



# NEW PROFESSIONS AND CAREER PATHS IN THE FOOD AND DRINK INDUSTRY: DELIVERING HIGH-LEVEL FOOD INDUSTRY SKILLS IN THE DIGITAL ECONOMY

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# FOREWORD

The food and drink industry is the leading manufacturing sector in Europe and is inextricably intertwined in Europe's social, cultural and economic fabric. Compared to other manufacturing sectors in the EU, it is a key provider of jobs and a relatively stable employer. Digitalisation in the food and drink sector is a key driver for strategic solutions which contribute to sustainable growth and jobs in Europe. Digital technology and automated systems in all its forms are drastically changing the face of manufacturing in the food and drink industry. Increasingly, due to product innovation, market competitiveness and technological progress, new skills are required in a wide range of areas.

This report is part of an EU funded social dialogue project which explores current changes in employment, alongside work-related challenges. More specifically, its aim is to achieve the following objectives on behalf of the European social partners in the food and drink sector:

- to identify the new technologies in the food and drink industry, the emerging jobs and the new skills and type of qualifications required
- to undertake a forward-looking reflection on what criteria will underpin the socially successful adaptation of Food Industry 4.0.

Bearing the above in mind, this report builds on the results of a previous EU funded Social Dialogue project entitled „Bringing in new talents and managing an ageing workforce: two sides of the same coin -implementing good practices for a more attractive food and drink industry in Europe” <http://fooddrinkeurope-effat-toolbox.eu/>, which aimed at identifying bottlenecks in recruiting new and skilled employees and also focused on potential challenges when companies are confronted with an ageing workforce.

This report is the result of a team effort. The project team of experts drafted the report and were responsible for the data collection and empirical analysis. Valuable inputs have been received from EFFAT and FoodDrinkEurope member organisations. The assistance of a dedicated steering committee that facilitated this exercise is gratefully acknowledged. Special thanks are also extended to other EFFAT and FoodDrinkEurope colleagues who helped in this project. The project has been jointly managed by EFFAT and FoodDrinkEurope.

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# EXECUTIVE SUMMARY

## ABOUT THE PROJECT

The scope of the project is to provide documented and balanced **insights about Food Industry 4.0 across EU Member States and its impact on work, skills and career paths**. The project aims at supporting the Social Partners (FoodDrinkEurope and EFFAT - European Federation of Food, Agriculture and Tourism Workers' Federation) in their efforts to maintain and develop a social dialogue to overcome challenges and grasp opportunities, thereby **placing people at the centre of a socially robust adaptation of Food Industry 4.0**.

This research project was carried out at the EU level and examples from a range of EU countries have been used to illustrate local conditions in a qualitative manner. To obtain insights about regional differences, workshops have been conducted in Budapest, Copenhagen and Bologna. These workshops have functioned as forums for the social partners, representatives of food companies, trade unions, universities, government and independent expert organisations to discuss how to adapt a socially robust approach to Food Industry 4.0.

## INDUSTRY 4.0 AND FOOD MANUFACTURING

The Fourth industrial revolution (Industry 4.0) is the **integration of digital and physical technologies into production and logistics, with the internet and opportunities for connectedness as the central infrastructure**<sup>1</sup>. Adapting to the technologies of Industry 4.0 will lead to changes in the way manufacturing is carried out and organised, as well as changes in requirements for skills and new career paths.

As the implementation of Industry 4.0 technologies in food manufacturing proceeds, it is envisaged that food manufacturers will compete on their ability to create value through the optimisation of processes with the help of digital systems and automated production equipment. In this context, **workers will most likely be hired for knowledge-based production roles, rather than manual work**. These changes are already taking place and an increasing number of EU countries are experiencing challenges related to the recruitment of workers in the food and drink sector.

The **food and drink industry is a major contributor to the economy of the European Union**. Within the EU, the food and drink industry has a leading position in terms of turnover and provides employment to 4.7 million people. Furthermore, more than 98 % of companies are SMEs. By 2017, more than 31,000 robots had been installed in the European food industry and the number is expected to increase further in the coming years.

Automation of food production is less widespread than in other manufacturing sectors. The reason for this is because of the specificities of the sector, which encompass, for example: strict requirements for handling and storage conditions of raw materials and finished products, the type of raw materials, the industry structure and technological challenges. Automation in manufacturing is generally considered to lead to job losses, but this is not always the case. This project provides examples of SMEs' and multinational companies' experiences of automation as a significant contributor to the creation of employment. There are also many other examples regarding the adaptation to Industry 4.0 which suggest that conclusions about the impact on employment are related to the local context.

## WORK IN FOOD INDUSTRY 4.0

Working in a manufacturing environment where the production and factory lay-out are organised to accommodate the principles of Industry 4.0 is different from working in an environment of assembly lines and manual labour. The digital environment penetrates the way work is organised, the tasks to be carried out, the technologies used and has an overall impact on the need for certain skills. Above all, digital skills are relevant for the Food Industry 4.0 working environment.

As assembly lines in manufacturing are replaced by automated systems, the way work is organised will change. In Food Industry 4.0, these changes manifest themselves as process-oriented work, working in teams and task operations. In other factories using Industry 4.0 production systems, daily work will become more oriented towards controlling and monitoring production systems and adjusting machines.

<sup>1</sup> Maier J. (2017)

## SKILLS AND TRAINING

This project has analysed the need for building skills within three categories: manual skills, cognitive skills and soft skills. In addition, developing digital skills has been considered in a transversal approach. Cognitive skills, together with manual skills, are the category of skills whose relative importance in food production and logistics is expected to increase the most as a result of the implementation of automated and digitalised systems. Cognitive skills relate to the ability to think, act and communicate, meaning that **reading, writing and the ability to perform calculations are core skills** in this category.

Even in Industry 4.0, technology is not a solution, it is an enabler. This means that without a properly skilled workforce it will be impossible to achieve the full potential of the technology; this is where craftsmanship skills come into play. Craftsmanship skills are about having knowledge and experience of the processes, materials and the combinations thereof, in order to fully exploit the potential of the materials to make safe and quality products and to improve processes. For work in Industry 4.0, craftsmanship skills gain a new dimension as the experience of materials and processes are needed to adjust automated technologies so as to ensure the best level of performance. It is suggested that the skills possessed by the Food Industry 4.0 worker of the future could be illustrated by these examples:

- The future worker will be a highly specialised “**super-technician**” with adequate IT skills, flexibility, capacity to interpret the emerging and ever-changing needs of modern food processing and high propensity to change.
- The future workers will have to **deal with matters of increased complexity** and to bear more responsibility; master a broader skills set and be sufficiently flexible to shift seamlessly between different tasks (**multitasking vs. specialisation**). Last but not least, workers will have to cope with an increased sense of external control due to the **online and real-time** data flows resulting from Food Industry 4.0.

Losing one’s job is a major cause of stress. It is essential to take this into account in a process of adapting to digitalised and automated systems, which means that there is a need to identify crucial elements of a more socially robust process. Providing the impacted employees with the best conditions to move on and find other career opportunities is a central element in such a process. Employment opportunities change constantly. For people to be in a position to find new jobs, their

skills base should be kept updated. Therefore, the Social Partners, in collaboration with education providers, must find ways to promote on-going learning and the recognition of workers’ skills. This goes beyond the food manufacturing industry.

It is claimed that several hundred thousand workers need to benefit from re-skilling or up-skilling to meet the requirements of adapting to Food Industry 4.0. There are major issues connected with this situation: workers who do not have an employment contract have no access or right to paid training; contemporary curricula for vocational education and training are lacking in many countries and many workers consider themselves to be insufficiently skilled. However, there are also many workers who believe that their present skill set makes them over-skilled for the tasks performed. It is a widespread practice for employers in the food and drink industry to carry out in-house training of the workforce, but this project has raised the issue of how to ensure that the workers acquire the necessary digital skills. Initiatives promoted by trade unions (e.g. funds to pay for training) or collaborative measures to map the present skills base and the skills needed for the jobs of the future, are just a few examples of how to overcome training-related challenges. Therefore, the Social Partners play a crucial role in providing proper training of the workforce.

### A SOCIALLY MORE ROBUST ADAPTATION FOR FOOD INDUSTRY 4.0

The European food industry is highly diverse in numbers, structures, products and its use of technology. Competition in the market is the major driving force for the food and drink industry to adapt to Food Industry 4.0. This includes not only the benefits for labour and capital from automated manufacturing, but also the social challenges that follow from Industry 4.0. There is one common conclusion for the European food industry: **without a workforce there is no production**. Securing an appropriate workforce is fundamental and requires the attention of both the employers and workers.

This means that the Social Partners have a central role to play in ensuring a **socially robust adaptation to Food Industry 4.0**; a process that is relevant and accepted by workers and employers, where adequate and proper attention is given to the social and human aspects of adapting to digitalised and automated systems. Recommended Actions for the Social Partners and other stakeholder groups are provided in **Chapter 7**.

# GLOSSARY

**Advanced manufacturing:** encompasses all aspects of the value chain from concept to end-of-life considerations and relies on information communication technology (ICT) to integrate the manufacturing and business activities into a seamless efficient operation. The technologies involved in advanced manufacturing can be divided into three main groupings: efficient production, intelligent production and effective organisation.

**Automated:** Computer-controlled production system (from a single piece of equipment to a complete production line) with reduced need for human intervention in the production process.

**Big data:** a complex information technology environment (software, hardware, network models) that allows for the processing of data files that are so large and so complex that they are difficult to process with existing database management tools.

**Cloud environment:** although there are several cloud-based services, one thing they all have in common is that the services are not run on a dedicated hardware device, but distributed on the provider's devices, with the operational details of the service hidden from the user. These services can be accessed by users over a network: in the case of a public cloud over the internet, or in the case of a private cloud over a local network or over the internet.

**Connectedness:** means standardized electronic data communication and exchange. It allows, for example, the supplier to receive real-time information on their customer's inventory depletion and new orders, or even integrates them into their production schedule in real time. Conversely, the buyer can receive real-time information on the movement, expected arrival, stock levels of goods shipped by their supplier and integrate them into their own enterprise management system in real time. Connectedness enables in-depth analysis and effective development.

**Digitalised:** System where data are collected, processed, stored and communicated or transferred by computers; in principle, a system where paper-based

registrations are eliminated and where data can be collected and processed on-line.

**Downtime:** this term is used to refer to periods when a system is unavailable. Downtime or outage duration refers to a period of time that a system fails to provide or perform its primary function. This is usually a result of the system failing to function because of an unplanned event, or because of routine maintenance.

**ERP (Enterprise Resource Planning) system:** software system that integrates data from production, technologies, office services, personnel and sales to improve management of the business.

**Food Industry 4.0:** describes the efficient organisation of food and drinks production processes in which the devices communicate independently and operate in a coordinated way along the material flow.

**ICT Information and Communication Technologies:** communication networks that receive and transmit digital information.

**Imaging technology:** imaging systems, hyperspectral, multispectral sensors, CT scanning, X-ray imaging and 3D visualization for better understanding of food processing, preservation and preparation processes, following structural changes within the product and for quality control.

**Industry 4.0:** describes the efficient organisation of industrial production processes in which the devices communicate independently and operate in a coordinated way along the material flow.

**Innovation cycle:** the technology adoption lifecycle is a sociological model that describes the adoption or acceptance of a new product or innovation, according to the demographic and psychological characteristics of defined adopter groups. The process of adoption over time is typically illustrated as a classical normal distribution.

**Intelligent system:** means a variety of clearly identi-

able electronic devices that are capable of recognizing relevant information and communicating with another device over an internet-based network. The term refers to networked 'intelligent' devices. This technology is developing and spreading at an accelerating pace.

**Job function:** job function is the routine set of tasks or activities undertaken by a person in that position. It can be interpreted as the combined list of responsibilities and competencies that an employer expects from a potential employee.

**Predictive maintenance:** we can predict the expected failure of the equipment without stopping the machine via continuous use of diagnostic tools. It has many advantages over other maintenance methods in that it provides an assessment of the condition of the equipment as a function of the parameters, it estimates life expectancy, predicts the time of failure of the parts and makes the source and extent of the failure easy to identify.

**Profession:** a paid occupation, especially one that involves prolonged training and a formal qualification.

**Real-time (monitoring):** is applied in the lean manufacturing automation pillar. Automation is about automating the business process of stopping machines and correcting problems based on a real-time response to the unplanned event of machine malfunction. This can prevent the production of defective parts, eliminate overproduction and avoid delays. Automation relieves the workers of the need to continuously judge whether the operation of the

machine is normal. The workers are therefore only engaged when there is a problem alert and hence can simultaneously supervise several machines to achieve better cost-effectiveness.

**RFID (radio frequency identification):** using electromagnetic fields to automatically track and identify tags attached to objects. Used for tracking products and containers in the food supply chain, for example.

**Robotization:** Process aimed at introducing more robots to carry out the work in a factory; robots may be fully automated and operate without human intervention, or robots may be of the collaborative type (co-bots) where the work of humans is facilitated by the co-bot.

**Socially robust adaptation of Industry 4.0:** a development process aimed at introducing a more digitalised and automated production system without compromising social aspects related to work, skills and people.

**Solution providers:** Industry 4.0 and digitalisation technology providers, enabling information technology to solve food industry modernization problems and tasks in new ways.

**Task:** is a piece of work to be done or undertaken.

**Transferable skills:** also known as 'portable skills' are qualifications that can be transferred from one job to another, like organisation or communication skills.

# CONTENTS

2	Foreword	27	4.2 Job functions, tasks and skills required in food industry 4.0
3	Executive summary	27	4.2.1 Job functions, tasks and manual skills
5	Glossary	29	4.2.2 Job functions, tasks and cognitive skills
8	<b>Chapter 1. Introduction of the project</b>	31	4.2.3 Job functions, tasks and soft skills
8	1.1 Setting the scene	33	<b>Chapter 5. Challenges and opportunities for work, skills and careers</b>
9	1.2 About the project	33	5.1 Motivations for adapting skills to food industry 4.0
10	<b>Chapter 2. Profiling the eu food industry and employment situation</b>	33	5.1.1 Motivations and professional identities
10	2.1 Present state of the eu food industry	34	5.1.2 The value of skills and experience gained in food industry 4.0
10	2.1.1 Turnover and industry structure	35	5.2 Food industry 4.0 And the skills gap
11	2.1.2 What makes the food industry special compared to other manufacturing sectors?	35	5.2.1 Identifying the skills gap
13	2.2 Employment in the eu food industry	36	5.2.2 Impact of the skills gap in selected eu countries
13	2.2.1 Employment in the food industry	38	5.3 Addressing the skills gap – examples from member states
14	2.2.2 Labour productivity and food processing	40	<b>Chapter 6. Delivering high level skills for food industry 4.0</b>
14	2.2.3 Employment situation in eu member states	40	6.1 Vocational education and training (vet)
15	2.2.4 Employment contracts and the relevance for building skills	40	6.1.1 Vet targeted at food industry 4.0
15	2.2.5 Working conditions in the food industry	41	6.1.2 Developing vocational education for the future
17	<b>Chapter 3. Explaining food industry 4.0</b>	42	6.1.3 The Teaching and Learning Factory
17	3.1 What is industry 4.0	43	6.2 Training in companies
19	3.2 Taking industry 4.0 Into a food manufacturing context	43	6.2.1 Passing on skills amongst colleagues
19	3.2.1 Introducing food industry 4.0	44	6.2.2 Online training while at work
20	3.2.2 Connectedness – fundamentals of food industry 4.0	45	6.3 Organising training
20	3.2.3 Digitalised data sets	45	6.3.1 Issues to take into account when organising training for Food Industry 4.0
21	3.2.4 Automated equipment and production lines	46	6.3.2 Other initiatives to promote learning about Industry 4.0
22	3.3 Regional approaches to food industry 4.0	47	<b>Chapter 7. Ways to socially robust adaptation to food industry 4.0</b>
22	3.3.1 Italy	47	7.1 Securing employment and its diversity
23	3.3.2 Hungary	48	7.2 Sharing the benefits of food industry 4.0 – A human centred approach
23	3.3.3 Germany	49	7.3 Growing with technology – personally and technologically
23	3.3.4 France	51	7.4 Recommended actions
23	3.3.5 Denmark	55	Appendix 1 List of references
24	3.4 Accessing digital and automated production systems	58	Appendix 2 Methodology
25	<b>Chapter 4. Working in food industry 4.0, Skills requirements and career paths</b>	60	Appendix 3 Selection of fact sheets
25	4.1 General requirements of work 4.0	68	Appendix 4 Selection of case studies
25	4.1.1 Work, skills and work organisation in industry 4.0		
25	4.1.2 Anticipated development in work as a result of food industry 4.0		

# 1. INTRODUCTION OF THE PROJECT

## 1.1 SETTING THE SCENE

The increasing adoption of digitalised systems and automated production technologies in the food and drink industry is already changing the way in which most jobs and tasks are carried out. As more digitalised and automated solutions make their way into manufacturing, the need for production workers to have adequate skills becomes a crucial element for a successful adaptation to advanced production environments.

Several studies<sup>2</sup> have been carried out regarding the impact of automated manufacturing on work, skills, employment and careers, but less is known about the impact of Industry 4.0 technologies on work, skills requirements and career paths in food and drink manufacturing. The **food and drink industry** differs from other industrial sectors due to the perishable nature of the raw materials, the importance of craftsmanship skills and abundance of SMEs, the embedded nature of aspects related to sustainability and the never-ending demand for its food and drink products. It is obvious that food manufacturing cannot be automated easily. In addition, the food industry plays a major role in providing employment to people with a low level of education in some countries or for specific functions and, at the same time, requires highly-skilled workers in other countries or for other tasks. It is fair to say that the food industry is a highly complex and diversified manufacturing sector and, therefore, conclusions about general manufacturing and Industry 4.0 technologies need to be adapted to the **Food Industry 4.0 context**.

The opinion that “automation leads to job losses” may well be true for some jobs in general manufacturing, but it is not the sole conclusion when it comes to food manufacturing. There are many examples showing that the implementation of digitalised or automated systems has improved food company performance and this has led to job creation. **Digitalisation and automation definitely change the way we work** as it has an impact on occupations, tasks, required skills, careers and, most importantly, the workers.

A fundamental requirement of adapting Industry 4.0 technologies in the food and drink industry is to ensure that **people are placed at the centre** of this process. This requires dialogue and mutual understanding between the social partners, building on a **balanced view** of the challenges and opportunities which stem from adapting Industry 4.0 technologies in food manufacturing. Food Industry 4.0 is the way forward for the European food industry. The **Social Partners are in a central position to ensure a socially robust process towards the Food Industry 4.0**.



<sup>2</sup> McKinsey Global Institute (2018) – Skill shift: automation and the future of the workforce, OECD Skills Strategy Flanders (2019), NESTA (2018) – In the Future of Skills: Employment in 2030, Pedersen M.L. and Jensen P. B. (2018): Fewer skilled workers is challenging for the Danish food industry, DI Analysis, September 2018, World Economic Forum (2016) – The future of jobs, employment, skills and workforce strategy for the fourth industrial revolution, and World Economic Forum (2018) – The future of jobs report

## 1.2 ABOUT THE PROJECT

The scope of the project is to provide documented and balanced **insights about Food Industry 4.0 and its impact on work, skills and career paths**. The project aims at supporting the Social Partners (FoodDrinkEurope and EFFAT - European Federation of Food, Agriculture and Tourism Workers' Federation) in their efforts to maintain and develop a social dialogue to overcome challenges and grasp opportunities, thereby **putting people at the centre of a socially robust adaptation of Food Industry 4.0**.

This project builds on a mapping exercise for documenting Food Industry 4.0 across EU Member States and its impact on work, skills and career paths. Furthermore, this project is focussed on the EU level

and examples from a range of EU countries are used to illustrate local conditions, which means that the project applies an explorative and qualitative research-based approach (Appendix 2). Three regional workshops have been conducted to obtain insights into the regional differences, **Figure 1**. These workshops have functioned as forums for the social partners for the exchange of knowledge and discussions, as well as for forward looking reflections.

To support the work of the Social Partners, this report provides a selection of **Recommended Actions** and a set of tools consisting of **Fact sheets** (Appendix 3) and **Case studies** (Appendix 4).

**Figure 1: The Regional approach of the project**

*Source: Elaborated by IFAU, 2019*

### 3 REGIONAL WORKSHOPS



# 2. PROFILING THE EU FOOD INDUSTRY AND EMPLOYMENT SITUATION

## 2.1 PRESENT STATE OF THE EU FOOD INDUSTRY

### 2.1.1 Turnover and industry structure

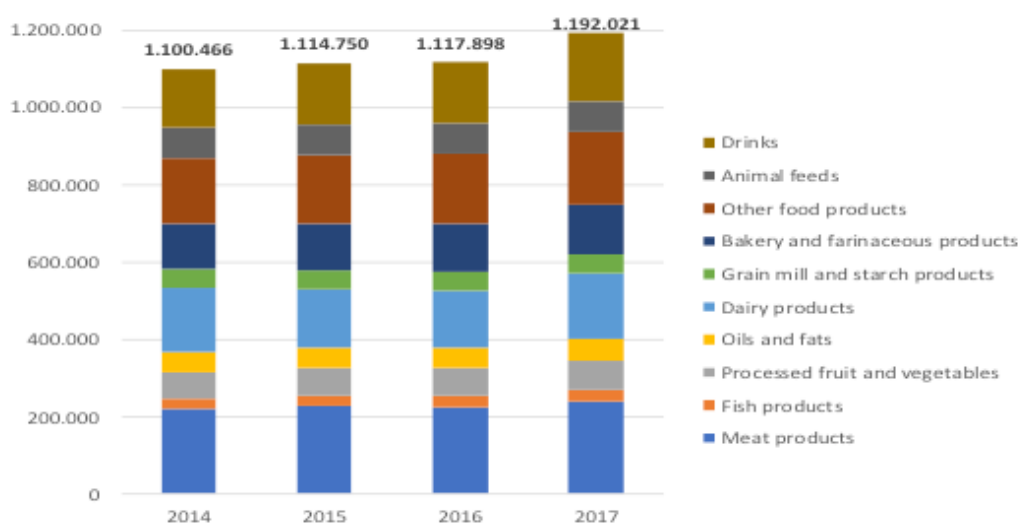
The **food and drink industry** is a **major contributor to the economy of the European Union**. Within the EU manufacturing industry, the food and drink industry occupies a leading position in terms of turnover (15.4% of total turnover in the manufacturing industry in 2017), employment, value added (12.3% of total manufacturing industry in 2016) and investments, **Figure 2**.

