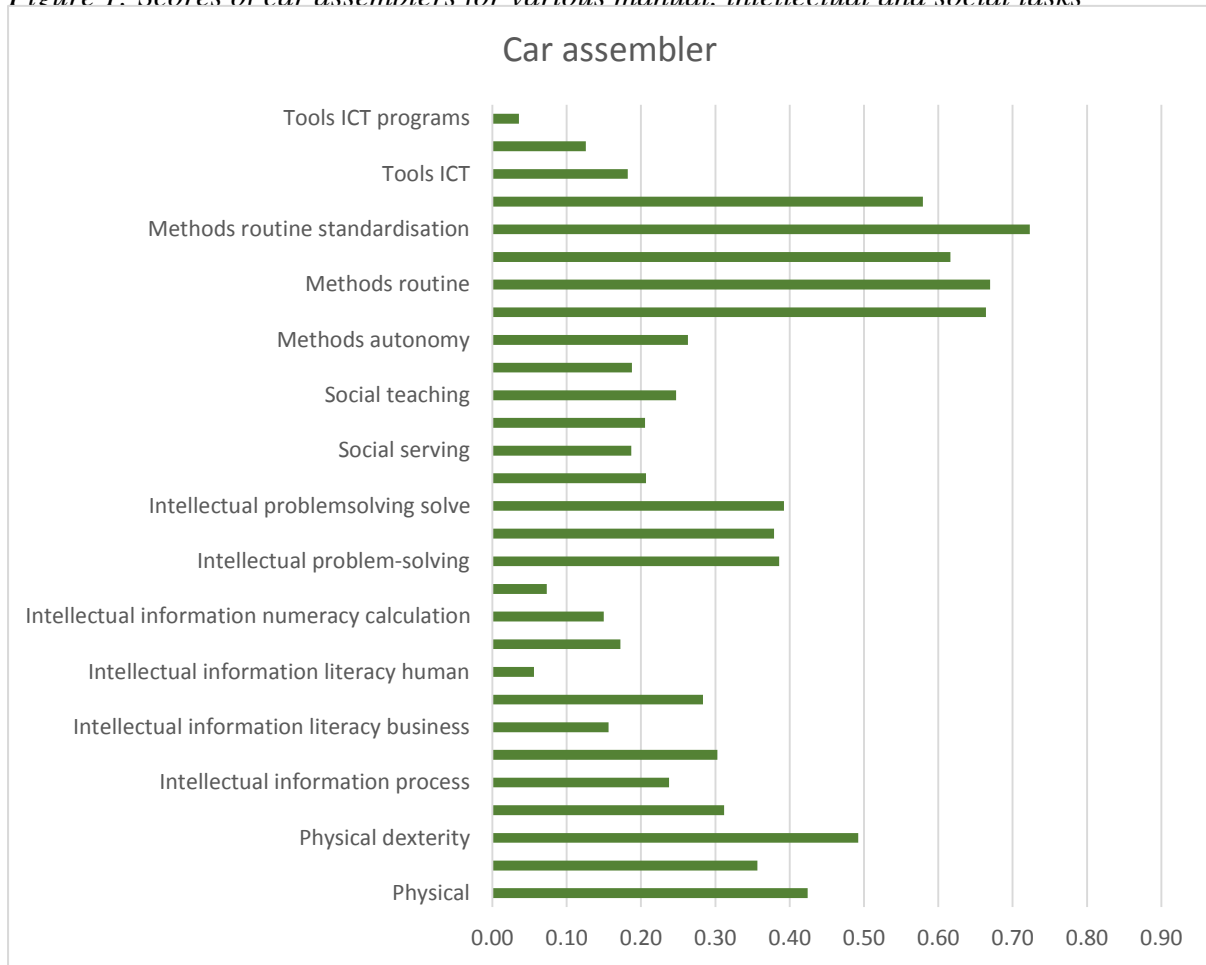
In terms of tools, the Eurofound framework differentiates between two main types: machines (excluding ICT) and ICT. The case studies show that car assemblers operate a large amount of equipment in order to assemble parts of vehicles. The machines are controlled by electronically and the car assembler uses ICT software when operating and monitoring the machinery. Car assemblers also use ICT equipment to test the electronic systems and software in the vehicles after their installation.