In 2016, **SMEs** accounted for 47.5% of total turnover and 45.8% of total value added of the food and drink industry, but also employed 61.6% of the total workforce and accounted for 98.9% of the total number of companies, **Figure 3**. In contrast, large companies employed one third of the workforce, but produced 52% of the industry's turnover. This indicates that productivity per employee in large companies is higher

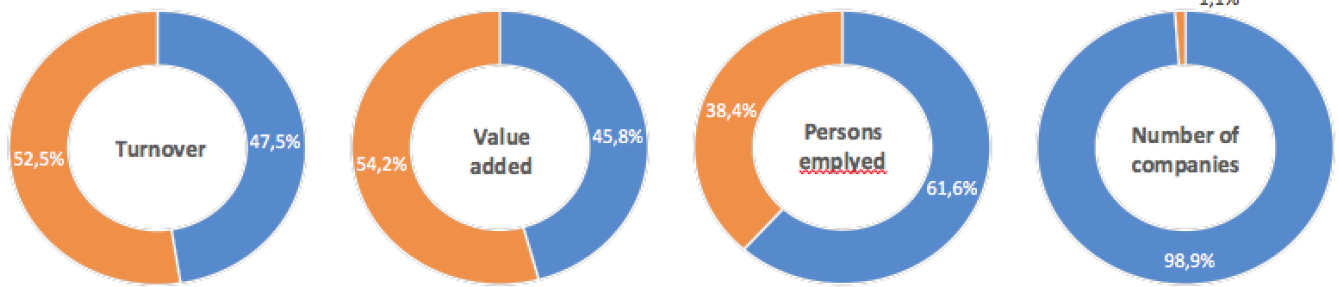
than in SMEs. Whilst there is potential for increasing productivity in SMEs, there are also significant barriers.

Measured by turnover, the meat, processed food, drinks and dairy sectors are the four largest sub-sectors of the EU food industry; together, they account for two thirds of the food industry turnover and value added, **Figure 4**. However, in terms of the number of companies, the baked goods and farinaceous products group is the largest, providing employment to one third of the workforce and representing nearly half of the businesses. In contrast, the meat industry employs 20 % of the workforce, but accounts for only 12% of the companies. This example shows that the meat industry has more large companies than the baked goods sector.

**Figure 2: EU food industry turnover 2014-2017, billions EUR**  
 Source: Eurostat (Structural Business Statistics) - <https://ec.europa.eu/eurstat/web/structural-business-statistics/overview>



■ SMEs  
 ■ Large Companies

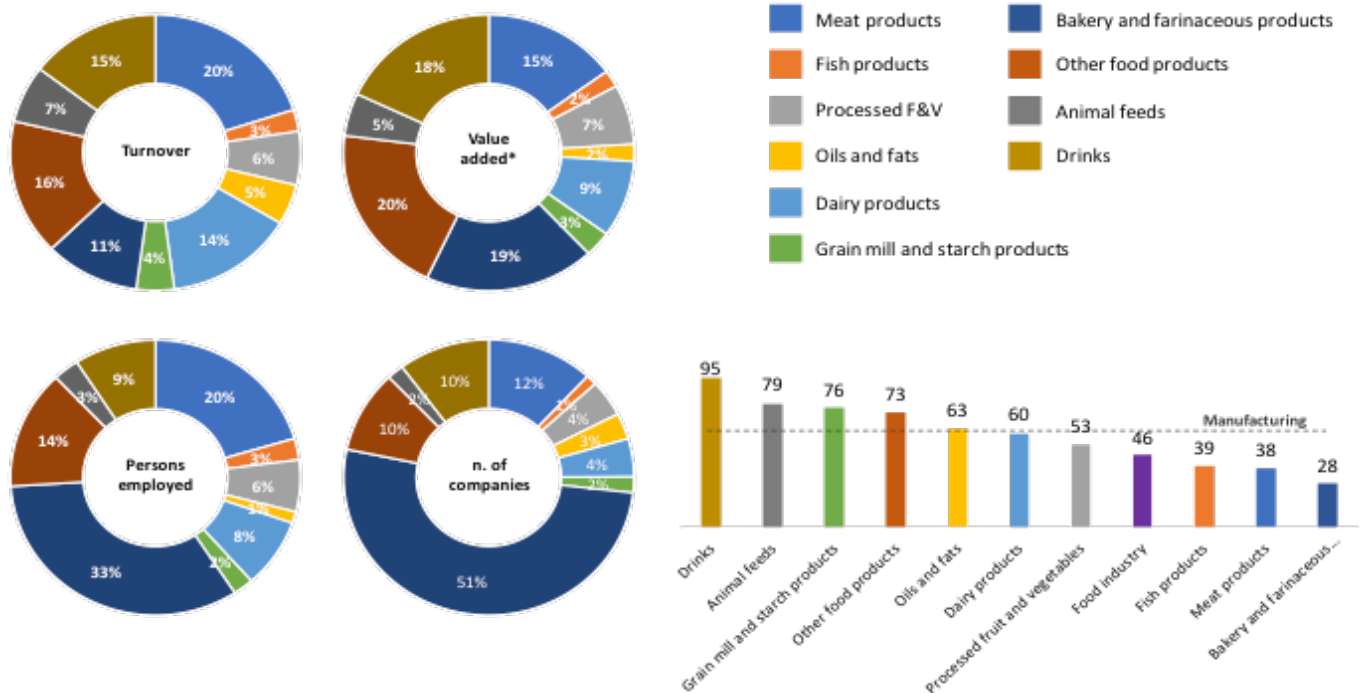


**Figure 3:** Contribution of SMEs and large companies to the EU food and drink industry (2016, % of total)

Source: [https://www.fooddrinkurope.eu/uploads/publications\\_documents/FoodDrinkEurope\\_Data\\_and\\_Trends\\_2018\\_FINAL.pdf](https://www.fooddrinkurope.eu/uploads/publications_documents/FoodDrinkEurope_Data_and_Trends_2018_FINAL.pdf)

**Figure 4:** Turnover, persons employed, number of companies (2017, as % of total), value added (2016, as % of total) and labour productivity (2016, 1,000 EUR/person) in the food and drink industry sectors

Source: [https://www.fooddrinkurope.eu/uploads/publications\\_documents/FoodDrinkEurope\\_Data\\_and\\_Trends\\_2018\\_FINAL.pdf](https://www.fooddrinkurope.eu/uploads/publications_documents/FoodDrinkEurope_Data_and_Trends_2018_FINAL.pdf)



## 2.1.2 What makes the food industry special compared to other manufacturing sectors?

Some specificities of the food industry have been identified during the course of this research project. These features are given below and help to better explain the specificities of the food industry sector in comparison to other manufacturing sectors.

### COMPETITIVE SITUATION:

Each stage of the food supply chain is characterised by

an uneven number of operators and an ongoing process of concentration. The search for greater efficiency within the food supply chain is one of the main drivers towards more digitalised systems and automated production processes. Food products are manufactured and traded by SMEs and large companies through the same mass marketing and distribution channels, such as retail stores. This implies that products produced with an artisan process (for example, pasta or cheese)

can be placed on display in a supermarket next to a similar product manufactured by an automated process. In this sense, the food sector differs from other manufacturing sectors where artisan products are rarely marketed through mass marketing channels.

### **TRACEABILITY, QUALITY AND CERTIFICATION SCHEMES:**

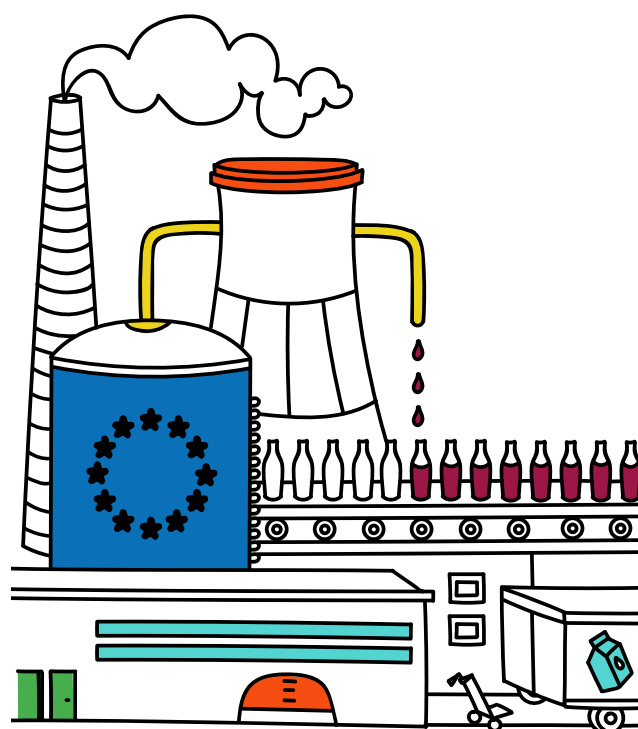
The demands for more information and full traceability of food products are evident and only evolving further. This requires systems for gathering, connecting and providing information and such systems must be tailored to the needs of trading partners (local or international partners), consumers and official reporting. Food safety is a key priority and traceability systems form the basis for ensuring only safe products are placed on the market.

### **RAW MATERIALS:**

The food industry's raw materials are perishable and need to be processed within a limited period from when they are harvested or slaughtered; and yet, close to 30 % of food produced is lost between field and fork. The diverse and perishable nature of the food industry's raw materials makes it difficult to automate the entire production process, unlike other manufacturing sectors where standardised raw materials can be subject to an automated production process.

### **SUSTAINABILITY:**

The food sector is giving increasing attention to sustainability and improved resource efficiency: topics such as food waste reduction and efficient use of energy and water are requiring companies to look for more controlled and monitored production processes, usually through the adoption of new technologies.



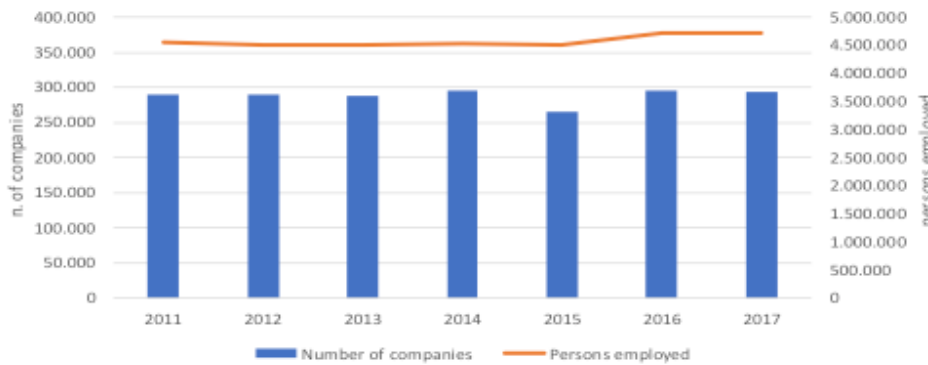
## 2.2.1 Employment in the food industry

The food and drink industry is the leading employer in the EU manufacturing sector and provides 15.5 % of employment in the EU manufacturing sector. The food industry has a workforce of 4.73 million, **Figure 5**.

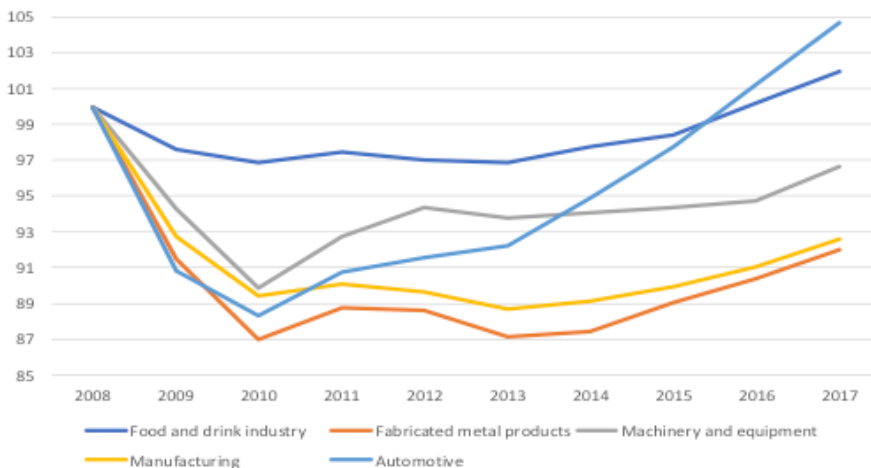
From 2008 to 2017, the food industry proved to be more stable in terms of employment than the overall manufacturing industry and other subsectors of manufacturing, **Figure 6**. This is due to a number of factors, above all the countercyclical nature of the food industry and its overall stability during crisis periods. Further factors including the embeddedness of the food industry in local agricultural production chains, contracts with customers regarding future supplies and the food industry's agility in exploiting new mar-

ket opportunities for exports are essential elements for maintaining a stable production and employment environment in the food industry.

The food industry is not only to be considered as a stable employment environment with regards to the number of jobs: the stability of employment across food industry subsectors is of similar importance. This implies that if jobs are lost or created in one food processing sector, there are potential opportunities for workers to shift between subsectors and to find new opportunities for work. **Figure 7** shows how employment across food industry subsectors has developed from 2015 to 2017.



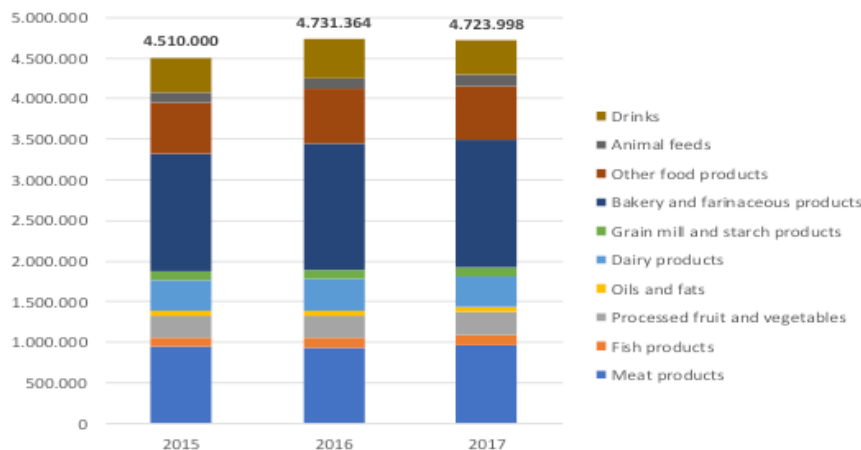
**Figure 5: Number of companies and number of persons employed in the EU food and drink industry (2011-2017)**  
Source: Eurostat (Structural Business Statistics) - <https://ec.europa.eu/eurat/web/structural-business-statistics/overview>



**Figure 6: Employment in the EU manufacturing industry (index, 2008=100)**  
Source: Eurostat (Structural Business Statistics) - <https://ec.europa.eu/eurat/web/structural-business-statistics/overview>

**Figure 7: Development in employment across food industry subsectors, 2015-2017, in millions of jobs**

Source: Eurostat (Structural Business Statistics) - <https://ec.europa.eu/EURstat/web/structural-business-statistics/overview>



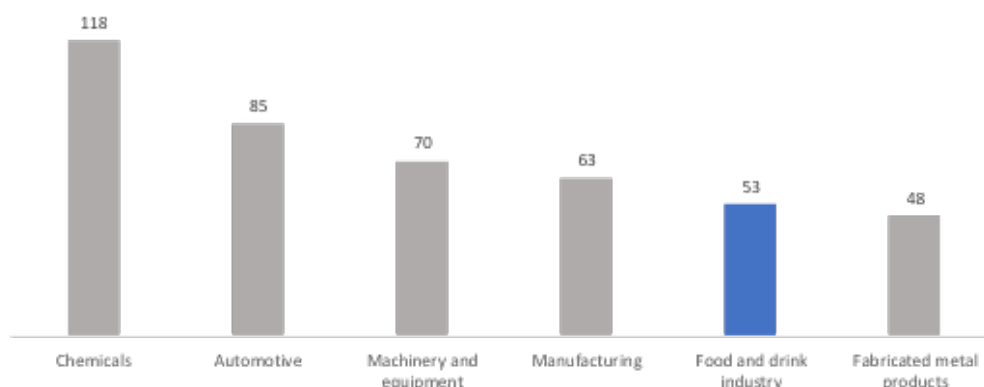
## 2.2.2 Labour productivity and food processing

When the labour productivity of the manufacturing sector is compared to that of the food industry, it is clear that the labour productivity of the food industry (53,000 EUR per person) is below the EU manufacturing average of 63,000 EUR per person, **Figure 8**. Such

numbers would indicate that the food industry, in principle, could increase labour productivity to reach the same level as other manufacturing sectors; this process is closely linked to the use of technologies.

**Figure 8: Labour productivity in the EU manufacturing industry, 2016, in 1,000 EUR per person**

Source: Eurostat (Structural Business Statistics) - <https://ec.europa.eu/EURstat/web/structural-business-statistics/overview>



## 2.2.3 Employment situation in EU Member States

Despite the relative stability in the aggregated employment situation across the EU food industry, Member States are experiencing quite a number of challenges related to filling vacant positions, attracting young talents and ensuring the development of proper skills:

**Germany:** the workforce has been growing over the last decade and companies are searching for employees. However, the number of young people starting vocational training in the food sector is declining. Currently, there is a shortfall of 6,000 applicants for vocational training in food-related jobs in German industry. The number of unfilled positions is rising and vacancies remain open for a longer period of time; the average for food-related jobs is more than 140 days.

**Denmark:** 40% of the workers are skilled workers and 80% of food companies report challenges regarding the recruitment of skilled workers. In 2018, the food industry employed more than 6,500 skilled workers (mainly butchers, bakers). Another major challenge is the ageing workforce and the average age of the workers is 46 (2016), in contrast to 42 in 2006<sup>3</sup>.

**Sweden:** the food industry needs to hire 25,000 more workers to reach production targets in 2019 and it has been predicted that there will be a shortfall of 30,000 workers by 2022<sup>4</sup>.

**Italy:** the food industry is expected to need over 43,000 new workers by 2024 due to the impact of industry 4.0. Amongst these workers, around 7 %

<sup>3</sup> Pedersen ML and Jensen PB, 2018

will have a university degree, around 26 % secondary school qualifications and the rest (25,000 or more workers) will have some form of technical or professional qualification<sup>5</sup>.

**Hungary:** the workforce in the food industry is concerned that automation will lead to job losses. This should be seen in the light of the current relatively low degree of automation of food manufacturing.

**United Kingdom:** several sources have identified a

labour shortage in food manufacturing of nearly 140,000 workers over the coming years. Another survey documents that 40% of companies in food processing and agriculture using temporary workers are struggling to find the necessary (in this case unskilled) workers<sup>6</sup>.

**The Netherlands:** the use of automated production systems is very high and there have been many job losses. The challenges particularly relate to supporting workers to move on to find new opportunities.

## 2.2.4 Employment contracts and the relevance for building skills

In 2014, the majority (80%) of the workers in the food industry were hired with an indefinite contract and close to 10 % had a fixed-term contract. Apprenticeship schemes and training contracts account for only a few per cent of the employment contracts in the food industry, although this is higher than the average for EU employment. About 3-4 % of the workforce is hired on contracts drawn up with temporary agencies and this is almost double the average of the EU manufacturing sector average<sup>7</sup>.

Since 2014, the use of temporary contracted workers has increased in the European food industry; this trend has been caused, in great part, by the migration of workers moving to earn more than in their home countries. For example, workers from eastern European countries such as Hungary, Poland, Bulgaria and Romania are travelling to work in food plants in Germany, Denmark, the Netherlands, Austria and other western European countries. In response, food and drink companies in east Europe are required to hire workers to fill the vacancies. There are also many examples of food companies hiring refugees and training these people as workers for the meat indus-

try or for other manual functions in food and drink production. This development pattern is leading to the creation of a multi-ethnic working environment in food plants, with the subsequent challenges of overcoming language barriers, the organisation of workers and developing the skills base.

The issue of employment contracts is particularly relevant when addressed in a skills context, since the general pattern in the food industry is that the employer pays for the up-skilling of the worker. When workers are hired on the basis of temporary contracts, contracts with agencies, or act as self-employed workers, the issue of the funding of training becomes highly relevant. From an employer's perspective, paying for training and up-skilling is, in the short-term, relevant for ensuring the presence of an appropriately skilled workforce for the present production system. In the long-term, investing in training is necessary to secure a workforce equipped with skills to manage future technologies and equipment and to support workers when they are required to move on in the event of job losses or changes in career paths.

## 2.2.5 Working conditions in the food industry

Eurofound carried out a survey on the working conditions in the European food industry in 2014<sup>8</sup>. The main conclusions of this survey describe the working conditions in food and drink manufacturing as follows:

- Working atypical hours (nights or weekends) is more prevalent in the food industry;
- Working hours are more regular (i.e. same number of hours and same number of days) in the food industry (compared to general manufacturing), this points to less flexibility in work planning;
- The work-life balance is not as good in the food industry compared to general manufacturing,

maybe due to atypical working hours.

Task rotation is an important part of organising work at the workplace level. **Figure 9** shows that, particularly in SMEs, the use of autonomous multi-tasking is widespread, indicating that the workers are required to carry out many different tasks and, importantly, the work is organised by the workers. **Figure 9** also shows that large companies make use of task rotation among the workforce, but do so within a fixed system allowing for limited flexibility for the workforce. This form of work organisation could mean that workers in large companies could be less motivated to build new skills.

<sup>4</sup> LRF and Job Center Sweden, 2018

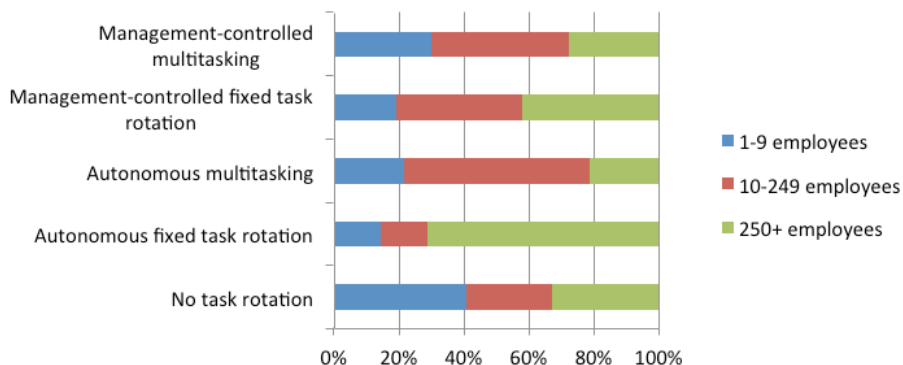
<sup>5</sup> Il Sole 24 Ore – The food industry will need 43,000 employees in five years, 17 July 2019

<sup>6</sup> Grant Thornton, 2017 and ALP, 2019

<sup>7-8</sup> Eurofound, 2014

Working in teams is more common in the food industry than in other manufacturing sectors, with 66 % of food industry workers working in a team. In 2014, the categories “no team work” and “team with no autonomy” were more widespread across food companies than categories of team work with higher degrees of autonomy. This could indicate that management-controlled work organisation is the dominant way of organising tasks in the food industry, therefore leaving only limited scope for workers’ initiatives for organising team work.

As the food industry makes increasing use of digitalised production environments, the working conditions will change. Operating automated production systems includes tasks such as monitoring production processes, in other words, work that requires less manual and physical activities, but also a certain level of digital skills. It is clear that skills sets that cover more skills categories are relevant to develop the workers.



**Figure 9: Organisation of work in the food industry – prevalence of task rotation, by company size (2014)**  
 Source: Eurofound survey, 2014

# 3. EXPLAINING FOOD INDUSTRY 4.0

The aim of this chapter is to provide insights into how Industry 4.0 technologies are used in a food and drink manufacturing context and how this impacts on work organisation and work. The chapter outlines regional differences regarding the way in which the food industry has adopted the Food Industry 4.0 production approach.

## 3.1 WHAT IS INDUSTRY 4.0

Industry 4.0 is also known as the Fourth Industrial Revolution to occur in manufacturing. From the first industrial revolution (mechanisation through water and steam power) to mass production and assembly lines using electricity in the second, the fourth industrial revolution will take what was started in the third with the adoption of computers and automation and enhance it with smart and autonomous systems driven by data and machine learning, **Figure 10**. In short, **Industry 4.0 is the integration of digital and physical technologies into production and logistics**<sup>9</sup>. Adapting to the technologies of Industry 4.0 will lead to changes in the way manufacturing is carried out and organised, as well as provide opportunities for developing new business models<sup>10</sup>.

The introduction of computers into Industry 3.0 was considered to be disruptive since computers represented an entirely new technology. The advances stemming from Industry 4.0 are related to the connectedness of computers through the Internet and the options for gathering and sharing vast data sets between computers. In this respect, the internet is a core element of Industry 4.0 and of connected systems that link more computers together within

a factory or with any other place on earth. Through the use of the cloud environment for data storage, equipment and operations can be optimised as data sharing is made possible.

In Industry 4.0, computer-based systems can function without human interaction, for example for manufacturing purposes. Such computers can be installed in automated manufacturing equipment, in hand-held devices for control or inspection, or the computers can be the IT systems in companies. As computers become more advanced and are able to process larger and more complex data sets, manufacturing will become smarter and therefore become more efficient, integrated, less wasteful and more predictive. In this way, manufacturing will become more firmly integrated within supply chains (e.g. by sharing information about delayed shipments and the need to re-orient production) or market communication (by providing information to consumers and society through apps). It is the **digitally connected machines that create and share information with each other that form the power of Industry 4.0** and the many (as yet unexplored) opportunities for creating value for companies, people and society, **Figure 11**.

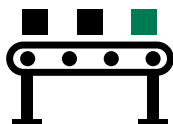
**Figure 10: From the First to the Fourth Industrial Revolution**  
Source: <https://www.spectralengines.com/articles/industry-4-0-and-how-smart-sensors-make-the-difference>

## THE FOUR INDUSTRIAL REVOLUTIONS



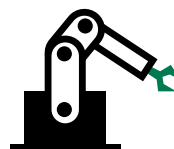
### Industry 1.0

Mechanization and the introduction of steam and water power



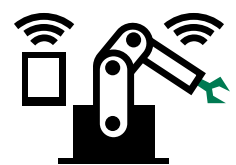
### Industry 2.0

Mass production assembly lines using electrical power



### Industry 3.0

Automated production, computers, IT-systems and robotics



### Industry 4.0

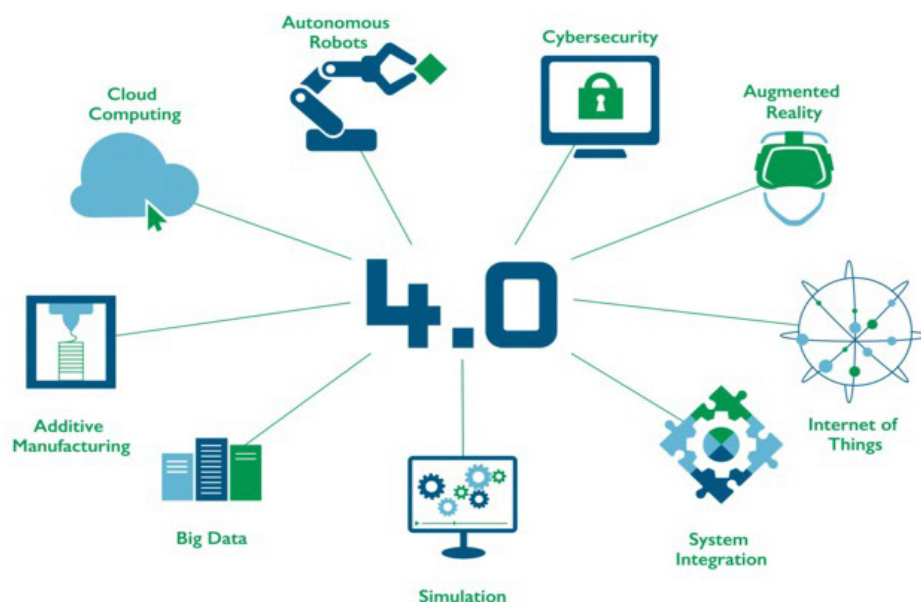
The Smart Factory. Autonomous systems. IoT, machine learning

<sup>9</sup> Maier J. 2017

<sup>10</sup> <https://www.forbes.com/sites/bernardmarr/2018/09/02/what-is-industry-4-0-heres-a-super-easy-explanation-for-anyone/#3c9e088b9788>

**Figure 11: The connectedness of Industry 4.0**

Source: <https://www.foodmanufacture.co.uk/Article/2017/06/15/Smart-food-factories-move-even-closer>



In essence, Industry 4.0 comprises a **set of digitally based technologies that can be applied individually or in combinations**, meaning that a transition to Industry 4.0 can be achieved by changing present systems from paper-based to digitalised systems, or from manual and mechanical to automated systems.

As computers become capable of working faster and with more complex data sets, computers controlling manufacturing equipment can be programmed to carry out specific tasks. This is what we know as automated manufacturing and robots. Humans may be monitoring the production, have more simplified work to do, or engage in a form of collaboration with the automated system. The latter production system is known as collaborative robots or “co-bots”. Having initially been very big and expensive, robots are now coming down in price and size, making them much more readily available for use in industry, including the food manufacturing sector.

Connected machines collect big data sets. This information can be used for informing the operator about maintenance, performance, quality or other issues as real-time data. Since the operator is informed “on-the-spot” about an issue or a need, the down-time of the machinery can be reduced, for example by maintenance being carried out while the machine is running. Another option provided by the connected systems is the sharing of information across locations within a factory or with external locations such as, for example, the supplier of the equipment. The connectedness increases the speed of reaction in the event of a problem and allows for issues to be resolved on-

the-spot. This is a huge advantage for manufacturing compared to the traditional way in which repairs were carried out, when the technical support personnel were required to travel to a factory to carry out the repair work. Connected factories also allow for the reorganisation of production, so some parts of the production process are undertaken at one location and other processes at a different location. Computer systems provide the infrastructure for organising production chains and for keeping track of the items produced. The new way of organising manufacturing provides a framework for dealing with highly flexible, large scale production<sup>11</sup> and also makes it possible to manufacture customised products and to increasingly involve the market actors, all at costs similar to the production of mass-market food products<sup>12</sup>.

## 3.2 TAKING INDUSTRY 4.0 INTO A FOOD MANUFACTURING CONTEXT

### 3.2.1 Introducing Food Industry 4.0

In Europe, the food industry is the leading processing industry in terms of production value and number of employees, as well as being a major user of resources. Therefore, increasing productivity and efficiency in the food industry is extremely important for companies and the global sustainability agenda. The application of Industry 4.0 technologies offers many new opportunities and challenges for companies and employees. As demonstrated in section 2.1, the food industry differs from other manufacturing sectors on topics such as raw materials, industry structure and market access. Consequently, the Industry 4.0 concept of industrial manufacturing cannot be directly transferred to the food industry but will need to be modified so as to become the Food Industry 4.0, as will be explained in this section.

**As the implementation of Industry 4.0 in food manufacturing proceeds, it is envisaged that manufacturers will compete on their ability to create value through the smart use of Industry 4.0 technologies and employees will be hired for knowledge-based production roles, rather than manual work. These changes will come within an already challenging recruitment environment that also includes workers for the shop floor<sup>13</sup>.**

At EU level, it has become almost common practice to focus on the opportunities provided by the technologies in Industry 4.0 for use in agriculture, logistics and for consumer communication<sup>14</sup>. This is pointing to an untapped potential for looking into applications of digitalised and automated solutions in a food processing context.

Many Industry 4.0 solutions have already been developed for other industries. Such solutions could be used in the food industry, but these solutions and systems have not yet been adapted to food industry requirements and its conditions such as, for example, the specific production environment or requirements for traceability data. According to expert estimates<sup>15</sup>, approximately 80% of the anticipated food industry

applications of digital systems and automated production equipment could be developed into an Industry 4.0 context by adapting solutions already applied in other industries. Approximately 20% of the present technology applications in food production would face the need for significant technological development. The most important Industry 4.0 options for food processing are related to the regulation, operation, hygiene, food safety and quality improvement of the manufacturing processes and this is complemented by the organisation of information flows, logistics, production, maintenance, administrative support and management tasks. It is evident that such changes in food production will have consequences for how work is organized and the kind of tasks to be undertaken.

Looking into the structure of the EU food and drink manufacturing sector, it is clear that businesses' patterns for adapting to Industry 4.0 do not follow a uniform pathway. Rather, it seems that large companies have already invested significantly in automated and digitalised solutions for the production and logistics of food and drink products. Smaller and medium-sized companies seem to be less automated and some are only at the beginning of a journey towards digitalizing processes in the factories. Examples of solutions for overcoming barriers to the transition to Industry 4.0 are provided in Appendix 3.

<sup>13</sup> Maier J. 2017

<sup>14</sup> Hungarian Food Industries, 2019

<sup>15</sup> Lagerberg T 2019; Collison M 2018; Hegyi A. and Sebök A, 2018

### 3.2.2 Connectedness – Fundamentals of Food Industry 4.0

Digitalised data are the fundamentals for a connected and highly integrated environment for linking data, hardware and people together and therefore represent the principles of the Connected Factory. This concept offers many new technological opportunities to solve food industry problems and the way work is carried out<sup>16</sup> in food plants:

- Provision of a digitalised environment allowing for the handling of large and complex data files across devices and departments and providing feedback to departments, mainly about food safety and quality assurance, but also for collecting information about key performance indicators of production systems;
- Installing electronic data gathering devices, such as vision systems or on-line sensors, to collect information for process optimization (e.g. image technologies) or quality control;
- Providing the basic digital infrastructure to have autonomous and automated systems and pieces of equipment (e.g. in production and logistics);
- Providing internet-based communication with electronic devices across the plant, but also with devices at external locations, allowing for real-time monitoring of the state of the equipment or exchange of information about inventories;
- Basis for predictive/preventive maintenance by linking the piece of machinery with the production control at the plant, but also to the supplier of the machine. In this way, the supplier can provide real-time support for solving technical challenges and reducing down-time of the machinery. In addition, online training can be provided to workers (refer to 6.2).
- Working routines and job tasks in a connected factory build on the use of computerized and connected devices. As many food companies have more than one plant, the Industry 4.0 and connected approach makes it possible for factories to be linked via digitalised data networks and share datasets regarding, for example, performance, product tracking or other related issues.

### 3.2.3 Digitalised data sets

Traceability is the second aspect, after data security, for which food companies use IT resources. Traceability involves the whole value chain, both upstream (suppliers) and downstream (retailers or other manufacturers) and is becoming even more important in a globalized market. In general, companies believe that IT can help them in many areas, such as better management of complex supply chains, improved ability to respond to market changes, to obtain better data for coordinating production flows and to be in a better position to act quickly in the case of product recalls<sup>17</sup>.

An important feature of digital systems is improved data collection to form large and complex datasets. Such datasets can be collected automatically from online sensors or from integrated systems that link information flows about raw material parameters with process parameters, or integrate data from the supply chain and logistics with information about customers' purchasing behaviour. Large datasets can be used for refining and optimising production, e.g. for improving or adjusting the material flow or the temperature curve of production lines. Using digital data for ensuring the better utilization of the production equipment is a key issue in food manufacturing and is applied, for example, in the Cleaning in Place (CIP) system. This system allows for the cleaning of the

machinery while it is in operation, thereby reducing down-time on the production line.

Real-time monitoring of production equipment and data flows are the fundamental requirements for the predictive maintenance of the machinery in food manufacturing. This system automatically calls for maintenance on a predictive basis, building on data gathered about the production flow and planned operations. For workers, predictive maintenance can have an impact on the jobs as greater responsibility becomes embedded in the daily tasks, including attention to the coordination of the production flow with other departments.

### 3.2.4 Automated equipment and production lines

Automated solutions come as single pieces of equipment, such as a filling machine, an automatic slicer or a fruit washing machine. There are numerous examples of combinations of automated pieces of equipment along a production line, leading to a form of work organisation where some functions are undertaken by the workforce and some functions are automated. In the meat industry, for example, workers carry out the slaughtering and deboning of pork and the processing of the meat is carried out by automated mixers and cookers to make sausages. In the drinks and dairy industries, the degree of automation is generally very high and manual work is limited to production control and monitoring of the automated systems. Manufacturing of processed food such as ready meals, baked goods and confectionery is generally highly automated, particularly if undertaken by large companies.

Large digital data sets are used by solution providers to develop imaging techniques which are systems where data are transformed into images of, for example, temperatures in a piece of meat during cooking, or the water content of a grain sample. In this way, data sets are useful for producing products of a higher quality. Large and complex data sets are also fundamental for automated processing equipment since such data sets connect data from different machines, diverse production parameters, information about a piece of meat, for example, and the flow of the production. **In this context, it is essential that the provider of the technical solution has sufficient insights into the production flow and work in order to design a processing line that, on the one hand, meets the specifications and requirements of the production and, on the other, accommodates workers' routines and working environment.** The solution provider needs to be informed about the characteristics of the

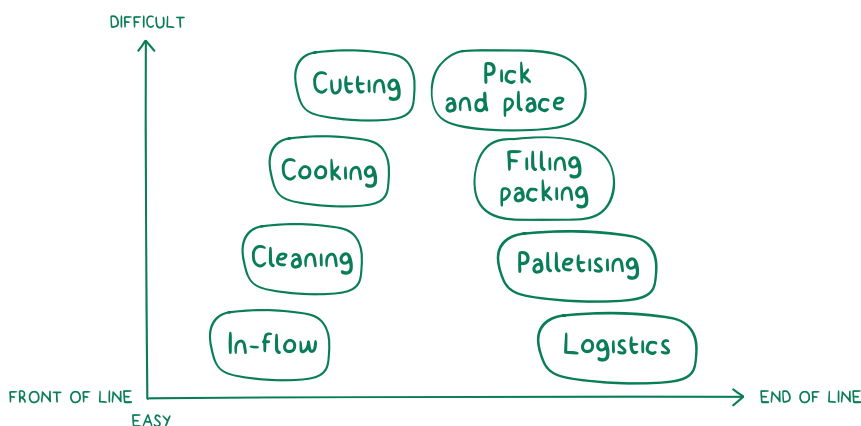
materials, how work is carried out and organized and the skill level of the workforce (e.g. linguistic challenges of reading instructions in English)<sup>18</sup>. This points to a need to bridge the gap between technology and craftsmanship skills, thereby **identifying a new perspective on craftsmanship**.

The use of automated production systems (e.g. robots) is mainly concentrated at the beginning (i.e. inbound logistics and quality control) of the production chain and at the end (i.e. packing, palletising and outbound logistics), **Figure 12**. This is because the operations performed (for example sorting of raw materials, filling bottles or palletising boxes) in these parts of the production line are simpler to automate than more complex functions, such as cutting or other forms of processing. In general, automated production systems can be categorised as<sup>19</sup>:

- **Generic robots** for (heavy) standard tasks such as sorting, filling or storing pallets;
- **Specialized robots** that perform more complex and specific tasks. (e.g. carcass opener in the meat industry, lettuce and pepper corers in vegetable processing and packing robots for biscuits and confectionery.)

The food industry makes use of collaborative robots, also known as “cobots” in the production, packing or storage departments of food plants. Collaborative robots require little space and maintenance, their installation is easy and flexible in a wide temperature range and different environments. Collaborative robots are designed to facilitate the tasks to be carried out by workers by providing support to functions. In packing departments, for example, collaborative robots can assist the workers in sorting, picking or placing the items or for forwarding items to the worker.

#### USING ROBOTS FOR FOOD PROCESSING



**Figure 12: The use of robots along the production line**  
Source: (Inspired by ING, 2019)

<sup>18</sup> Lagerberg T., 2019

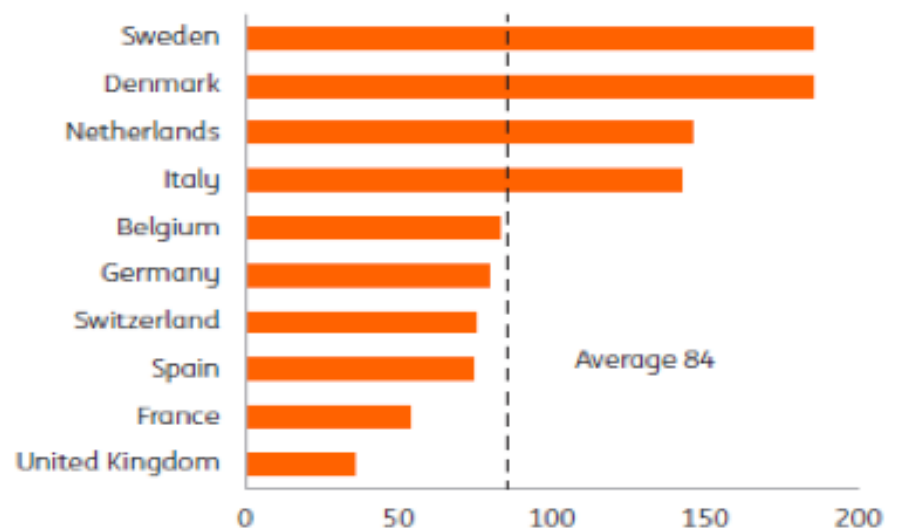
<sup>19</sup> ING, 2019

## 3.3 REGIONAL APPROACHES TO FOOD INDUSTRY 4.0

**Figure 13** shows the robot stock in the food and drink industry per 10,000 employees in selected EU Member States in 2017. Nordic countries are those with the highest density of robots, which may be due to their

relatively higher labour costs. In absolute terms, in 2017, the total number of robots in the European food and beverage industry exceeded 31,000.

**Figure 13: Robot stock in the food and drink industry per 10,000 employees (2017)**  
Source: (ING 2019)



### 3.3.1 Italy

In Italy, a survey<sup>20</sup> carried out on a sample of 200 food companies of medium and large size showed that the uptake of Industry 4.0 technologies was very limited. 10% of the surveyed companies had introduced collaborative robotics, 2% only augmented reality and 1% only 3D printing. Most of the investments in digital systems by the surveyed companies were related to the safeguarding of intellectual property rights and company data. Furthermore, the survey pointed to a shortage of shop floor workers with suitable skills as the main constraint for not having introduced Industry 4.0 technologies. It is also important to note that only 11% of the surveyed companies mentioned the re-skilling of workers among the benefits deriving from the introduction of Industry 4.0 technologies. A few examples from the companies are presented below.

- In Italy, large multinationals such as Nestlé have completed very large projects like the new “Pizza Hub” plant in Benevento, with an investment

of over 50 million EUR and a workforce of 150 employees. The plant is based on the company’s concept of a “connected factory” (i.e. a new way of thinking the value chain, connecting the different functions and moving from the “traditional” automated factory to a connected/integrated plant).

- Medium-sized companies such as Cereal Dock (producer of grains, pulses and cereal processing) have invested in automation, with a specific focus on process, logistics and business optimisation. One of the company’s objectives was to retrieve as much data as possible to be able to improve its services, its traceability, product customisation and business development.
- The Patfrut (SME), cooperative, which is involved in fruit and vegetable conditioning and packaging, has invested over 2 million EUR in a fully automated sorting machine which is able to scan fruits with optical systems and to sort them into three quality categories (refer to Appendix 4).

### 3.3.2 Hungary

The Hungarian company, Bonafarm, has improved its competitiveness and recruited more workers as a consequence of better data gathering and analysis. Bonafarm has invested in a digitalised system allowing the company to collect and analyse data from the different stages of production (agricultural

production, meat processing and product quality) and this has led to a significant increase in the company's performance. New job functions have been created in the field of fully automated measurement, data flow management, analysing and reporting.

### 3.3.3 Germany

A survey involving 304 companies in the German food processing industry shows that two thirds of the respondents were actively implementing digital and automated systems, Figure 14. Companies in the survey indicated production costs and competition as the most important drivers for digitalisation<sup>21</sup>.

The Bitkom survey<sup>22</sup> also showed that the digitalisation score in production reached 79% in contrast to 96% for logistics and supply chains, indicating that the production functions still have a potential for further adaptation of Industry 4.0 technologies.