Comparison with Eurofound's job content scores

Using data from different international sources, Eurofound researchers constructed a database containing scores of job tasks for many different occupations in Europe (see Eurofound, 2016)

Working as a car assembler is a physical, repetitive job that requires dexterity; it is also a job that has a high level of routine tasks (Figure 1). Car assemblers mainly work autonomously and the content of social tasks, such as social serving and teaching, is relatively low. The level of intellectual tasks, such as problem-solving is moderate, and the level of intellectual tasks related to numeracy and literacy is low.

Figure 1: Scores of car assemblers for various manual, intellectual and social tasks



Job quality of the occupation

The concept of job quality refers to the potential impact of the characteristics of jobs on the well-being of workers. Based on information from the case studies, this chapter discusses the job quality of the work of car assemblers. The discussion uses a Eurofound model, which has the following four main dimensions of job quality (Eurofound, 2013):

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

A further element, pay/wages, was added for this study to enrich the analysis.

Intrinsic quality of work

Intrinsic job quality has three main components:

- skills – how varied and stimulating the skills required in the job are;
- autonomy – to what degree the worker work on their own and can decide the pace of the work and how to carry out work tasks;
- social support – how stimulating and enriching the social environment of the job is.

Taken as a whole, intrinsic job quality can be understood as a measure of the richness of work as creative human activity, which is what skills, autonomy and social support are all about.

The case studies show that the intrinsic quality of work of car assemblers is generally regarded as good and improving. Traditionally, a car assembler’s job constituted the classical example of ‘Fordism’ where manufacturing work is organised as monotonous, repetitive, routine manual tasks along a long assembly line. The introduction of robots means that ergonomically harmful work is increasingly being taken over by robots or collaborative robots. Furthermore, the introduction of more flexible and advanced manufacturing processes mean that car assemblers have more intellectual tasks related to the monitoring of production, problem-solving, the documentation of production and the verification of quality.

Working as a car assembler requires a broader set of skills related to problem-solving, ICT and processing of information than before. Regarding autonomy, the job mainly includes routine tasks in the sense that they are standardised as the car assembler follows the instruction and blueprint. However, the increasing number of tasks related to problem-solving indicates that the work of car assemblers is becoming a little more autonomous. On the whole, the job of a car assembler has become a more stimulating and enriching occupation, with a more balanced variety of work tasks and skills.

The social support component of the job may be improving. Previously, car assemblers tended to perform more routine tasks individually along a longer assembly line. Employee interviews indicate that such forms of isolated work still exist in the industry. However, the general trend is that there are now typically fewer work stations and, at the ones that remain, car assemblers cooperate in teams. Furthermore, the more advanced manufacturing processes involve more contact with quality and maintenance departments.

Employee interviews also indicate that car assemblers who have experienced good working conditions typically identify good colleagues, excellent team spirit and management as important factors for the establishment of good working conditions. The employees describe good working conditions as teamwork, where workers help and respect each other. Overall, the case studies indicate that working as car assembler is becoming more socially stimulating.

Employment quality

The case studies indicate that the employment quality, wages and contractual stability of car assemblers are generally good, as most are covered by collective agreements and are strongly represented by trade unions.

To achieve flexibility, the car industry has increased the use of temporary agency workers who do not have the same contractual stability. Hence, there is a trend of polarisation between core workers and temporary workers. On the one hand, there is a shrinking group of core employees who can be confident of agreed pay rises, bonuses for additional achievements, and special holiday and premium payments. On the other hand, there is a growing group of marginalised employees who have to put up with often scarcely calculated reimbursements and low temporary incomes. This group grew significantly in the post-crisis boom as the automotive industry recovered after the 2008 crisis (Blöcker, 2012).

Workplace risks

In terms of health and safety, the job of car assemblers has improved significantly in recent decades. The case studies indicate that the occupation tends to involve fewer manual and physical tasks due to the introduction of lifting equipment and automation technologies. This means that the job has become much less physically demanding.