### 3.3.4 France

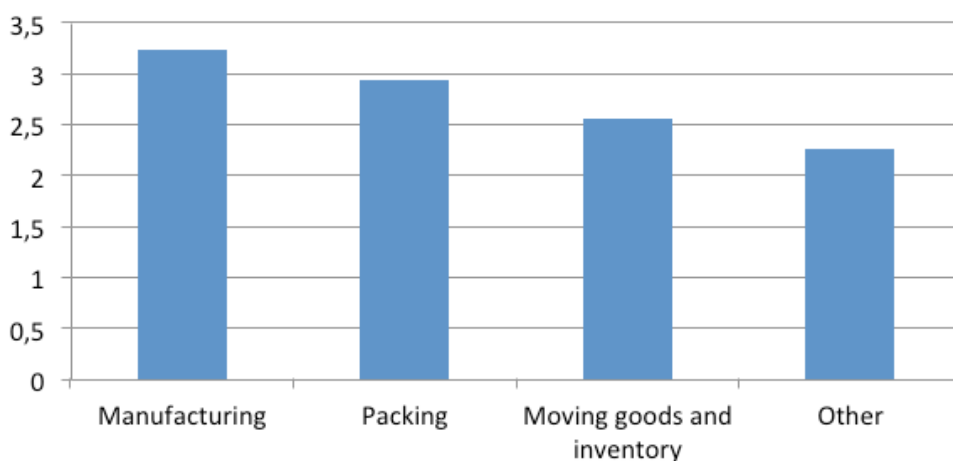
By 2019, more than two thirds of the companies in the French food industry had begun the adaptation of Food Industry 4.0; that is 30% more companies than in 2017. This was made clear in a survey of 250 companies of all sizes and subsectors. The survey pointed to the fact that, as a result of the digitalised systems and opportunities created by using Big Data, food companies would be forced to shorten the innovation

cycle, leading to a faster turnaround from the idea stage to the placing of a new service or product on the market. Innovations would be more connected to the supply chains and require lower development costs. The survey showed that 60% of innovation projects were related to new products or recipes and 30% were related to traceability

### 3.3.5 Denmark

As more than two thirds of the production output from the Danish food industry is for the global market, the competitiveness of the industry is of crucial importance, Figure 15. From a survey carried out among Danish food companies, it is clear that without automation more production would have been moved away from Denmark to lower-cost countries.

In this sense, access to a well-educated workforce, a good digital infrastructure and the flexibility of the Danish labour market model are the fundamentals for a transition towards Food Industry 4.0 and for contributing to the creation of employment in the food industry<sup>24</sup>. An example of an automated production system that builds on an extensive pool of data is the



**Figure 15: Food industry automation score on different functions, 2019**

Source: (Jensen P.B, 2019).  
Note: score 1 = worst, score 5 = best performance

<sup>21</sup> Bitkom study, 2019

<sup>22</sup> ibid

<sup>23</sup> Les Observatoires du secteur alimentaire, (2019)

<sup>24</sup> Jensen P.B. (2019)

use of automated machinery for splitting carcasses in the pork industry. Here, a system calculates the optimal cut to be carried out for achieving the best fore end, middle piece and ham of pork carcasses. The carcass is scanned and the meat and bones are shown on a monitor allowing the operators to follow the production. For workers, whilst the system has improved worker safety, it has also led to the loss of a number of jobs; for the company, the benefits include increased production efficiency, fewer accidents and better exploitation of the carcasses.

The opportunities and connectedness resulting from the integration of digital systems are illustrated by

the Lantmännen Unibake company (refer to Appendix 4). For Unibake, the company's ERP system is the fundamental digital infrastructure for developing a new business platform for full automation of the Group's factories. All data are digital, including recipes and quality control records and this is the basis for developing standards. The use of hand-held scanners is part of the daily routines on the shop floor. The digital infrastructure is the back bone of the standardization system. Digital infrastructure, advanced production systems and connectedness provide very good training opportunities for the workers, who are offered task rotation and opportunities for training in other plants in the Unibake group.

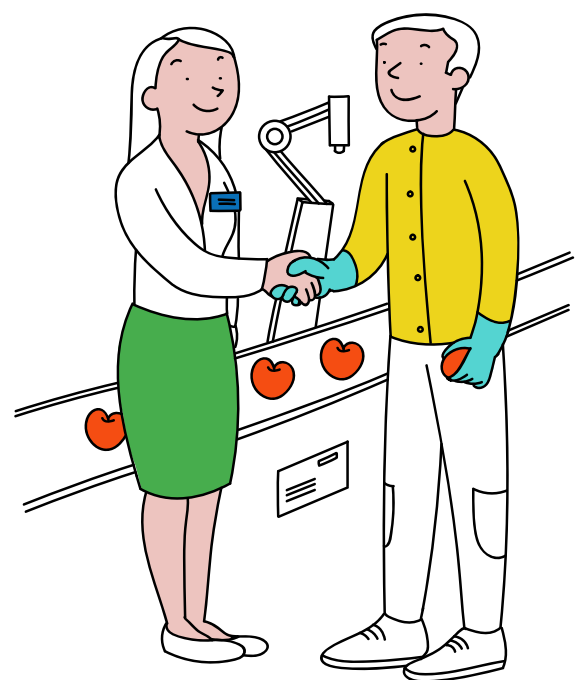
### 3.4 ACCESSING DIGITAL AND AUTOMATED PRODUCTION SYSTEMS

A general approach for accessing digital or automated production systems is to contact equipment suppliers on an occasional basis rather than as part of a strategic development process. This pattern seems more prevalent among smaller companies with less experience in working with digitalised technologies. An example of an SME taking the step of installing automated systems is the Italian company Patfrut in the fruit sector (Appendix 4).

An additional perspective is that many SMEs, particularly the very small companies, have artisan production methods as a core feature of their brand. For such companies, the reluctance to adopt Industry 4.0 technological solutions can be strongly rooted in the fear of losing brand value and reputation. This suggests that there is a clear need for strengthening the dialogue between food processors (of all sizes) and solution providers.

Investing in automated production systems can be undertaken as an upgrading of existing systems or installation of new lines. The latter can lead to changes in the factory lay-out and therefore have potential implications for the organisation of work. The installation of new production lines can be adapted to working routines and lead to improved working conditions, as well as more jobs. This was demonstrated by the Bük factory in Hungary (Appendix 4). This case study clearly shows that a constructive and open dialogue involving factory management, trade union

representatives or workers' representatives can lead to benefits for both the company and the employees. For example, more than 16 highly qualified workers have developed their skills on the efficient high-speed lines between 2016 and 2018.



# 4. WORKING IN FOOD INDUSTRY 4.0, SKILLS REQUIREMENTS AND CAREER PATHS

This chapter provides insights into working in the food industry and an analysis of the Manual, Cognitive and Soft skills required for tasks of work in Food Industry 4.0 targeted at production workers. The chapter illustrates how Food Industry 4.0 technologies could impact a selection of job functions. Towards the end, the chapter looks into the skills' requirements for working in Food industry 4.0 and the opportunities for career paths. In Appendix 3, Fact Sheets provide examples of initiatives designed to ensure the establishment of a workforce which has the skills required for working in Industry 4.0.

## 4.1 GENERAL REQUIREMENTS OF WORK 4.0

### 4.1.1 Work, skills and work organisation in Industry 4.0

Working in a manufacturing environment where the production and factory lay-out are organised to accommodate the principles of Industry 4.0 is different from working in an environment of assembly lines and manual labour. The digital environment penetrates the way work is organised, the tasks to be carried out, the technologies used and has an overall impact on the need for certain skills. Above all, digital skills are relevant for the Industry 4.0 working environment for controlling the production process, for reporting and for communicating.

As assembly lines in manufacturing are replaced by robots and automated systems, the conventional way of manning the assembly lines with many workers, each performing a specific task, is changing from task-oriented work to process-oriented work. This means that the worker is required to understand the process and not only the specific task and to engage in the organisation of the process. This could be organised, for example, as an autonomous production team of workers with different skills who all perform a variety of job functions.

The digital environment is a micro-environment in the sense that it frames the worker, the process and the control device, thereby defining the "sphere of work". Accordingly, the digital environment could also be considered to be a global environment since the connected devices link persons and machines across countries or factory locations. Adapting mentally to a micro-environment or a global environment can prove

challenging for people, but it also holds opportunities for gaining new insights and for developing linguistic skills. Considering the digital communities that are formed through the linking of production workers, supervisors, maintenance workers and providers of the technical solutions, it seems clear that the sense of collective intelligence will become an increasingly important factor for work in Industry 4.0.

Even in Industry 4.0, technology is not a solution, it is an enabler. This means that without a properly skilled workforce, the full potential of the technology cannot be fulfilled and this is where craftsmanship skills come into play. Craftsmanship skills are about having knowledge and experience of the processes, materials and the combinations thereof to fully exploit the potential of the material to make quality products and to improve processes. For the purpose of working in Industry 4.0, craftsmanship skills gain a new dimension as the experience of materials and processes are needed for adjusting automated technologies to achieve the best performance. Curiosity and interest in learning new skills and using new technology are very important characteristics of European industry's future workforce. For the present workforce, the need to adapt relevant skills for the present and future production environments is even more urgent. It is also fair to state that employers may also need to gain competencies to understand how to organise work and make the most of the present skills base possessed by their workforce.

### 4.1.2 Anticipated development in work as a result of Food Industry 4.0

An important aspect has emerged from research carried out for this project related to the fact that digitalisation changes the composition of employment and job functions. Tasks that can be (rather easily) automated will become even more automated in the

future. Whilst this may place jobs at risk, but it is also proven that new jobs are created following the adaptation to Industry 4.0 technologies. Adaptation to Food Industry 4.0 will also have an impact on how the work is carried out and organised. The following tasks

are anticipated to be daily tasks of shop floor workers in the Food Industry 4.0<sup>25</sup>:

- Less labour intensive interventions;
- Technologies to be used as enablers and for assistance;
- More task variation and increasing responsibilities;
- More expectations in terms of process optimisation;
- Handling data and countering *poorer information*;
- More intense collaboration with colleagues and external partners;
- Manipulating and controlling digital systems rather than food.

As digital systems, automation and the use of robots can take over job functions that workers with a lower level of education perform today (for example packing of goods), the adaption to Food Industry 4.0 may provide fewer employment opportunities for this group of people. Another option is that a range of new occupations will be developed as a consequence of adapting to Industry 4.0 in food manufacturing. Examples of such occupations could be robot-specialist, on-line maintenance supporter, or other specialist functions related to digital systems, automatic hardware, and aspects of collaboration<sup>26</sup>. In the case of maintenance, for example, the adaptation of this function to the Industry 4.0 context would lead to a different way of working. Instead of calling the maintenance workers, the line operator would use a smartphone to send a picture to the maintenance worker and the problem might be solved on-line with production still running. This form of collaboration has an impact on how colleagues interact and talk to each other, as well as on job satisfaction. For this kind of process to materialize in the context of all the digitalised solutions, there is a call for encouraging soft skills and strong social competences amongst the workforce.

A survey from France<sup>27</sup> concluded that the opportunities for using Big Data and digital information for the development of new products and services for the food industry would require a change in the way work is organised. The traditional way of organising work in production, sales, logistics etc. would need to change to a more integrated approach. For example, innovation projects would be organised as transversal projects from shop floors to management, in other words a form of organisation where cognitive skills and abilities to collaborate are essential. For shop floor workers, this would mean engaging in project work, administering many tasks, building new skills and working in a process - and project - oriented environment. Another example from an Italian company shows how Industry 4.0 provides the conditions for new ways of working: a network has been

formed following the opening of a new innovation department in a cooperative in the cereals industry. The intention of the network is to serve as a common pool of knowledge, with specialists working together on innovations and the development of the company, making use of internal and external resources linked through the network. Relying solely on the Industry 4.0 technologies for food manufacturing will not work without establishing an integrated working environment where workers' skills are properly matched to the requirements of the organisation of production and applied technologies. It is therefore essential to know the present skills base of the workforce (Appendix 3), as well as to ensure that the workforce is equipped with relevant skills to carry out the work or with the skills required to support the worker to move on to other employment opportunities.

A study<sup>28</sup> on the future skills required for the global manufacturing sector has provided a comprehensive map of the most relevant skill categories, together with an outlook on how automation is expected to impact the demand for such skills, **Figure 16** (refer to Appendix Methodology).

The McKinsey study (**Figure 16**) introduced five macro categories of skills: Physical and manual, Basic cognitive, Higher cognitive, Social and emotional and Technological skills. Since the McKinsey study was carried out for the general manufacturing sector, research carried out in this project indicates that three core skills are relevant for working in the food and drink industry 4.0:

- Manual skills
- Cognitive skills
- Soft skills

<sup>25</sup> Desseyn J, 2019

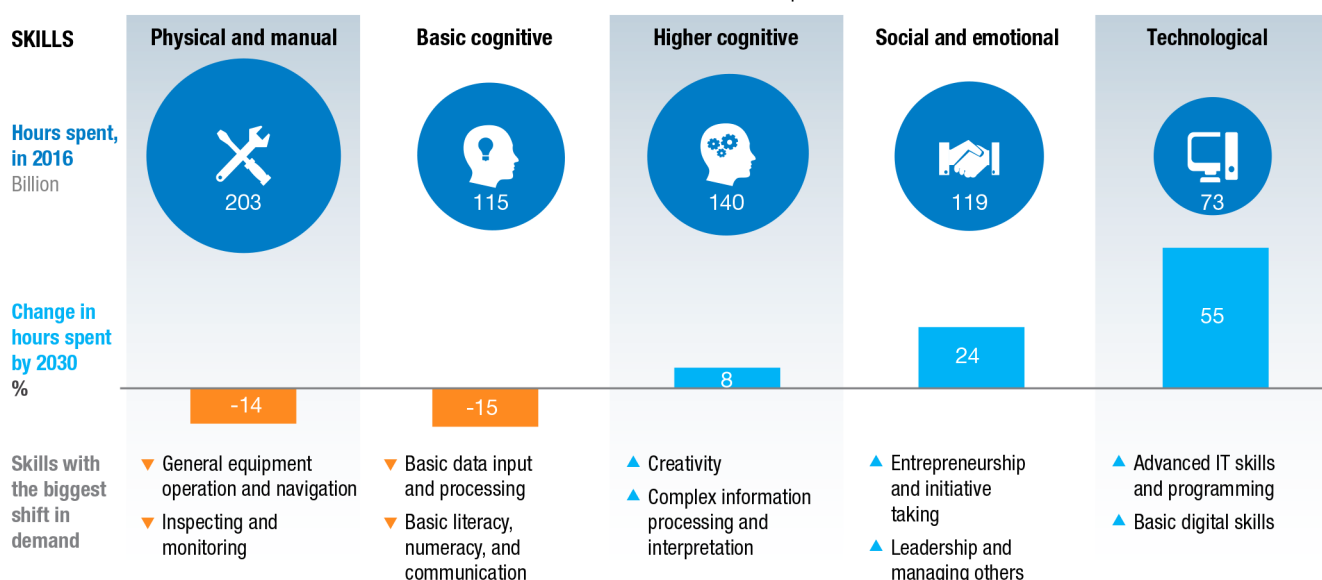
<sup>26</sup> Korsberg L, 2019

<sup>27</sup> Les Observatoires de secteur Alimentaire, 2019

<sup>28</sup> McKinsey Global Institute, 2018

## Automation and AI will change the skills needed in the workforce

Total is for United States and 14 Western European countries



**Figure 16: Expected evolution in working hours for the skills needed in the global workforce in general manufacturing**

Source: McKinsey Global Institute, 2018 – Skill shift: automation and the future of the workforce

## 4.2 JOB FUNCTIONS, TASKS AND SKILLS REQUIRED IN FOOD INDUSTRY 4.0

### 4.2.1 Job functions, tasks and manual skills

This category of manual skills is relevant to production workers, maintenance workers, craftsmen and other professions. The essential feature of manual work is the value of experience which can only be gained from “working with one’s hands”, either in direct contact with the food items, from maintaining and servicing the machinery, or via the operation of the digitalised and automated production equipment. The essence of manual skills is the ability to act and take action in a given situation, and this action is very often based on experience gained through many years of work. Additionally, the basis for developing experience is established by a training sequence which may take the form of an apprenticeship or other systems of vocational training (refer to chapter 6).

It is anticipated that the need for hard physical labour in the food and drink industry will be reduced in the near future as such functions are increasingly becoming automated, although this depends on the local context. Given the future skills requirement, it

is important to consider that many tasks requiring manual labour today may not exist in the near future due to the adoption of Industry 4.0 technologies by food and drink companies.

Based on **Figure 17**, it is evident that skills for operating digitalised production equipment are essential and are increasingly replacing manual labour. Essentially, this is pointing to the need for providing workers with **skills to operate advanced manufacturing equipment, for example skills for understanding the process flow, the limitations and options of the machinery**. There is also a need for providing workers with the **necessary preventive and protective measures, such as ensuring that each worker has received the necessary health and safety information and training**. The shift in skills requirements also means that there is a need to integrate digital competencies in functions involving tasks such as monitoring, registration or controlling equipment, in other words, skills required to **read and act upon written**

**instructions** (e.g. recipes and cooking times). It is also clear that functions requiring manual labour will be fully or partly automated and consequently it will be necessary for all workers to acquire **basic digital skills**.

Craftsmanship skills will require a contemporary **upgrade to include industrial parameters such as automatic manufacturing and robotics**. The importance of **craftsmanship skills**, as well as experience and knowledge of food processing practices, are expected to remain high (maybe even higher than today). Furthermore, there is a need for craftsmanship skills in functions within food production and equipment maintenance, which once again underlines the need to maintain a focus on the skills acquired by carrying out manual work and gaining experience.

Furthermore, large industrial bakeries, dairy plants or meat processors require craftsmanship skills and the reasons for this are to be found in the need to

**combine the experience gained by working with your hands with the ability to operate and act in Food Industry 4.0.** (Refer to Appendix 4).

**Workers in maintenance and technology support functions will have to acquire skills for dealing with automated production equipment and for communicating digitally** with, for example, production control or providers of the processing lines. However, the **hands-on technology insights** and experience of how production systems and pieces of equipment work and should be maintained possessed by maintenance workers are valuable skills. As more technological support is carried out in the form of online consultations with equipment suppliers and internally in the company, the **workers with technological and mechanical skills** will need to increase their digital knowledge without compromising craftsmanship skills to provide (emergency) maintenance through a user interface<sup>29</sup>

**Figure 17: Tasks and related job functions requiring manual skills and the impact of Food Industry 4.0**

Tasks	Examples of job functions in the food industry	Examples of Food Industry 4.0 technologies
<b>Operating processing equipment, systems and utilities in production</b>	<ul style="list-style-type: none"> <li>• Assembly line workers</li> <li>• Operators of food processing machinery</li> <li>• Operators of collaborative robots and automated systems</li> <li>• Workers with monitoring tasks</li> <li>• Worker in collaboration with “co-bots”</li> </ul>	<ul style="list-style-type: none"> <li>• Automated devices and automated production lines</li> <li>• Collaborative robots</li> <li>• Mobile manipulators</li> <li>• Self-driving vehicles</li> </ul>
<b>Mechanical skills and equipment and process machinery repair</b>	<ul style="list-style-type: none"> <li>• Mechanics</li> <li>• Maintenance workers</li> <li>• Robot repairer</li> <li>• Plant support and service function</li> </ul>	<ul style="list-style-type: none"> <li>• Automated production lines, online communication</li> <li>• Robots and automated devices</li> <li>• Integrated systems</li> <li>• Internet of Things</li> </ul>
<b>Craftsmanship skills</b>	<ul style="list-style-type: none"> <li>• Mechanics</li> <li>• Production technician</li> <li>• Butcher</li> <li>• Dairy technologist</li> <li>• Baker</li> </ul>	<ul style="list-style-type: none"> <li>• Digitalised information systems</li> <li>• Vision technologies</li> <li>• Automated production equipment</li> <li>• 3D printing for decoration</li> </ul>
<b>Other physical skills</b>	<ul style="list-style-type: none"> <li>• Machine feeders</li> <li>• Machine cleaners</li> <li>• Workers along packing lines</li> <li>• Warehouse workers</li> </ul>	<ul style="list-style-type: none"> <li>• Built-in automated system self-cleaning surface or Cleaning-in-Place technologies (CIP)</li> <li>• Vision-based systems for sorting</li> <li>• Automated vehicles for picking and transportation in warehouses</li> </ul>

## 4.2.2 Job functions, tasks and cognitive skills

Cognitive skills relate to the ability of thinking, acting and communicating, which means that **reading, writing and the ability to perform calculations are core skills** in this category. These skills are relevant for all workers in the food industry, including at more advanced levels for job functions such as team leaders or supervisors. Cognitive skills are used, for example, for reading recipes and production plans, for calculating throughput and adjusting machines, or for keeping track of inventories. In this perspective, cognitive skills are obviously relevant for employees in supervisory positions, such as the operators of production lines, technicians monitoring production flows or for workers in logistics and storage departments.

Cognitive skills are, together with manual skills, the category of skills whose relative importance in food production and logistics is expected to increase the most as a result of the implementation of automated and digitalised systems. For example, the work carried out by setup technicians (e.g. entering production programmes of machines or adapting collaborative robots) could be less important because of the increasing use of user-friendly interfaces for basic settings, but this is not certain, since the opposite is just as possible: more robots in a production environment would require more work to adjust and programme the production system.

Research carried out by the Italian industry federation (Confindustria) and by the national food industry federation (Federalimentare)<sup>30</sup> has identified the main future trends in work organisation:

- Future work will shift from routine manual work to activities requiring more cognitive skills;
- Tasks will be a combination of specialist functions and multitasking, thus less routine work;
- Workers will need to adapt to continuously evolving technologies and new working procedures, requiring them to build digital skills and skills for operating advanced equipment and data systems;
- All staff groups will have to adapt to continuous learning to widen their skills base to include more cognitive, digital and soft skills.

The need for general data entry activities will be sharply reduced by the integration of systems and online/real-time data registration that is made possible by the Internet and digital communication systems. As a result, competences such as advanced literacy and writing, data interpretation skills and information processing will become more important for shop

floor workers and their team leaders, **Figure 18**.

**Figure 18** shows that the importance of skills for reading, calculating and communicating is significant in the digitalised production environment of Food industry 4.0. **Written communication** is becoming vitally important to all job functions related to food production and information is continuously shared and stored on digital devices (hand-held as well as large integrated data networks). Being able to **read and understand written information is therefore a core skill** to master, as well as the **ability to communicate and operate digital devices**.

Abilities to communicate, to act and to understand information also require appropriate **linguistic skills**. In many food companies, the corporate language is English, but it is not certain this also applies to the production workers. In numerous food plants across Europe there are many nationalities represented among the workers on the shop floor and there is a clear need to communicate in a language they all (or at least most of them) understand.

<sup>30</sup> Federalimentare, 2018.

**Figure 18: Tasks and related job functions requiring cognitive skills and the impact of Food Industry 4.0**

Tasks	Examples of job functions in the food industry	Examples of Food Industry 4.0 technologies
<b>Basic reading, calculating and communicating</b>	<ul style="list-style-type: none"> <li>• Worker in production or packing department, process operator</li> <li>• Worker in warehousing and logistics</li> <li>• Production line monitoring</li> <li>• Line operator</li> <li>• Internal logistics and movement of goods</li> </ul>	<ul style="list-style-type: none"> <li>• Digitalised communication</li> <li>• Monitors for production planning and control</li> <li>• Automated machinery</li> <li>• Integrated data-driven systems</li> <li>• Reporting systems for production flows and resource use</li> </ul>
<b>Coordinating and planning of work</b>	<ul style="list-style-type: none"> <li>• Team leader</li> <li>• Trainer/mentor</li> <li>• Production line/department coordinator</li> </ul>	<ul style="list-style-type: none"> <li>• Intelligent sensor systems for quality and production flows</li> <li>• Online learning systems for, e.g., adjusting the machines</li> <li>• Integrated data-driven systems</li> <li>• IoT, real-time monitoring and online communication</li> </ul>
<b>Information monitoring, processing and interpretation</b>	<ul style="list-style-type: none"> <li>• Production worker</li> <li>• Set-up technician</li> <li>• Logistics worker</li> <li>• Quality control</li> <li>• Application of craftsmanship skills in a function</li> <li>• Maintenance worker</li> <li>• Team leader</li> <li>• Production planner</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated data-driven systems</li> <li>• Digitalised reports from system, equipment and production monitoring</li> <li>• Predictive maintenance and CIP systems</li> <li>• Vision and detection systems</li> <li>• RFID tags for logistics</li> </ul>

Reading skills and digital skills are fundamentals for mastering a job or making a living in today’s society. For food industry workers, the requirements for improving reading, writing and communication skills are evident and driven by the need for skills to operate advanced manufacturing equipment, including the reading of progress reports, production plans or technical specifications. Having such cognitive skills is important for workers who are looking for new careers in automated manufacturing environments.

With regards to **skills for inspection and monitoring** of production, many of the related activities have been replaced by technology in recent years, for example by vision and detection systems for sorting and initial quality control. It is reasonable to state that there will be less of a need for this category of skills in the future. However, **skills do not become obsolete since**

**they can gain value if developed to match a contemporary context.** For example, when implementing new automated solutions or production machinery, the solution provider’s specialist knowledge should be combined with workers’ insights about work organisation and routines, as well as quality standards, forming the basis for achieving a good process for changing a production environment.

This points to a **new set of cognitive skills**: the ability to think critically, to analyse data and the situation and to initiate action. To exploit the full value of workers’ cognitive skills, these skills should be closely linked to skills obtained from manual work. Essentially, the better the worker or team leader understands the production process, the situation, the technology and the data, the better interpretation, action and result can be expected to be.

### 4.3.3 Job functions, tasks and soft skills

Soft skills are a cluster of skills including the ability to collaborate, to lead, to learn and to interact with other people, in other words a set of skills related to interactions with other people. This cluster of skills is relevant for all groups of workers in the food industry, but the need to apply such skills may vary according to job function. For a team leader or mentor, the application of a wide range of soft skills is essential, whereas for some workers the ability to show leadership may be of less importance.

An important issue within soft skills is the ability to adapt to a changing working environment or to add new requirements to a well-known task. For example, the willingness to learn or the demonstration of an open-minded approach to an inclusive work culture, could be regarded as valuable soft skills. In spite of the increasing level of automation in the food industry in

Northern Europe, the craftsmanship skills and experience of shop floor workers will also be needed in food industry 4.0. It was clearly stated at the workshop that a process can, indeed, be automated, but it takes a craftsman's insights to understand the process, as well as their experience in production to keep an automated production process on the right track (Refer to Appendix 4).

**Soft skills** include such skills as competences related to the interaction with other people, empathy, learning and leadership. Strong soft skills were highlighted by most of the stakeholders and experts consulted for the study as a key set of skills which employers look for when recruiting new employees, including both young talents and experienced workers, **Figure 19**.

**Figure 18: Tasks and related job functions requiring cognitive skills and the impact of Food Industry 4.0**

Tasks	Examples of job functions in the food industry	Examples of Food Industry 4.0 technologies
<b>Organising, monitoring, reporting, communicating (online)</b>	<ul style="list-style-type: none"> <li>Supervisors</li> <li>Process operators/workers</li> <li>Trainers/mentors</li> <li>Shop stewards/workers' representatives</li> </ul>	<ul style="list-style-type: none"> <li>Communication networks and digital devices</li> <li>Online learning systems</li> <li>Digital planning and reporting systems</li> <li>Online platforms of diverse kinds</li> <li>Automated production environments</li> <li>Real-time information for process control and inspection</li> </ul>
<b>Group leader supervision, coordinating, organising work, training colleagues, learners</b>	<ul style="list-style-type: none"> <li>Trainers/mentors</li> <li>Supervisors, team leaders</li> <li>Workers</li> <li>Apprentices and learners</li> <li>Staff – across all functions</li> <li>Quality control, product development, production inspection</li> </ul>	<ul style="list-style-type: none"> <li>Online information flows and digital data management</li> <li>communication via digital devices</li> <li>Electronic systems for translation of languages</li> <li>Online learning systems</li> </ul>

In the digitalised food manufacturing industry, the ability to act in networked conditions will be crucial. In this context, there are multiple examples of networked conditions: a network of collaborative partners (such as, for example, the network including the worker, the team leader, the maintenance function,

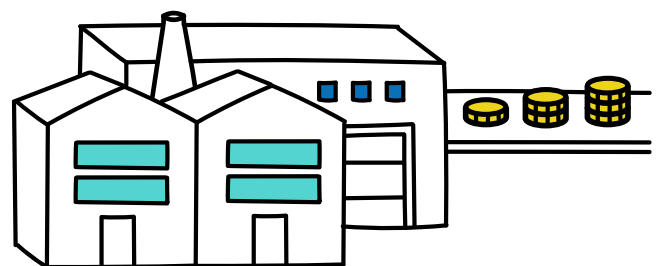
and the solution provider) that are linked via the internet; a network as a group of fellow workers carrying out similar functions in other departments or in other plants of the company; a network involving the apprentice or trainee, the trainer/mentor, the team leader and management, in other words, a network

established for the purpose of education. The point is that working in a networked environment includes requirements for interacting with other people either face-to-face or via digital devices and the competences of understanding and acting according to the present situation.

Soft skills are gaining importance in the digitalised and automated working environment and possessing soft skills is an asset for all groups of staff, including workers on the shop floor. The **core of the soft skills set is the ability to interact with other people**, such as colleagues, trainers/mentors, employers, supervisor or others. In the digitalised environment, where people are increasingly reliant on technology for communication and information flows, it is even more important to be **able to communicate** and interact properly and appropriately with other people.

From the project's workshops it was evident that there is a perception among employers that soft skills are somehow innate and more difficult than other skills to be learned and it is therefore more difficult to find people who are naturally gifted with these competencies. It was pointed out by the social partners on several occasions that future work organisation will be highly dependent on **team work, the sharing of tasks** and objectives and on **collaborative and inclusive work environments**, thereby underlining the need for soft skills.

**When automated production systems are installed, the factory lay-out may be changed and subsequently the work is organised in a new way. The changes in work organisation may change the working conditions for the workers in the production teams, for example when work becomes monotonous or the work is carried by an isolated worker. In such cases, a good social network among the colleagues in the factory is essential. Workers, team leaders or supervisors with strong social competences are important for ensuring a good social network among colleagues and with the management.**



# 5. CHALLENGES AND OPPORTUNITIES FOR WORK, SKILLS AND CAREERS

This chapter addresses the challenges and opportunities for work, skills and careers in Food Industry 4.0, building on the findings set out in the previous chapters. The chapter applies a forward-looking approach to propose career paths for young talents and experienced workers and provides examples of the impact of the skills gap in selected Member States. In this way, the chapter forms the basis for the discussions in chapter 6 on what needs to be done to acquire the necessary skills.

## 5.1 MOTIVATIONS FOR ADAPTING SKILLS TO FOOD INDUSTRY 4.0

### 5.1.1 Motivations and professional identities

Literature<sup>31</sup> and research for this project indicate that in the next few years the core competences required for working in Food Industry 4.0 will change, with an increasing need to leverage new digital functions (e.g. big data, clouds, and electronic information flow and data management) to optimise processes, increase efficiency of the overall factory and obtain better insights into supply chain developments. One thing is certain: the food industry workers' future skills set will be different compared to the skills possessed by the present workforce. This fact has been stated continuously by presenters at the regional workshops of the project, as has the need for to identify the skills required by the Food Industry 4.0 workforce.

A transversal characteristic of work in the Food Industry 4.0 is that what once used to be a well-known profession with clearly defined tasks, such as, for example “baker” or “butcher”, is now changing to become a new profession where the tasks are defined according to the work organisation and technologies applied. In Food Industry 4.0, a “master baker” may be the worker who supervises the team of workers operating the baking lines, and the master baker's work is centred around monitoring, reporting and quality inspection. This illustrates the need for a set of **skills that go beyond craftsmanship skills**, where **the ability to think and act in a process-oriented manner is emphasised**.

Maintenance work becomes an integrated task of operating a specific piece of machinery or production line and the food industry worker then has to carry out food production tasks and maintenance tasks. Other tasks related to production monitoring and reporting may also be performed. Whilst this illustrates the diversity of tasks to be carried out by workers in Food Industry 4.0, the example also demonstrates the val-

ue of the skills base and experience gained from the Food Industry 4.0 for getting a job in related sectors. Discussions at the project workshops indicate skills set required by the future Food Industry 4.0 worker may be illustrated by these examples:

- The skills which will be in highest demand will be those required to implement Industry 4.0 technologies and will require the presence of highly specialised “**super-technicians**” with appropriate IT skills, flexibility, the capacity to interpret the emerging and ever-changing needs of modern food processing and a high propensity to change<sup>32</sup>.
- The future workers in the European food industry will have to **deal with matters of increased complexity** and to bear more responsibility; they will have to master a broader skillset and be sufficiently flexible to shift seamlessly between different tasks (**multitasking vs. specialisation**). Last but not least, workers will have to cope with an increased sense of external control due to the **online and real-time** data flows resulting from Food Industry 4.0.

<sup>31</sup> McKinsey Global Institute (2018) – Skill shift: automation and the future of the workforce; OECD (2019) Skills Strategy Flanders; NESTA (2018) – In the Future of Skills: Employment in 2030; Pedersen M.L. and Jensen P. B. (2018): Fewer skilled workers is challenging for the Danish food industry, DI Analysis, September 2018, World Economic Forum (2016) – The future of jobs, employment, skills and workforce strategy for the fourth industrial revolution, and World Economic Forum (2018) – The future of jobs report

<sup>32</sup>Federalmentare, 2018

## 5.1.2 The value of skills and experience gained in Food Industry 4.0

Food industry workers with experience in advanced manufacturing, team work and who possess an understanding of digital solutions are attractive recruits for other industries using similar types of production systems and where process thinking and cognitive skills are high on the agenda. This could include industries such as food ingredients, bio-based products (bio-chemicals or bio-materials), agribusiness, chemical and pharmaceutical industries and many others, **Figure 20**.

Examples of career paths rooted in Food Industry 4.0 are set out below. The examples are based on company presentations and discussions at the project's regional workshops.

### Examples of career paths rooted in Food Industry 4.0

- A worker in the food industry who is very keen on computer-controlled production lines and has an interest in developing digital skills could train colleagues in the factory and then move on to a career as a teacher at a vocational education centre or seek employment with companies producing food processing equipment.
- Process-oriented thinking, experience of operating automated equipment, monitoring and reporting, as well as the experience gained from working in an environment (bio-based manufacturing, chemical or pharmaceutical industries) with a high demands for hygiene and auditing, makes this person a valuable employee in other industries.
- A young talent is taken on as an apprentice in a meat plant, for example, and is trained as a meat

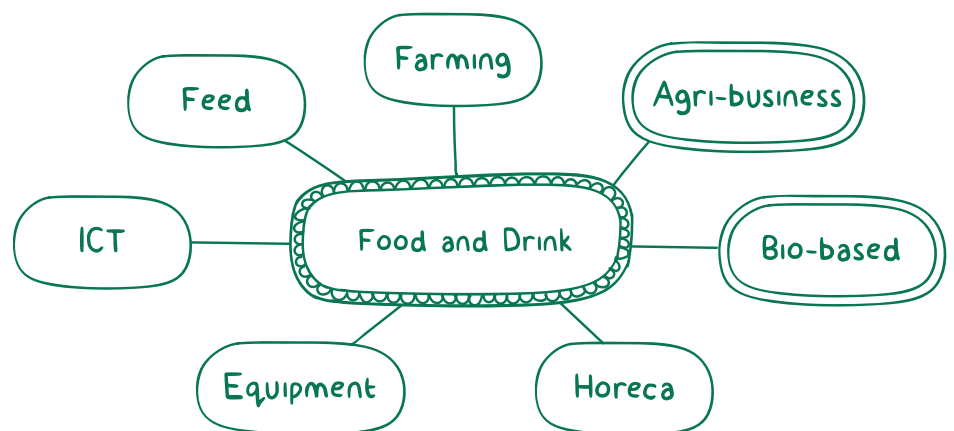
industry worker. The young talent takes interest in improving working conditions and work organisation. The person's career takes a turn and the young talent is offered additional education to learn more about work organisation, thereby enabling them to develop a career in the area of work and working conditions.

- A senior worker performing manual work in the Food Industry 4.0 is offered training in using digital communication devices and to improve reading skills. After this course, the worker has acquired a new set of skills, for example the monitoring of raw material quality. The worker's career can be extended and they can stay longer in the food industry or can find work elsewhere.

The process of adapting the technologies of Industry 4.0 will lead to fewer jobs which require physical strength and more jobs requiring skills for operating digitalised systems and computer-controlled production lines. Such working conditions can make it possible for experienced workers to remain in the labour market longer as people can be transferred to tasks requiring less manual or physically demanding work. The food industry employs many workers with no formal education, as well as socially vulnerable people such as refugees. These groups of workers are trained in the factory so the workers obtain the skills needed to carry out defined tasks. In this sense, Food Industry 4.0 demonstrates inclusiveness, building on the soft skills, craftsmanship skills and social competencies of its workforce.

**Figure 20: Diverse career paths from a skills base rooted in Food Industry 4.0**

Source: IFAU elaboration



## 5.2 FOOD INDUSTRY 4.0 AND THE SKILLS GAP

### 5.2.1 Identifying the skills gap

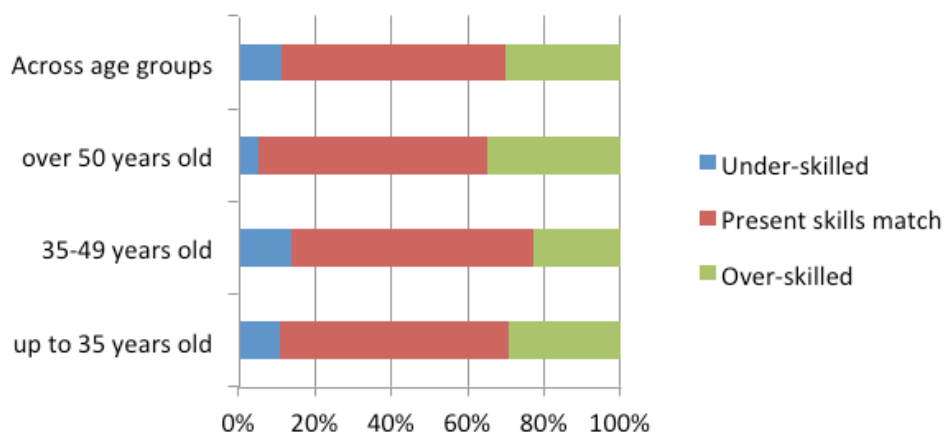
In 2017, it was reported that more than 31,000 robots<sup>33</sup> has been installed in food factories and new occupations and job functions have emerged. Technology develops rapidly and, ideally, the skills base of the workforce should be aligned with the food and drink companies' requirements. A Eurofound survey (2014) concluded that more than 60% of the workers in the food industry said that their present skills correspond to their duties, **Figure 21**. Workers aged over 50 were the largest group to (35%) to consider themselves to be over-skilled (22 % of workers in the age group 35-49).

It is clear that there is a gap between the skills possessed by today's food industry workforce and the future requirements for skills. In Germany, 88 % of the food industry has identified the workforce's lack of digital competencies as the most important obstacle for the adaptation of Industry 4.0 technologies<sup>34</sup>.

The Organisation for Economic Co-operation and Development (OECD) has clearly stated that workers in industry (all sectors) will be required to improve skills for reading, writing, communicating, solving problems, acting and working with digitalised systems<sup>35</sup>. The widening skills gap will have a significant social impact on the workforce and companies need an appropriately skilled workforce to remain competitive

and prosperous. If not addressed, the skills gap will lead to a polarisation of the workforce: one group that is over-skilled for the present tasks, and another group that is under-skilled. The issue is therefore also how to apply the skills currently possessed by the workers.

A skilled workforce is of paramount importance for the competitiveness of the food industry and for an inclusive digital society. It is estimated that 44% of EU citizens currently lack basic digital skills<sup>36</sup> and that 37% of the current workforce lacks sufficient digital skills<sup>37</sup>, despite their increasing importance across most job functions. In terms of skills, 59.2% of the surveyed food companies<sup>38</sup> believed that the skills necessary to engage in digital transformation are already available in-house and only 37% of the surveyed companies had started implementing strategies to reskill their workforce. Finally, 46% of the surveyed food companies reported that, as a result of adopting digital technologies, they had maintained a stable number of employees, while 24% reported an increasing number of employees and new vacancies; only 5% of respondents reported a reduction of the workforce due to new technologies and automation.



**Figure 21: Match between skills and tasks by workers in the EU food industry 2014**

Source: Eurofound survey, 2014

<sup>33</sup> ING, 2019

<sup>34</sup> Bitkom, 2019

<sup>35</sup> OECD, 2016

<sup>36</sup> European Parliament (2018) – Education in the digital era: challenges, opportunities and lessons for EU policy design

<sup>37</sup> European Parliament (2018) – Report on a comprehensive European industrial policy on artificial intelligence and robotics

<sup>38</sup> European Commission (2018) – Digital transformation scoreboard 2018 - EU businesses go digital: Opportunities, outcomes and uptake

## 5.2.2 Impact of the skills gap in selected EU countries

The UK food industry has indicated that there is need for re-skilling workers. Today, there are many vacancies that are difficult to fill. For job functions related to production and operations, the vacancy rate<sup>39</sup> is nearly 50% and for technical and quality related jobs the vacancy rate is more than 60%<sup>40</sup>, **Figure 22**. It is also estimated that the present skills gap will result in the need for 130,000 additional jobs to be filled by 2024 and that these jobs are destined for workers, food engineers and scientists<sup>41</sup>.

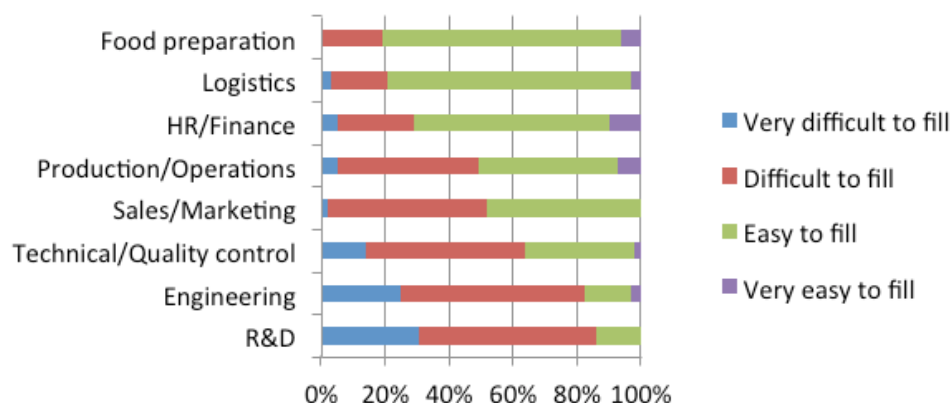
It is reported that the **Danish** food industry is experiencing challenges recruiting skilled workers (skilled in the sense that they have received vocational education). This is important as nearly 40% of the employees in the Danish food industry are skilled workers. The largest segments of skilled workers are

the bakers and butchers, a group counting nearly 6,500 employees. A particularly large number of older works are scheduled to retire in the short term amongst the category of technically skilled workers. This will leave the Danish food industry in severe need of skilled technical workers, such as process operators and technicians, whilst it will continue to face the challenges of recruiting workers in these groups<sup>42</sup>.

For the **Italian food sector**, it is expected that over 43,000 new workers will be needed in the next five years due to the impact of industry 4.0. This underlines the crucial aspect of finding ways to provide relevant training. Italian trade unions have joined forces to establish a fund to pay for training. So far, more than 4,000 workers have received training, **Figure 23** and Appendix 3.

**Figure 22: Challenges for recruiting staff in the British food industry, 2016**

Source: Grant Thornton, 2017



**Figure 22: Number of workers in Italy having received training for Food Industry 4.0 from Fondimpresa, 2016-2017**

Source: <https://www.fondimpresa.it/>

Profiles of participants	N°	As % of total participants
SME workers	3,942	92%
Female workers	1,609	38%
Workers aged > 50 + foreign workers	968	23%
Workers aged 18-29	635	15%
Shop floor workers	2,501	59%
Clerical workers	1,566	37%
Managers	194	5%
<b>Total participants</b>	<b>4,264</b>	<b>100%</b>

<sup>39</sup> Vacancy rate in Figure X: Percentage of vacancies reported to be very difficult and difficult to fill in.

<sup>40</sup> Grant Thornton, 2017

<sup>41</sup> Food and Drink Federation (2016) – Unlocking talent – the key to driving food and drink productivity

<sup>42</sup> Pedersen and Jensen, 2018

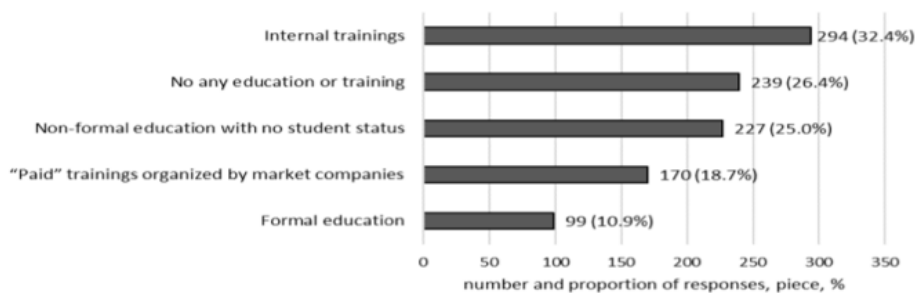
A survey carried out among **Hungarian agri-food enterprises** focussed on managers' experiences of employing recent graduates, **Figure 24**. The managers particularly highlighted the lack of professional practical skills, the ability to carry out system thinking and economic knowledge amongst the competencies of the young employees<sup>43</sup>.