Working time and work–life balance

The case studies show that:

- car assemblers have a good work–life balance;
- working time and working conditions are regulated in collective agreements at industry as well as company level.

However, employee interviews suggest that some car assemblers complain about poor working conditions and these may vary depending on the organisation of work and the production management. Car assemblers who have experienced poor working conditions typically complain about monotonous work content and heavy physical work. The work day is described as being monotonous and stressful; this has a negative influence on working conditions when workers do the same thing over and over again without variation. In addition, several employees mentioned heavy lifting and hard physical work as some of the challenges when working as a car assembler. The interviews indicate that physically stressful and monotonous work still exists in the automotive industry.

Pay/wages

Wage levels in the automotive industry in the four countries are generally high. A comparative analysis found that increases in hourly real wages were experienced in the automotive industry in all four countries in the period 2008 to 2011 after the financial crisis (Schulten and Müller, 2014). The increases in wages were obtained in a period with declining employment after the crisis and a decreasing number of working hours. This increase in wages despite declining employment may be explained by the strong representation of trade unions, which managed to negotiate good working conditions for the remaining workers. But while unionised car assemblers maintain high wage levels, the increasing use of temporary assembly line workers employed by external providers reflects a polarisation of wage levels. In Germany, for example, a temporary worker employed by one external provider earns €800 less a week than a comparable Audi employee doing the same job (Shaughnessy, 2012).

The average wage for car assemblers depends on their level of experience. For car assemblers in the UK, for example, the annual wage for new car assemblers is between €12,834 and €17,298, while for experienced car assemblers it is between €17,856 and €24,552, giving a relatively high wage gap between the two groups with the difference between new car assemblers and experienced car

assemblers being about 40%.⁶ By way of comparison, the wage difference between new and experienced operators in the UK is 31% for chemical plant machine operators and 29% for hand packers.

⁶ €17,856/€12,834 = 39%; €24,552/€24,552 = 42%

Conclusions

The occupation of car assembler is traditionally regarded as the classical example of Fordism, where manufacturing is organised as a series of repetitive and routine manual operations sequenced on a very long assembly line. However, global competition, overcapacity and decreasing home markets have forced European car manufacturers to reorganise their supply chains and introduce new, flexible ways of organising production to adapt more swiftly to market changes.

To adapt to market changes, the car industry in the four case study countries have been forced to reorganise their supply chain globally through foreign mergers and acquisitions, and the outsourcing of production to new locations. Companies also attempt to increase their flexibility by increasing the use of temporary workers who work on short contracts. This enhances the company's flexibility to adapt quickly to fluctuations in market demand by firing the temporary workers and keeping on its permanently employed staff. Typically, the use of temporary workers has been agreed with trade unions at company level to increase the competitiveness of the company and hence the employment stability of the permanently employed.

The general trend is that car manufacturing companies have introduced greater modularisation: 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 other main components. By doing this the assembly line has fewer work stations. These changes affect the work tasks of car assemblers who are required to carry out more comprehensive assembly operations at fewer work stations.

Besides these changes in work organisation, a key driver of change in the sector is the digitalisation of both manufacturing processes and of connected vehicles and the customer relationship, enabling new services. Overall, car manufacturing companies attempt to increase efficiency by using digitalised production equipment, automation and robots. Furthermore, software is increasingly being embedded in new vehicles. This opens up new market opportunities where automotive producers not only sell vehicles but also transport solutions derived by embedding software in vehicles that records data about, for example, fuel consumption, energy efficiency, driving routes, engine malfunctions, and parts that need to be changed or repaired. Hence, there is a tendency for automotive companies to change from a production-based strategy to a customer-based one.

All these changes affect the job content of car assemblers. Working as a car assembler is still a physical, repetitive job that requires manual dexterity and the job has a high level of routine tasks. However, as digitalisation and automation of production increases, car assemblers are asked to take on more intellectual tasks related to information processing and problem-solving. The car assembler also gets more social tasks, particularly related to teaching and coaching. Teaching tasks such as training junior and temporary workers is an important social task for car assemblers with seniority. With the greater use of temporary workers, permanently employed car assemblers are increasingly becoming involved in coaching and mentoring.

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