It was concluded in the survey (Hamza et al, 2018) that Hungarian agricultural and food industrial enterprises consider it important and necessary to continuously broaden the knowledge of their workers: 73% of respondents support the training of their employees. Based on the results it can be also stated that the

companies mainly provide more accessible vocational training for their employees in the framework of non-formal education. It is valid for both formal and non-formal education that they are primarily used by large enterprises engaged in the processing of agricultural raw materials and which are managed by a leader who has a high level of education or qualifications. Internal training is the dominant form of training (**Figure 25**) and is implemented by involving genuine experts and allowing the targeted delivery of the professional experience accumulated within the company. **Figure 25** also shows that 26.4% of the workers do not have any forms of formal education or training.



**Figure 24:** Average values of professional competencies and skills of young employees in the Hungarian agri-food sector (1 = insufficient, 4 = excellent)  
Ref: Hamza et al, 2018



**Figure 25:** Forms of training of employed workforce among the surveyed Hungarian firms  
Ref: Hamza et al, 2018

<sup>43</sup> Hamza et al, 2018

## 5.3 ADDRESSING THE SKILLS GAP – EXAMPLES FROM MEMBER STATES

The research carried out for this project allowed for the identification of a number of possible **solutions to overcome the identified skills gaps**.

In **Italy**, the skills gap is regarded by food companies as a constraint for the introduction of Industry 4.0 technologies, rather than a challenge related to securing a skilled workforce for operating already installed technologies. An analysis of concrete solutions to overcome the skills gaps already applied in sectors where the introduction of industry 4.0 technologies is more widespread can provide useful insights for the development of similar approaches for the food sector. This is especially true in the case of solutions applied in manufacturing sectors where craftsmanship still plays an important role and will continue to do so in the future, such as precision mechanics for example. A review of literature focusing on the Italian precision mechanics industry<sup>44</sup> has made it possible to identify the key elements of a successful approach to overcoming the skills gaps in the transition towards an industry 4.0 manufacturing model, as set out below.

### Key elements for mapping the skills gap in precision mechanics – an example from Italy

- Mapping of the current professional profiles and of the related skills, i.e. the elaboration of a “skills map”. The criteria included: the prevalent nature of the activities carried out (manual vs. intellectual), the functions performed by workers (production, supervision and control, design and planning, etc.), the age and experience of workers, etc.
- Identification of the (new) professional profiles and of the skills which will be needed for the application of industry 4.0 technologies (these have been discussed above).
- Re-training of the current workforce to allow the transition from the current set of skills to the skills required for working in industry 4.0. Re-training will have to be tailored to the different profiles and sets of skills identified in the “skills map” (see point 1) and to the “target profiles/sets of skills” needed.

- Selection of newly hired workforce with the required skills for working in industry 4.0 (or at least with a set of skills which allows successful training to meet those requirements).

The elements covered in points 3 and 4 above clearly require the provision of specialist training courses by public and private bodies to complement in-house training provided by companies.

In **France**, a collaboration involving trade unions, employers’ associations and education bodies within the food sector has formed a joint initiative: “Les Observatoires du secteur Alimentaire” (Refer to Appendix 3). The purpose of this Observatory is to anticipate the evolution of professional activities and to forecast the skills and qualification needs. In this way, the Observatory is useful for companies, for workers and trade unions, as well as for other stakeholders such as institutions providing training for the food industry.

In **Flanders (Belgium)** a project has been carried out by Mpiris<sup>45</sup> for mapping the skills required by the future food industry worker. The project focused on skills required for a process, rather than for an occupation or a function. The key findings in terms of workers' skills are listed here:

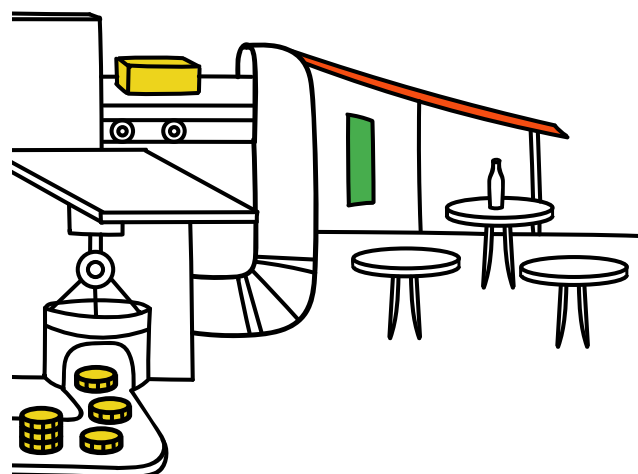
- Challenges related to using digital communication tools efficiently;
- Worker's sustained involvement in the task or function;
- Challenges related to handling increasingly complex matters, implying a need for strengthening cognitive skills;
- Coping with increased responsibility;
- Mastering a broader set of skills;
- Flexibility and ability to shift seamlessly between tasks;
- Pro-active problem solving skills such as analytical and statistical skills and abstract thinking;
- Coping with an increased sense of external control.

The project in Flanders has been supplemented by a number of follow-up initiatives targeted at improved collaboration with education providers (Alimento in Belgium); promotion of the food industry as a result of digitalisation and a project focussed on organisation culture in a digitalised context.

In **Hungary**, a public-private partnership involving the Technical University of Budapest has joined forces

and established the Industry 4.0 Innovation Hub (Appendix 3). This Hub demonstrates technologies related to Industry 4.0 on a pilot-scale, making it possible for interested companies to see and test these technologies. The Hub primarily targets SMEs in Hungarian industry and can be regarded as a gateway to motivate companies to start a process of adapting to (Food) Industry 4.0.

It is clear that the European food industry is faced with the challenges of having a sufficiently large workforce with the required skills. Therefore, it is relevant to identify how these relevant skills can be acquired and to examine the need to devise new ways of learning. These issues are discussed in the following chapter.



<sup>45</sup> Dessey J. (2019)

# 6. DELIVERING HIGH LEVEL SKILLS FOR FOOD INDUSTRY 4.0

In this chapter the focus is on ways to deliver the skills required for working in Food Industry 4.0. The chapter will look into diverse learning and training systems applied in the food industry and provide guidance on how training could be organised.

## 6.1 VOCATIONAL EDUCATION AND TRAINING (VET)

### 6.1.1 VET targeted at Food Industry 4.0

Demand for skills required for future food processing activities will change as a result of changes in automation and digitalisation - the **emergence of new, so far unknown multidisciplinary professions**. Examples of such new occupations could be innovation specialist, simulation and modelling specialist, digitalisation supervisor, processing systems advisor, robot operator, robot designer, factory lay-out planner, production analyst, systems developer, manufacturing system engineer, process planning expert, artificial intelligence application expert, IT support and service system builder, food ingredient database programmer, “big data” analyst, “big data” processor, intelligent sensor maintenance, robot server technician, robot trainer, robotic arm maintenance, production control system maintenance, consumer personal assistant and many more yet unknown occupations. The core issue is that the new occupations are rooted in the way work, work organisation and requirements for skills change as a consequence of Food Industry 4.0. Therefore, the way education and training is offered today to young talents and for reskilling and upskilling of workers needs to be adapted to the present situation.

A study from Germany concludes that technological developments have led to structural shifts between sectors and occupations and that these can be expected to continue in the future<sup>46</sup>. Digitalisation not only offers potential for substitution, but also for productivity and inclusion. In order to cope with the future challenges of a digitalised world of work, the study recommends that vocational schools, on-the-job training facilities or technology centres organized by training alliances should become central places for imparting knowledge about the digitalisation of the world of work. New methods should be developed to define the competence profiles required in occupations, sectors, and regions. It would also be helpful to have closer links between technology providers and the actors responsible for training and qualification.

Although most of the Hungarian agro food enterpris-

es face labour supply challenges, only a minority of them are taking steps by themselves and participating in the dual vocational training system so far<sup>47</sup>. In the three years preceding the Hungarian Agricultural Labour Market Barometer Survey, 18.7% of the enterprises were associated in secondary agricultural vocational training courses, thereby providing apprenticeship contracts and traineeship place. According to the agro food enterprises, the main reasons for not getting involved in dual vocational training are as follows: lack of capacity, complicated administration, lack of applicants, lack of information about practical dual training opportunities and a frequently changing legal environment. The lack of systems thinking, practical skills and problem-solving skills were regarded as challenging for the future of the Hungarian food industry.

In the United Kingdom, VET qualifications exist in a wide variety of sectors and prepare learners for work and further study. Apprentices are employed and are taught core, transferable skills. Technical and occupational learning take place on and off the job. New standards for a comprehensive set of occupations have been developed in 2018-2019 and these standards define the skills required for a specific occupation, including those in the food industry<sup>48</sup>. The new standards have been developed to meet the requirements in a digitalised and automated production environment. For workers with more experience or in supervisory functions, the defined skills reflect a more profound emphasis on social skills and cognitive skills, whilst still building on food industry skills. The modernisation of the vocational education curriculum for the food industry must reflect the new processes carried out in the food industry and the systems for integration of the value chains, as well as the new technologies being implemented. The following examples<sup>49</sup> could be considered relevant for inclusion in an upgraded VET targeted at food processing in the digital era:

- Understanding of the value chain from primary

<sup>46</sup> Matthes B. et al, 2019

<sup>47</sup> Hamza et al, 2018

<sup>48</sup> www.ukstandards.org.uk

<sup>49</sup> Dalla Rosa, 2019

- production to processing and marketing of the final product, and the underlying digitalised systems;
- Acquiring skills for controlling the production process through a man-machine interface applied to food manufacturing processes;
- Understanding the integration of the supply chain and inventory systems and gaining skills for working with RFID-tags or other advanced technologies to monitor and oversee digitized production processes and logistics;
- Ability to work with digitalised systems for quality management, including Big Data and the Blockchain technologies, particularly at quality management level.

## 6.1.2 Developing vocational education for the future

It has been claimed on more than one occasion at the project's regional workshops that the existing vocational education and training provision has not kept up with changes in skills and the labour market and in some countries vocational education is severely lagging behind basic needs. This is a call for change to ensure that the vocational education system meets with the needs of the digital era. Vocational education and training has to include digital skills, training in operating automated equipment and must find ways for strengthening the building of soft skills (e.g. process organisation, process-thinking, collaboration and team-work)<sup>50</sup>.

Attracting new talents continues to be a challenge for the food industry, including in Northern Europe. The young generation's perception of "working in industry" is often based on exaggerated perceptions (for example cold, heavy, dirty and hard work within a rigid structure) which means that the food industry as a career path is seen in an unfavourable light given the better working conditions in other sectors<sup>51</sup>. It is therefore essential to convey a message to future talents about the food industry's attractiveness as a place to work and develop a career. The digital and automated production environment, the integration of tasks and the need for process thinking and soft skills are considered as crucial elements for promoting the food industry to future talents.

For recruiting talents to work in the food industry, it is essential to provide the attractive and contemporary opportunities for education and a type of work that meets the expectations of the younger generation. To attract new talents, representatives of the Hungarian Bonafarm Group regularly visit primary schools, secondary schools, technical colleges and universities and help to run awareness raising programmes. The company also invites students and future workers to come and visit the modern production environment in the slaughterhouses and meat processing plants. The young talents must identify vocational education as a starting point for continuous education and this

means that vocational education needs to link with other opportunities for additional education, re- and upskilling and that the "apprentice degree" can be used as a valid qualification for entering into other educational institutions, such as college.

An example of an educational programme that could motivate skilled workers from the food industry to consider a career path beyond the shop floor is the Summer school offered by the Research Centre for Bio-economy at the University of Hohenheim in Germany. Today, the Summer school is designed for undergraduate and masters students but could, in principle, be relevant for trained apprentices from the food industry. At the Summer school, students are trained to obtain a comprehensive overview of food technology transitions and paradigmatic shifts within the agri-food sector. The Summer School integrates knowledge about the production side with social sciences and a wider social perspective. At the end of the Summer school, students will have a thorough understanding of food technology transitions, meaning that the course that could build further on the competences acquired during the apprenticeship and the experience gained from working in the food industry.

<sup>50</sup> Hamann et al, 2019

<sup>51</sup> LRF and Job Center Sweden, 2018

### 6.1.3 The Teaching and Learning Factory

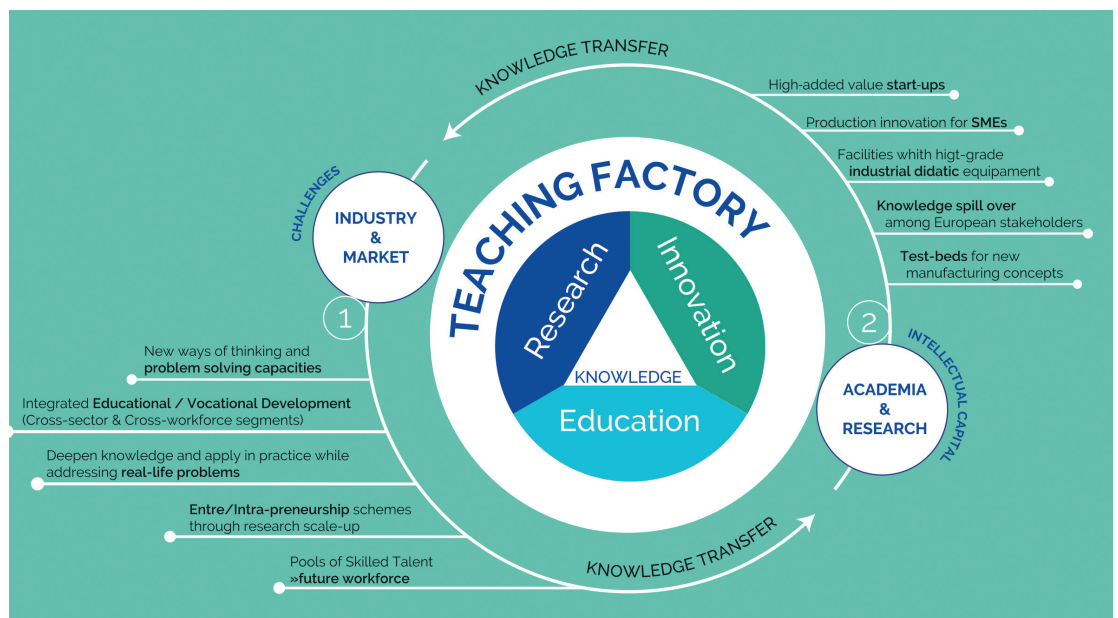
The “Teaching and Learning Factory”, **Figure 26**, is one of the emerging manufacturing education paradigms and it has attracted major interest in various educational and business pilot activities (Hegyí A. and Sebők A., 2018). Its main objective is to modernize the teaching processes and bring them close to the industry, providing young talents in the food industry with “hands-on-experience”.

The Teaching and Learning Factory is a learning approach already applied in Food Industry 4.0. Its core element is the close collaboration between the education provider and the food factory in a real-time learning environment, reflecting the work and skills

required as organised, for example, through apprentice schemes or vocational education.

In the Danish red meat industry, training as an apprentice is an established approach to gaining skills for working in this industry. Both at college and when working in the meat plant, the young talents are provided with skills and knowledge to operate automatic equipment and processing lines and are also helped to build manual skills for working with a knife (Appendix 3). The skills acquired are listed in **Figure 27**. Apprentices receive a salary while training and the college is supported by government funds and levies from pig slaughtering<sup>52</sup>.

**Figure 26: Teaching Factory: An educational paradigm for future manufacturing in Europe**  
Source: ManuFUTURE – EU High-Level Group, 2018



**Figure 27: Skills acquired when training to become an Industrial Slaughterer, Denmark**

Competences gained when training to become an **Industrial Slaughterer** – two years and six months of education

- Correct use of a knife;
- Cutting of pork carcasses;
- Deboning of pork for export markets;
- Hygiene and food safety;
- Animal welfare;
- **Ergonomics and working conditions;**
- Quality and yield control;
- Calculations;
- **Use of ICT**

Competences gained when training to become an **Industrial Slaughterer (pork)** – three years and six months of education

- Same competences as for Industrial Slaughterer training, plus:
- Slaughtering of pigs;
- **Knowledge of automated equipment and use of robotics;**
- **Assessment of production method;**
- **Optimization of production;**
- **Collaboration and team work;**
- **Planning and organisation of work;**
- **Abilities to combine manual and skilled work with the work performed by automated equipment and robots**

<sup>52</sup> <https://www.ug.dk/uddannelser/erhvervsuddannelser/foedevareerjordbrugogoplevelser/slagter>

It is evident from **Figure 27** in the previous page that skills that are relevant for working with automated equipment and digitalised systems are integrated in the theoretical and practical training of the apprentices, both at the college and in the meat plants. Although this scheme might initially appear to be an apprentice scheme, the real difference lies in the possibility to train the young talents at college and

in the plants in the use of real industrial equipment. There is close collaboration between the college, the red meat companies and the Technological Research Institute regarding the technical challenges, advanced processing equipment and requirements for skills, and it is this collaboration that ensures that the skills are constantly adapted to the present needs of the meat industry.

## 6.2 TRAINING IN COMPANIES

### 6.2.1 Passing on skills amongst colleagues

Once they have been trained to work in the food industry, the workers should have the opportunities to further develop their skills – preferably according to the worker’s own choice. Evidence from Danish food plants shows<sup>53</sup> that when given this opportunity, workers may choose education such as basic literacy, “computers for beginners”, language training (English), technical skills or truck driver’s license. Having the opportunity to build skills of their own choice is motivating for the employees and strengthens their employability in the event that they have to find another job. For older workers who may be exhausted following a long career, the opportunity to remain in the company whilst holding another position can be very important in order to avoid early retirement. For example, a worker who has been constantly required to perform physically demanding tasks for many years can be retrained to carry out a monitoring function and then carry out other tasks and less demanding work. Similarly, if workers are equipped with skills to use computers and digital devices, other careers are open to them. Training in companies can, in some cases, accommodate the worker’s request for developing skills; alternatively, training must be provided by external facilities.

For some workers, an environment requiring many tasks to be performed can prove challenging. For these people, it is vital to define a set of tasks that suit the individual, yet also allows the (team-) work to be carried out. In this case, appropriate training and knowledgeable work organisation are essential features. It is crucial that workers across age groups, skills levels and occupations are equipped with proper skills, including skills which may be acquired from in-house training and collaboration with colleagues.

Interviews, workshops and literature have pointed to the fact that the majority of workers in the food industry are trained for their job through colleagues’ instructions and support. It is therefore critical to ensure that the skills held by experienced workers are passed on to new (and younger) colleagues and that the skills passed on are up to date. This is relevant for manual, cognitive and soft skills, as well as for digital skills. When it comes to acquiring skills for operating equipment and data-systems in the framework of Food Industry 4.0, the degree to which skills are passed on between colleagues is less clear, as illustrated by a few examples set out below:

#### **Example A: Experience is fundamental for operating automated processing equipment**

A young trained butcher has acquired a great deal of knowledge about manual work, machines and the meat industry from attending vocational education and he is now working in a job where he has to operate an automatic meat processing machine. The talent is not experienced, only trained, and therefore has only theoretical knowledge of what to do. It requires experience to act correctly and, in this example, an experienced colleague would be needed to ensure that the automatic machine runs properly and to adjust the machine to achieve optimised performance in the given conditions<sup>54</sup>.

#### **Example B: What to look for before an automated system breaks down**

The organisation of training has to reflect the daily routines and tasks carried out on the shop floor if training is to be of any use for the worker. An example from the cereal industry illustrates this issue: in a flour mill using automated production, all workers

<sup>53</sup> Sorensen M.C., 2019

<sup>54</sup> Hamann K. and Wahlgreen K. 2013

are in a control room carrying out work that requires technical understanding and digital skills. Previously, an operator and a maintenance worker would be working in the mill and their work would be regarded as two separate job functions. In the automated milling industry, the functions mentioned are merging into a “use and maintain function”, a trend that is gaining a foothold in the food industry across the EU. Trained workers can give feedback to the mechanics about technical difficulties, but in this example, the issue is what does an operator of automated equipment need to look for before the line breaks down and how should such training be organized?<sup>55</sup>

Bonduelle Hungary (Appendix 4) has established an internal learning scheme of its own to ensure an appropriate level of professional and up-to-date knowledge amongst the workforce. In addition to the apprentice scheme, workers are trained by colleagues so as to ensure that there are skilled workers in the

## 6.2.2 Online training while at work

Automated production lines and machinery are fitted with digital systems that link the machines to internal systems of the company for data processing but are also linked to external parties such as providers of the machines. This is made possible by the internet and it also illustrates the training possibilities which are a consequence of Food Industry 4.0. Online training can be organized in connection with the installation of a new line or a new piece of equipment, for regular training and for support functions, as explained in the example from Sweden:

One of Sweden’s largest meat companies invested in a new piece of equipment for automatic sorting of meat. First of all, the equipment was demonstrated at the provider’s premises and workers were invited to test and to operate the equipment. Then the equipment was installed at the first plant and the solution provider went to Sweden, adjusted the equipment and trained the workers to use it. Once the machine was working well and the workers were confident, the solution provider installed the second piece of the same type of machine and trained the second team of workers. Now both machines are up and running and the workers are offered on-line support should they experience any problems with the machines.

The Hungarian company Bonafarm Zrt. (Appendix 4) has established a fundamental resource of professional knowledge on automation and digitalisation based on an innovative approach. The company builds on

production area and skilled electricians or mechanics in maintenance to attend to the automatic equipment and production lines. Maintenance work is organized as preventive maintenance and this system requires digitalisation skills. The operators will have a basic skills set to be used if there is no maintenance worker available on the shift. At present, two of the nine workers per factory have taken part in the internal education programme.

The examples provided demonstrate that acquiring knowledge is one aspect, but without sufficient experience, production – and maybe also worker safety – may be compromised. Only the combination of experience with appropriate skills can provide the necessary insights to ensure the correct execution of tasks. It is therefore obvious that the issue of how skills are passed on amongst colleagues needs to be high on the agenda to ensure the presence of an appropriately equipped workforce for Food Industry 4.0.

apprenticeships and side-by-side training of colleagues in order to ensure the provision of a skilled workforce for the group’s slaughterhouses and meat processing plants. Bonafarm organises regular re-training and leadership training for the workforce, thereby ensuring that team leaders on the shop floor are qualified. The Company’s internal trainings are continuously modified in order to ensure that the workforce operates within, and complies with, the Company’s internal digitalised reporting and traceability systems.

However, when implementing online training solutions, it is necessary to pay attention to the possible additional stress for the workers due to the requirement to attend training while performing daily job functions. The Social Partners play a role here in developing the training schemes of the future. There is a need for shorter training programmes condensed into a few days of training where SMEs can get information about actual, real problems from recognized experts.

<sup>55</sup> Seier M. 2019

## 6.3 ORGANISING TRAINING

### 6.3.1 Issues to take into account when organising training for Food Industry 4.0

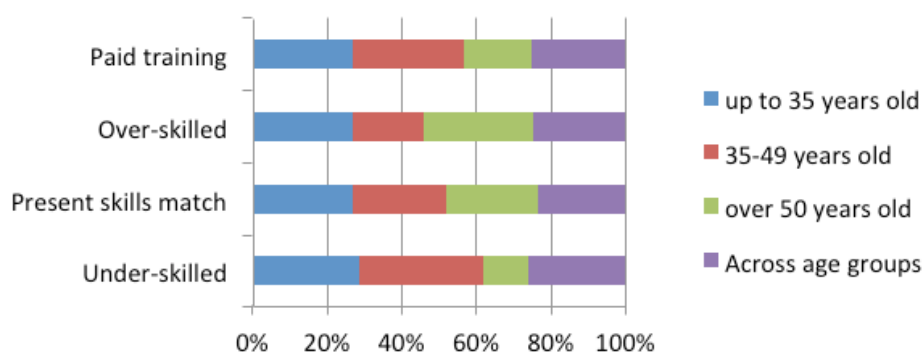
Equal opportunities are particularly relevant in the food sector. The sector employs people from many diverse backgrounds, countries and levels of education. The Eurofound survey showed that in 2014, only 15 % of the female workers in the agri-food industry received employer-paid training in contrast to 26% of the male workers<sup>56</sup>. While these opportunities may be relatively easy to offer in large companies, they are more complicated to implement in SMEs, where the resources and opportunities for personal development are more limited. Therefore, it is necessary to address the development of open or new structures that enable employees to gain adequate skills and facilitate the transition from one company to another.

To ensure improved opportunities for workers for personal development and as support for new employment opportunities, re- or upskilling should be provided in a vertical approach. In practice, this means undertaking efforts to build further upon an existing skills base. With this approach, the modernization of training would build on existing structures and facilities for education and training and up-to-date curricula and learning methods (e.g. online courses or life-long learning programmes). For the worker, the benefit of the vertical skills base is that a career path can be developed and at the same time diversified during working life. Here, it should be pointed out that workers today may have four or five jobs during their working life in contrast to the previous

generations where workers stayed in a company for nearly a lifetime<sup>57</sup>. Therefore, modernizing the system for acquiring skills for Food Industry 4.0 needs to take into account the career paths of the workforce.

A major challenge reported at the regional project workshops was the issue of paying for workers' training. **Figure 28** shows that workers under the age of 35 in the agri-food sector claimed to be under-skilled and a similar group at the same age claimed to be over-skilled - despite both groups having received employer-paid training. An even higher percentage of older workers claimed to be over-skilled. This points to an important issue: it is not sufficient to provide employer-paid training; the issue is to provide the right training (skills) and then find a solution to fund this training.

The project's research activities have shown that there is a need to address the organisation of training, including finding ways to fund training, as well as identifying topics for learning. An example from Italy demonstrates how three trade unions have established a fund to pay for the training of workers (in the food industry) to acquire skills for Food Industry 4.0 (Appendix 3). Unionlearn<sup>58</sup> is the learning and skills organisation of the Trade Union Congress in the UK. Unionlearn supports workers across industries to develop their skills. Unionlearn reports that every year more than 240,000 workers get help to progress their learning in areas ranging from English and maths to



**Figure 28: Employer-paid training and assessment of the matching of workers' skills, 2014**  
Source: Eurofound, 2014

<sup>56</sup> Eurofound, 2014

<sup>57</sup> Collison M., 2019

<sup>58</sup> www.unionlearn.org.uk

high level apprenticeships. The outcome of supporting workers to learn is significant. Workers with union support to learn are 2.7 times more likely to get a pay rise, 5.7 times more likely to gain a promotion and 80 per cent of the learners develop transferable skills. Unions embed this success by securing learning agreements with employers – which is very close to the ideals of a lifelong learning culture. Trade unions play a key role for finding ways to organise training

and to ensure that adequate training is offered. In Belgium, trade unions across sectors have joined forces to address the needs for the training of workers to meet the challenges of Industry 4.0 and the digital era of work (Appendix 3). This has resulted in a number of good practices regarding how to organise and attain new skills, with the key issue being collaboration involving many trade unions.

### 6.3.2 Other initiatives to promote learning about Industry 4.0

Companies may also need support to find the expertise needed to adapt to Food Industry 4.0 and this includes support measures for providing training to the workforce. For example, it has been made clear that, for Italian SMEs, not having the right skills base is regarded as the major obstacle for adapting to Industry 4.0 technologies. To meet the needs for training – not only in the food industry – the Italian government has developed the Impresa 4.0 plan (Appendix 3). This plan provides a framework of support measures for industry to facilitate the adaptation of Industry 4.0, including funds for training of the workforce.

Another approach has been taken in Hungary, where a joint initiative between government and university has led to the creation of the demonstration hub, Industry 4.0. In practice, this is a pilot-lab where companies can run pilot-tests and get an idea of what the technologies of Industry 4.0 can be used for (Appendix 3). In Germany, the Federal Ministry of Labour and Social Affairs wants to support and encourage

companies in setting up in-house Innovation Spaces (“*Experimentierraume*”) in order to test the potential of new ideas through an online platform. Companies are encouraged to share knowledge and experiences and to present innovation projects which are open for discussion – all with an overall aim of stimulating learning<sup>59</sup>.

Other initiatives to promote the adaptation to Industry 4.0 have been identified and examples are provided in the collection of facts. The central issues are that it is necessary to demonstrate how technologies work to convince industry (particularly SMEs) of the relevance of such technologies and training for the use of digital and automated systems needs to be formalised and properly funded.

Initiatives to raise awareness of adult learning have been implemented, e.g. campaigns in the form of multimedia advertisements and “adult learning weeks” are widespread in countries such as Denmark, Finland, Portugal and Slovenia.

# 7. WAYS TO SOCIALLY ROBUST ADAPTATION TO FOOD INDUSTRY 4.0

The report's findings relate to the work, skills, training, career paths and technologies in the context of food and drink manufacturing. In this chapter, the report's findings are grouped under three themes:

- 1) Securing employment and its diversity;
- 2) Sharing of the benefits of Food Industry 4.0 – a human centred approach;
- 3) Growing with technology – personally and technologically.

## 7.1 SECURING EMPLOYMENT AND ITS DIVERSITY

Workers in the food industry include people who have trained in this industry and gained vast experience, people who have attended vocational education and obtained a skills Certificate (e.g. apprentices) and workers who have entered the food industry with skills and careers rooted in other sectors. There is an established pattern of migrant workers moving primarily from East to West in Europe to find work in the food industry, with the main motivating factors being wages and working conditions. The workforce in the EU food industry includes people with different skills bases, nationalities, employment status and diverse levels of experience.

A general perception of people not familiar with the food processing industry is that a job in the food industry takes place in unpleasant working conditions, it is physically hard, it is monotonous work with limited flexibility and with few opportunities for building a career. Given these preconceptions, it is not surprising that young talents tend to favour a career in other sectors, such as computers or retailing. The technologies applied in Food Industry 4.0, combined with the specificities of the food industry, can be turned into a strong platform for attracting talents to the Food Industry 4.0 for an education, for work or for a career (change). Not only does automated manufacturing change the way work is carried out, but also the physical requirements of working in the food processing industry are changing. The need for hard physical work is being constantly reduced as machines and automated systems are installed. This is good for workers' health and safety and the working environment becomes appealing to a larger group.

A working environment where digital systems are used for gathering data can have an impact on the individual, since data may be linked to the worker's actions. This can cause workers stress and discussions about the monitoring of work and rights to privacy. The connected nature of Industry 4.0 means that there is a need for transparent working conditions where issues related to data security and personal

integrity are given due consideration.

The food industry provides employment to a highly diversified workforce, including people with a low level of education. There are many examples of SMEs and large companies that take on workers and provide them with training from day one. The training is focused on equipping the new colleague with the skills needed to perform a specific function, such as operating a machine. As the technology level of the processing operations increases, the workers' skills must be adapted to the present level of technology and the state of digitalisation. There is a gap between the skills set possessed by today's workforce and the skills required for food industry 4.0. This gap goes both ways: some workers are over-qualified for their present functions and many more need to acquire new skills. If the European food industry fails to address the challenge posed by the skills gap, it will lose competitiveness and market share in the global food market, triggering a negative spiral with vast consequences for production and work.

It is a well-known fact that when production is automated it becomes more efficient and this leads to improved competitiveness of the business and this is not limited to food manufacturing. Increased sales of products may be a consequence of better competitiveness and this requires bigger production and therefore a larger workforce. This is clearly illustrated in the report's case studies. However, there are also examples of the opposite situation in which automation leads to job losses. Since close to one third of the workers in the European food industry are not employed directly by a food company, appropriate and paid training assumes major importance. The Social Partners must join forces to identify how skills and the provision of skills can be incorporated into a socially robust adaptation of Food Industry 4.0.

The workers in today's food industry tend to have more than one career during their working life and younger generations are even more inclined to "shop

around” and change careers more often. Looking ahead, this could imply that the ageing workforce will remain the backbone of the food processing industry, whereas young talents will be moving on in their career. With the skills base provided by working in Food Industry 4.0, experienced workers are attractive

to hire in other process-oriented industries where digital systems and automated production are central elements. This calls for closer collaboration between the Social Partners to ensure that the food industry becomes a preferred career choice.

## 7.2 SHARING THE BENEFITS OF FOOD INDUSTRY 4.0 – A HUMAN CENTRED APPROACH

The food industry is the largest employer within European manufacturing, providing work to 4.7 million people and the majority of the companies are SMEs. The food industry includes large companies with big production facilities employing hundreds of people. This makes the food industry stand out due to its numbers, structures, products and its use of technology. Traditional knowledge, hand-made products and local conditions are features that add to the complexity and heterogeneous appearance of the European food and drinks industry. There is one common conclusion across the industry: **without a workforce there is no production**. Securing an adequate workforce is fundamental and requires the attention of both employers and workers.

This means that the Social Partners have a central role to play ensuring a **socially robust adaptation to Food Industry 4.0**, making sure that it is a process that is relevant and accepted by workers and employers, in which adequate and proper attention is given to the social and human aspect of adapting to digitalised and automated systems.

The areas of food production which are automated tend to be raw material handling, packing, quality control and warehousing in particular. Manual labour is centred around the tasks that require craftsmanship skills or work requiring physical activity, such as moving or collecting items. In the context of Industry 4.0, craftsmanship skills are turned into the essential knowledge and experience that is necessary to ensure that the production benefits from the digitalised and automated systems.

There are many views on the impact on employment of Industry 4.0. This project has shown that the impact of digitalisation is not uniform across companies or European regions. The local context is very important,

underlining the importance of social dialogue. Examples from project workshops have demonstrated that automation has led to the creation of many jobs and the subsequent challenges of recruiting enough workers. There are also many examples of workers losing their jobs after food companies have adapted Industry 4.0 technologies. The learnings are that whilst no clear impact on employment of Food Industry 4.0 can be predicted at an aggregated European level, there is a real need to turn the focus to the impact of local conditions.

**This is where the Social Partners share a joint responsibility for ensuring a transparent and socially robust adaptation of Industry 4.0 technologies in which social issues are at centre stage.**

Work in the food industry becomes lighter and safer when machines take over. For example, when robots are used for cutting carcasses, the meat worker is spared the heavy work and risks of injury from splitting the carcass – as long as due consideration is given to the working conditions and worker safety. Tasks such as monitoring and reporting production data or scanning of finished goods require less physically demanding working and can be undertaken by workers who have difficulties in coping with hard manual work. In this sense, automation can be an option for keeping an ageing workforce active and for the food industry to stand out as an attractive place to work at a later stage in a person’s career. Studies from Italy, Denmark, France and the United Kingdom<sup>60</sup> have concluded that the food industry will be short of several hundred thousand workers, especially appropriately skilled workers. In this perspective, there is work to be done to keep all workers active in the food industry and to provide present and future workers with the appropriate sets of skills.

The project has shown that a joint approach involving

both workers and employers is required to reap the full benefit of installing new technologies.. New technologies interact with existing factory lay-outs, work organisation, routines and skills. A transparent dialogue that emphasises the value of experience, the social impact and the identification of mutual benefits is considered a cornerstone for ensuring a good process of implementing new technologies.

During the project, trade unions have continuously pointed to the need for providing equal access to proper training facilities and for equipping the workforce with the appropriate skills. Employers have also acknowledged the challenges of recruiting a sufficient number of skilled workers. This clearly indicates that there is mutual agreement that proper skills are essential for the European food industry to thrive. The project workshops all highlighted the vital need to find ways to fund training. In those cases where the worker has an employment contract, training is paid by the employer. When the worker is hired as a tempo-

rary worker or is self-employed this situation may be different as it is not compulsory for the employer to pay for the training of these groups. Solutions for the provision of training have been suggested at project workshops: trade unions have proposed establishing funds for paying for workers' training (Italy), or collaborative approaches to ensure that both employers and trade unions have knowledge of the present and future skills base (France).

It is of utmost importance for the European food industry to reach out to attract workers and future talents to ensure a future workforce. Food Industry 4.0 could be the driving force to promote the food industry to a wider group of talents – both young and old. The digitalised food industry opens up new options for career paths that naturally link the food industry to other sectors, building on digitalised and automated processing. There is a need for a new approach to promoting the food industry.

## 7.3 GROWING WITH TECHNOLOGY – PERSONALLY AND TECHNOLOGICALLY

It is a fundamental principle that **technology is an enabler**, not a solution. This principle clearly states that technology cannot function on its own: human interaction and a context are both required. As technologies become increasingly advanced, it is obvious that the requirements for benefitting from digitalised and automated systems are increasing – for workers and for the company. For the provider of the technological solution, the increased complexity leads to demands for understanding how automated processing systems must be designed to become well integrated into existing factory lay-outs and working routines. Knowledge of production routines, work organisation and the workers' experience are essential factors to fully benefit from technology. For the implementation of new technology to get off to a good start, dialogue between workers, company and technology provider is fundamental. Social Partners play a key role in establishing and driving this dialogue and in ensuring that new workplaces and systems fit the people who use them.

Today, more than 31,000 robots have already been installed in the European food industry and more are expected. Medium-sized and large companies

in particular have taken the lead here, whilst many SMEs continue to have doubts about the opportunities created by adapting to Food Industry 4.0. An important learning that emerged in all the project's three regional workshops was that whilst **SMEs were interested** in adapting Industry 4.0 technologies, the idea of dealing with the **process of adaptation was more challenging**. To address this need, a number of initiatives have been launched across the EU, for example hubs to demonstrate technology, training programmes for SMEs, or trade union driven measures.

In many European countries, vocational education and training has not kept up with the requirement for skills for young talents and experienced workers. Digital technologies and training in the use of automated equipment must be included in modern curricula, as well as learning programmes ensuring that appropriate and industry-relevant manual, cognitive and soft skills are acquired. However, providing the student/apprentice with proper craftsmanship skills must not be compromised. It has become clear during the project that there is an urgent need for vocational education in Europe to improve the delivery of skills to meet

the requirements of the food companies and also to attract young people to these educational courses. The certification of the skills gained from vocational education needs to be a valid passport for building further skills at a later stage. This could help to promote a career path rooted in the food industry. The Social Partners and providers of vocational education must address the need to modernise education and training which is relevant to the food industry, particularly in the context of digitalised manufacturing.

A major challenge for vocational education and training (VET) is to identify the best ways for developing soft skills. It is a fact that work in the Food Industry 4.0 is turning towards process-thinking, project oriented tasks and work is organised teams. This shows how important it is to have workers with strong social skills, the ability to communicate and to interact with many different groups of workers in a company. The food industry is becoming more multi-cultural, making linguistic skills highly relevant for the workforce.

There is consensus among diverse stakeholders that future career paths should be based on a life-long learning approach, i.e. a new way of thinking about education and training. The idea is to have a certain set of skills (e.g. craftsmanship skills within baking) and continuously adapt this set of skills to the contemporary requirements. This could take the form of a “Skills Passport” that is continuously updated throughout the worker’s career. The Social Partners could promote this continuous learning approach.

Possessing digital skills is fundamental in today’s manufacturing environment, but the key question is about **having the right digital skills and being able to apply these skills in a job function**. From the project workshops it was clear that both young talents and experienced workers need to adapt their digital skills to the work in the food industry. Looking ahead, it is evident that as more technology is installed in food and drink factories, there is a greater need for digital skills, without forgetting about the need to understand the complexity of the digital and integrated production systems. This new skill of understanding complexity is closely linked to craftsmanship skills and this combination will become even more important in future manufacturing. Having the right digital skills in combination with other skills, e.g. craftsmanship skills or cognitive skills, is a valuable skill set for an employee, not only in food manufacturing, but also for employment in other industries. From this point of view, it is fair to state that technology contributes to widening opportunities.

Once new machinery or digital systems have been installed, there is a need to learn to operate such systems. The online environment makes it possible for the technology provider to train and guide the workers and to provide real-time support in case of machine breakdown. The online environment holds a number of new opportunities for increasing factory performance, but also for new ways of learning. For the online environment to become a successful tool for learning, it is essential that those who learn, i.e. the workers, have the necessary reading, language and digital communication skills and, most importantly, are motivated to learn.

Work will constantly change and adapt to the technologies applied. Automated manufacturing has an overarching impact on employment and work, whilst a digitalised working environment has an impact on the people carrying out the work. This leads to the final conclusion of the project:

**Food Industry 4.0 is the reality and to ensure a socially robust adaptation of digital and automated technologies, people must be put first. The Social Partners are the key players to pave the way for a successful and socially robust process.**

## 7.4 RECOMMENDED ACTIONS

The recommended actions for key stakeholder groups are provided in the following **Figures 29 to 31**. The recommendations are grouped into three Themes to reflect the main topics of the project. Some of the listed recommended actions are generic and apply to work

in general, whereas others are targeted specifically at the food industry. The intention is for the recommended actions to stimulate Social Dialogue and promote actions to ensure a socially robust adaptation of Industry 4.0 in food manufacturing.

**Figure 29: Recommended actions for Theme 1: Securing employment and its diversity**

### Theme 1: Securing employment and its diversity

Social Partners	<ul style="list-style-type: none"> <li>• Champion the Social Dialogue to promote the food industry as an attractive place to work;</li> <li>• Outline an ambitious training policy including workers' rights to training and paid education leave, with access to adequate training facilities;</li> <li>• Provide a Skills Guarantee Certificate for skills and competences of the low-skilled worker;</li> <li>• Provide gender-harmonized measures to close digital divides, especially for female workers;</li> <li>• Define proper work and job functions and include options for education;</li> <li>• Elaborate Skills Maps to clarify the match between skills and tasks and to ensure motivation for up/re-skilling;</li> <li>• Consider implementing a system for Personal Development Plans for workers;</li> <li>• Develop training programmes building on workers' present skills base;</li> <li>• Develop an approach for knowledge transfer between workers;</li> <li>• Develop an open culture to modern ways of learning;</li> <li>• Involve workers' representatives in discussions about social aspects;</li> <li>• Ensure that actions and policies are inclusive to also accommodate the needs of less educated workers;</li> <li>• Gender aspects need to be included in dialogue and policy making, particularly relevant for women and socially vulnerable workers;</li> <li>• Include Social Partners in the process of modernising education programmes targeted at the food and drink sector;</li> <li>• Creation of social funds that make training programmes accessible for all companies, including SMEs;</li> <li>• Joint approach to address the issue of "being online option" in respect of workers' right to being offline outside working hours</li> </ul>
Policy makers and government	<ul style="list-style-type: none"> <li>• Ensure young people are ready to work and that they have obtained basic literacy, numeracy, digital, linguistic and soft skills;</li> <li>• Develop contemporary curriculums for the vocational education facilities targeted at young talents and experienced workers;</li> <li>• Provide framework conditions allowing for modernisation of the way vocational training is organised and carried out;</li> <li>• Support and collaborate with food and drink companies with the aim of promoting the food and drink industry as a career path;</li> <li>• Set up recognised certification systems to value and recognise skills;</li> <li>• Outline upskilling and reskilling policies to forestall the obsolescence of the jobs and professions concerned;</li> <li>• Develop preventive health and safety policies (i.e. stress, burn-out etc.).</li> </ul>

## Theme 1: Securing employment and its diversity

Providers of education and training

- Modernise technical colleges and vocational education and training (VET) systems to accommodate skills for working in a digitalised and automated environment;
- Develop education targeted at young people entering into a food industry career and experienced workers in need of re-skilling and up-skilling;
- Develop contemporary education programmes that include craftsmanship skills and digital skills;
- Develop contemporary education programmes that include craftsmanship skills and digital skills, soft skills, language and basic literary and numeracy skills;
- Modernise apprenticeship programmes in collaboration with food and drink industry representatives and trade unions to ensure the relevance of the education, the inclusion of advanced and evolving manufacturing techniques and for making a food and drink industry apprenticeship attractive for starting a career;
- Apprenticeship programmes should include forms of dual learning (work-study programmes), whilst developing the VET system towards generalist occupations instead of narrow, specialist occupations;
- Include ways to develop soft skills in curricula;
- Consider new ways to organise training by linking up with technology providers, food companies, educators and other stakeholders.

Providers of digital and automated solutions

- Collaborate with Social Partners to develop a system for capturing of skills (skills mapping platform) and job functions;
- Make sure that the systems and production equipment are user-friendly and motivating for the workers and allow for off-time;
- Include workers' experience when designing automatic production equipment to ensure sound working conditions;
- Develop production systems that meet requirements of a heterogeneous group of people that have to work together in teams;
- Collaborate with the Social Partners to ensure a proper and involving process for implementing digitalised and automated production systems, including instructions, training and support for re-organising work flows.

**Figure 30: Recommended actions for Theme 2: Sharing the benefits of Industry 4.0 – a human centred approach**

## Theme 2: Sharing benefits of Industry 4.0

Social Partners	<ul style="list-style-type: none"> <li>• Champion the Social Dialogue to ensure that workers are in the centre of the adaptation of Food Industry 4.0;</li> <li>• Promote policies that redistribute the value of digital ownership. In this context, collective bargaining rights are important;</li> <li>• Promote transparency and involvement in decisions about implementation of digitalised and automated systems (reasons, costs, benefits and risk);</li> <li>• Robust risk assessment and management systems to ensure that digital processes and automated systems are safe, fast and reliable; ergonomics and a human factors approach play a key role;</li> <li>• Involve workers' representatives to improve working conditions, reduce hazardous and dangerous work and for organising work in the context of Food Industry 4.0;</li> <li>• Build further on the technological options for creating jobs for socially vulnerable people (e.g. ageing workers);</li> <li>• Continue the Social Dialogue to ensure transparent working conditions in an automated working environment aiming for a Working Time Charter;</li> <li>• Further develop a joint approach (employees and employers) to the worker's right to privacy and human dignity through collective negotiation (discussions on use of cameras and digital surveillance in the workplace),</li> <li>• Further develop a joint approach (employers and employees) to generally implementing digital or automated systems;</li> <li>• Collaborate to develop jobs and tasks that ensure worker's motivation, options for personal development and best application of skills;</li> <li>• Update job descriptions and take the new skills, responsibilities and ways of working into account and adjust remuneration of workers.</li> </ul>
Policy makers and government	<ul style="list-style-type: none"> <li>• Provide public funds for promoting the adaptation of Food Industry 4.0, including funds for training of workers;</li> <li>• Provide funding for improving the quality of statistics about work and economics related to automated manufacturing and by industry;</li> <li>• Involve national (employment) agencies in order to support SMEs in the re-skilling and up-skilling of workers;</li> <li>• Include the right and access to training, paid education leave and the workers' right to disconnect in national legislation;</li> <li>• Reinforcing of the European Globalisation Adjustment Fund in the event that jobs are lost as a result of adapting to Food Industry 4.0;</li> <li>• Provide forums or platforms to promote knowledge exchange and collaboration among stakeholders in Food Industry 4.0.</li> </ul>
Providers of education and training	<ul style="list-style-type: none"> <li>• Develop new ways of learning, including on-line training courses for food and drink industry workers (so training can take place during working hours);</li> <li>• Maintain training programmes that provide the craftsmanship skills and traditional courses offered to workers in the food and drink industry;</li> <li>• Develop education programmes and courses that aim at building generic skills rather than specialist skills.</li> </ul>
Providers of digital and automated solutions	<ul style="list-style-type: none"> <li>• Collaborate with the Social Partners to promote a proper process towards implementation of automated systems;</li> <li>• Include workers' knowledge and experience when designing production equipment.</li> </ul>

**Figure 31: Recommended actions for Theme 2: Sharing the benefits of Industry 4.0 – a human centred approach**

## Theme 3: Growing with technology Personally and technologically

Social Partners	<ul style="list-style-type: none"> <li>• Champion the Social Dialogue to promote the Food Industry 4.0 with a view to career paths, recruitment and proper working conditions;</li> <li>• Use collective bargaining as a tool to shape the digital transformation of work;</li> <li>• Equip the workforce with skills enabling them to carry out their duties in a digitalised environment;</li> <li>• Develop a learning culture that includes the use of digital interactions;</li> <li>• Involve workers’ representatives in the planning of new skills to be acquired in order to reduce worker’s stress from demands for learning;</li> <li>• Collaborate with providers of Industry 4.0 solutions to explore the opportunities and challenges for using cloud computing with a view to learning how such technologies can contribute to improve working conditions;</li> <li>• Promote knowledge sharing across companies to increase the understanding of the benefits and challenges from accessing Industry 4.0 solutions;</li> <li>• Train supervisors and managers in the use of digital tools and support their teams.</li> </ul>
Policy makers and government	<ul style="list-style-type: none"> <li>• Promote the use of digital systems for learning in schools, VET facilities and at the work place;</li> <li>• Safeguard social dialogue and collective bargaining rights, including the right to information and consultation for workers’ representatives;</li> <li>• Provide support for developing a system or platform that encourages knowledge sharing among businesses (particularly SMEs and small-scale companies) on how to approach Industry 4.0;</li> <li>• Establish a pilot-scale Industry 4.0 food processing facility to discuss and promote the understanding of modern technologies for product development, value chains, company performance and working conditions;</li> <li>• Clear legal framework for data security;</li> <li>• Practical data privacy;</li> <li>• More investments in research and skill building for the food and drink industry.</li> </ul>
Providers of education and training	<ul style="list-style-type: none"> <li>• Promote the inclusive use of digital systems and automated manufacturing equipment in food and drink industry education and training programmes;</li> <li>• Develop, in collaboration with the Social Partners, learning programmes targeted at up-skilling of present workers in a short-term and mid-term view;</li> <li>• Collaborate with the Social Partners on implementing a life-long-learning approach in the food and drink industry</li> <li>• Collaborate with providers of automated systems and digitalised solutions for keeping educations up to technological standards;</li> <li>• Consider the development of Food Industry 4.0 Apprenticeship system in collaboration with the Social Partners, to include measures that allow for adding further education to an “apprentice degree”.</li> </ul>
Providers of digital and automated solutions	<ul style="list-style-type: none"> <li>• Collaborate with providers of education and training to include digital systems and automated equipment in educations targeted at the food and drink industry;</li> <li>• Collaborate with Social Partners to encourage knowledge sharing (across countries or sectors) about best practices for implementing Industry 4.0.</li> </ul>

# APPENDIX 1

## LIST OF REFERENCES

- ALP (Association of Labour Providers), (2019)** – *ALF Food Supply Chain Labour Survey Results*
- Bitkom (2019)** – *Erhöhung 4.0 – Status Quo, Chancen und Herausforderungen*. Presentation by B. Rohleder (Bitkom Research) and C. Minhoff, (BVE), Berlin, March 26, 2019
- Campden BRI (2018)** – *Trends in robotics and digitalisation with link to professions, skills and career paths*
- Carucci M. (2019)** – “*Federmeccanica. Ecco come cambia il lavoratore nell’industria 4.0*”, *Avvenire*, 12/07/2019.
- CEMEET (2018)** – *Digitalisation and the world of work*
- Cereal Docks (2019)** – *From commodity to ingredients, from feeding to nourishing, from stabilization to flexibility*, presentation at project workshop in Bologna, 2019
- Collison & Associates Limited (2018)** – *Effects of technology on the food chain in the UK & Europe*
- Collison & Associates Limited (2019)** – *Short Supply Chains: what does this mean for food manufacturing; how can skills & technology support it*
- Collison M. (2019)** – *Using automation & digitalisation to create higher quality jobs in the food chain*, presentation at project workshops
- Collison M. (2018)** – *SKIN project Challenge Paper*, developed for the Technologies Innovation Challenge Workshop, SKIN Short Food Chain Innovation Project
- CSB System AG (2018)** – *Digitalisation in the food and beverage industry: promising or challenging?*
- Dalla Rosa M. (2019)** – *Digitalisation in the Italian Food Industry: new skills and training*, Presentation at the project regional workshop in Bologna workshop, June 2019
- Desseyn J. (2019)** – *Scope Food Industry Flanders, Impact of digitalisation on skills needs*. MPIRIS, presentation at the project’s workshop in Copenhagen, February 5, 2019
- Education & Training 2020** – *Survey on policies and practices of digital and online learning in Europe* - Prepared on behalf of the European Commission by Danish Technological Institute
- Eurofound (2014)** – *Agro-Food Sector – Working Conditions and Job Quality*; Eurofound Working Conditions Survey
- European Agency for Safety and Health at Work (2018)** – *Foresight on new and emerging occupational safety and health risks associated with digitalisation by 2025*
- European Commission (2018)** – *Digital transformation scoreboard 2018 - EU businesses go digital: Opportunities, outcomes and uptake*
- European Economic and Social Committee (2018)** – *Overview of the national strategies on work 4.0: a coherent analysis of the role of the social partners*
- European Parliament (2018)** – *Education in the digital era: challenges, opportunities and lessons for EU policy design*
- European Parliament (2018)** – *Report on a comprehensive European industrial policy on artificial intelligence and robotics*
- Eurostat** – *Community Innovation Survey, 2014*, as reported in *FoodDrinkEurope, Data & Trends 2017*
- European Trade Union Confederation (2018)** – *Collective voice in the platform economy: challenges, opportunities, solutions*
- Federalimentare (2018)** – *Nuove competenze per coniugare tradizione ed innovazione nell’industria alimentare*, presentation given at CNEL, Rome, June 6, 2018

**Federation of Hungarian Food Industries (2019)** – *Modernisation strategy of the Hungarian food industry through Industry 4.0 and digitalisation* – compiled by Digitalisation Work Group of the Federation of Hungarian Food Industries

**Fondimpresa (2017)** – *Formazione e competenze per l'industria 4.0 nell'agroalimentare* - Report di monitoraggio 2016/2017 and Elaboration of data reported in Fondimpresa (2017) - *Formazione e competenze per l'industria 4.0 nell'agroalimentare* - Report di monitoraggio 2016/2017

**Food and Drink Federation (2016)** – *Unlocking talent – the key to driving food and drink productivity*

**FoodDrinkEurope (2018)** – *Data & Trends 2018*

**FoodDrinkEurope (2019)** – *Data & Trends 2019*

**Forbes (2018)** – *What is Industry 4.0 – Here's a super-easy explanation for anyone*, <https://www.forbes.com/sites/bernardmarr/2018/09/02/what-is-industry-4-0-heres-a-super-easy-explanation-for-anyone/#105750709788> (Sept. 2, 2018)

**Frey, C. B. & M. Osborne (2013)** – *The future of employment: how susceptible are jobs to computerisation?*

**Grant Thornton (2017)** – *FD Economic contribution and growth opportunities*

**Hamann K., Gentile M. and Zelenák L. (2019)** – *Summary paper from the project workshop*, Copenhagen, February 5-6, 2019

**Hamann K. and Wahlgren K (2013)** – *A new approach to vocational education – the case of Industrial Slaughterer*

**Hamza E., Racs K, Szabó D, Tóth O.M and Varga E. (2018)** – *Challenges of labour supply in agri-food sector in Hungary*, Results of the Hungarian Agricultural Labour Market Barometer Survey, presentation at the 13th European IFSA Symposium, 1-5 July 2018, Chania (Greece)

**Hegyí A., Sebök A. (2018)** – *Challenge Paper of New Professions and Career Paths in the Food & Drink Industry: Delivering high level Food Industry Skills in the Digital Economy Workshop*, Budapest, Hungary (25-26 October 2018)

**Hungarian Ministry for Innovation and Technology (2018)** – *Upskill your downhills, the future of education and training in the context of digitalisation*

**ING (2019)** – *Food Tech: technology in the food industry*

**Il Sole 24 Ore** – *The food industry will need 43 thousand employees in five years*, 17 July 2019

**Jensen P. B. (2019)** – *Automation & digitalisation in the Danish food & drink industry*, Danish Food and Drink Federation, presentation at the project's workshop in Copenhagen, February 5, 2019

**Kagermann H, Wahlster W, Helbig J.** – *Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0.*; 2013

**Korsberg L. (2019)** – *Presentation about digitalisation in Danish Crown*, project workshop in Copenhagen

**Lagerberg T. (2019)** – *Presentation about future trends in digital and automated technologies* – insights from ABB, project workshop in Copenhagen, February 6, 2019

**Les Observatoires de secteur Alimentaire (2019)** – *Les impacts du numérique sur les métiers de secteur alimentaire*

**LRF and Job Center Sweden (2018)** – *Demand for staffs and competencies in the food sector 2018*

**Maier J. (2017)** – *Made Smarter Review* (Siemens UK)

**Matthes B., Dauth W, Dengler K, Gartner H and Zika G. (2019)** – *IAB Stellungnahme: Digitalisierung der Arbeitswelt – Bisherige Veränderungen und Folgen für Arbeitsmarkt, Ausbildung and Qualifizierung*, <http://doku.iab.de/stellungnahme/2019/sn1119.pdf>

**ManuFUTURE – EU High-Level Group (2018)** – *ManuFUTURE Vision 2030 - A Competitive, Sustainable and Resilient European Manufacturing*. [http://rm-platform.com/images/DOCUMENTS/ManuFUTURE\\_Vision-2030\\_VC\\_30\\_05\\_2018.pdf](http://rm-platform.com/images/DOCUMENTS/ManuFUTURE_Vision-2030_VC_30_05_2018.pdf)

**McKinsey Global Institute (2017)** – *A future that works: automation, employment, and productivity*

**McKinsey Global Institute (2018)** – *Skill shift: automation and the future of the workforce*

**McKinsey Global Institute (2018)** – *Solving the United Kingdom's productivity puzzle in a digital age*

**NESTA (2018)** – *In the Future of Skills: Employment in 2030*

**Nomisma (2017)** – *La propensione dell'alimentare italiano all'adozione delle tecnologie di Industria 4.0*, presentation

given in Rome, April 6, 2017

**OECD (2016)** – *The risk of automation for jobs in OECD countries: a comparative analysis*

**OECD (2019)** – *Skills Strategy Flanders*

**Pedersen M.L. and Jensen P. B. (2018)** – *Fewer skilled workers is challenging for the Danish food industry*, DI Analysis, September 2018

**Poutanen K, Nordlund E, Paasi J, Vehmas K, Lkerman M.** – *Food Economy 4.0 - VTT's vision of an era of smart consumer-centric food production*; 2017.

**R U Robots Limited (2018)** – *Trends in robotics related to food production*

**Report of the high level expert group (2019)** – *The impact of digital transformation on EU labour markets*

**Seier M. (2019)** – *Digitalisation and advanced manufacturing in Lantmännen Unibake*, presentation at the project workshop in Copenhagen, February 6, 2019

**SETCA (2019)** – *The new ways of working and the union practice*

**Sorensen M.C. (2019)** – *Building skills with the workforce in Arla Foods*, presentation at EFFAT Bio economy workshop in Copenhagen

**Vesentini I. (2018)** – *“Così a Bologna la fabbrica «è entrata» in un campus internazionale”*, Il Sole 24 Ore, 29/08/2018

**World Economic Forum (2016)** – *The Fourth Industrial Revolution: what it means, how to respond*

**World Economic Forum (2016)** – *The future of jobs, employment, skills and workforce strategy for the fourth industrial revolution*

**World Economic Forum (2018)** – *The future of jobs report*

# APPENDIX 2

## METHODOLOGY

### **ANALYTICAL APPROACH**

The project has been carried out as a qualitative analysis including some quantitative aspects. The project has applied an explorative approach in its research activities. Throughout the project, priority has been given to making sure that data gathering and the presentation of results have been undertaken with a balanced approach to ensure that both employers' and workers' views have been heard.

The aim of the project is to provide answers to the following questions:

- In what way could Food and Drink Industry 4.0 be explained?
- Which sectors of the food and drink industry have implemented automated and digitalised technologies?
- In which part(s) of the production chain are automated and digitalized technologies implemented?
- What are the enabling factors for use of Industry 4.0 technologies in the food and drink industry?
- What have been the challenges and opportunities following the implementation of Industry 4.0 technologies in the food and drink industry in terms of employment, skills, professions and career paths?
- Which measures could be implemented to ensure a socially more robust adaptation to Food and Drink Industry 4.0?
- In what way could education and training be organized to accommodate the need for delivering skills for Food and Drink Industry 4.0 – for young talents and experienced workers?
- Which actions could be recommended to the Social Partners and other stakeholder groups to ensure a socially more robust adaptation to Food and Drink Industry 4.0?

### **ACTIVITIES IN THE PROJECT**

The project is based on a mapping exercise, a series of regional workshops and consultations with the project's Steering Group and stakeholders. The mapping exercise was designed to gather literature about

Industry 4.0, the European food and drink industry, automation and digitalisation in the food industry, work and employment and skills. Relevant literature included government reports, statistics, industry reports and trade magazines and information retrieved from the internet, for example articles, newsletters or company presentations. Data has been gathered at a multitude of levels: at EU and Member State levels, the food industry and its subsectors and for work and skills. Previous project initiatives carried out by the Social Partners and relevant EU funded projects about automation and digitalisation in the food and drink industry have been consulted so as to build upon existing knowledge. The mapping exercises led to findings about digitalisation in the food and drink industry, expected development patterns for skills requirements and identified a range of challenges and opportunities related to digitalisation and automation, with a special emphasis on how this may impact work.

To obtain more detailed insights and identify good practices for a socially more robust adaptation to Industry 4.0 technologies, a series of three regional workshops has been organized: Central and East Europe (Budapest, October 25-26, 2018), North-West Europe (Copenhagen, February 5-6, 2019) and Mediterranean Europe (Bologna, June 3-4, 2019). The participants at the workshops included the Social Partners at EU level, representatives of the social partners in the regional workshop host countries and invited key note speakers. Overall, more than 20 key note speakers gave presentations at the project's workshops, representing trade unions, food and drink companies, government, education, technology providers and organisations and consultants. An average of 30 participants attended each workshop. A key purpose of the workshops was to provide a forum for discussions to achieve a balanced understanding of the challenges and opportunities for work, skills and career paths in Food and Drink Industry 4.0. Following the presentations given by key note speakers such as trade unions, companies and organisations, the forum discussed the challenges and opportunities related to Food Industry 4.0.

In order to cover all the aspects defined in the research outline for the project, each of the three workshops was designed to focus on a specific theme. This has been reflected in the selection of key note speakers and the Challenge Paper, **Figure 32**.

### **LIMITATIONS OF THE DATA SET**

Statistics about Food Industry 4.0 is almost non-existent, so the statistical data refer to food manufacturing. Due to the lack of sufficiently detailed and relevant statistics, it has not been an aim of the project to calculate economic benefits for companies or workers. Work in general is moving towards the platform economy with its novel recruiting and working agreements. This also affects the food industry. In this Closing Report, some of the recommendations made are relevant for general work in the platform economy and such recommendations must be adapted to the food industry context.

**Figure 32: Themes of the three Regional Workshops**

Workshop	Theme of Challenge Paper and presentations
Budapest	Defining Food and Drink Industry 4.0 – a starting point for the discussions about Industry 4.0 and skills
Copenhagen	Partnerships and learning for the future – a starting point for the discussions about how to learn in Industry 4.0
Bologna	Compiling skills and requirements for learning – a starting point for the discussion of how to include skills, training and Industry 4.0 in the social dialogue

# APPENDIX 3

## SELECTION OF FACT SHEETS

- Les Observatoires du secteur Alimentaire (France)
- The i4.0 Platform (Hungary)
- Impresa 4.0 National Plan (Italy)
- Vocational education for the red meat industry (Denmark)
- Sample Factory (Hungary)
- New ways of working – Pedagogical guide (Belgium)
- Italian trade unions establish training fund (Italy)

## Fact sheet no. 1:

# Les Observatoires du secteur Alimentaire (France)

The Observatoires du secteur Alimentaire is an observatory created in January 2014. It is the result of cooperation between the food industry association, the trade unions and training institutes (VET). The observatory covers the agro-food industries and food retailing. In total, the observatory covers 27 trade associations, 48 employer federations and 16 trade unions, which jointly represent 720,000 employees and 80,000 enterprises. The overall aim of Les Observatoires du secteur Alimentaire is to facilitate the transition to Industry 4.0 in food production and retailing and the acquisition of the skills needed. In addition, the observatory enhances and supports the diversity and mobility of the workforce. It is a joint platform (web-based tool), focusing on all aspects of workforce/career planning, jobs and tasks, skills and career development. It enables both employers and employees to gain insights into the present situation, as well as the future developments of the entire chain in the areas of recruitment, needed skills and possibilities of training and cross-sectoral pathways. The content of the website is structured in order to provide the possibility to:

- **OBSERVE**, since it provides regular statistics on the enterprises and jobs and their development in all three sectors.
- **UNDERSTAND**, since it provides studies on the prospects of the professions, qualifications and jobs within the entire food-chain, using a common language and thus enhancing cross-sectoral understanding and cooperation.
- **ACT** by using the insights to provide information and to contribute to making the professions and jobs attractive on a local level and by creating partnerships.

### **ABOUT THE SPECIAL SKILLS-JOB TOOL-KIT**

The website features a special tool-kit, the “skills-job tool”. The tool helps employers to manage their human resources through descriptions of jobs and the organisation of activities, recruitment, job interviews and identification of training needs. Employees also

have the possibility to study the detailed descriptions of skills and to plan their career and training accordingly. All production jobs are listed, including jobs in maintenance and logistics. The tool-kit consists of a comprehensive, systematic cross-sectoral mapping of the seven principal professional areas within the entire chain (production, maintenance, logistics, innovation, quality and hygiene, safety, environment, sales and support) and the job functions within each area, i.e. production manager and process analyst. Detailed descriptions of the skills and qualifications needed for each job function are provided, as well as suggested pathways to cross-sectoral career shifts.

The website also features an electronic library with information on events, studies, videos and guidelines. For example, videos show the impact of digitalisation on the food sectors. For the employers, there are guidelines on how to implement changes and how to motivate employees to make use of the training possibilities.

For the employees, there are instructive videos on the impact of digitalisation and automation. The statistics, as well as the studies, can also serve the trade unions and help them to assess the changes and plan for the future of their members.

[www.observatoires-alimentaire.fr](http://www.observatoires-alimentaire.fr)

## Fact sheet no. 2:

# Working Group on Employment, Education and Training and the National i4.0 Technology Platform Association (Hungary)

The Industry 4.0 National Technology Platform Association was established in May 2016 under the leadership of the Institute for Computer Science and Control (SZTAKI), Hungarian Academy of Sciences, with the participation of research institutions, companies, universities and professional organisations with premises in Hungary, and with the full support of the Government of Hungary, specifically that of the then Ministry of National Economy. Today, it is operated as a legal entity of an association under the umbrella of the Ministry of Innovation and Technology.

The Hungarian Industry 4.0 National Technological Platform Association operates several Working Groups in order to fulfil its mission defined in its Organisational and Operational Regulations. The Working Groups focus on specific issues related to I4.0 and they formulate responses and recommendations to the challenges presented by companies and other bodies.

Currently the Platform has 6 Working Groups:

- Strategic Planning
- Employment, Education and Training
- Production, Logistics and Cyber-physical Pilot systems
- ICT technologies and safety
- Innovation and Business model
- Legal and Regulatory aspects

The main task of the Employment, Education and Training Working Group is to address all educational aspects of I4.0. This includes determining the highest priority working preconditions and implications for its practical implementation. It is expected that there will be a fundamental impact on the employment and labour market from adapting the I4.0 technologies and change will be significant: the technical environment of physical work, the organisation and control of production, the dominant concepts of corporate business economics, all these aspects will require more attention to social aspects, including demography, workforce mobility and approach to the related social issues. These changes require a completely new strategic thinking and tools to be applied from all actors representing government, industry and research.

The members of the Employment, Education and Training Working Group are representatives of the Hungarian government, universities, ICT/robotics solutions provider companies, independent expert organisations, leading IT and electronics companies, etc.

<https://www.i4oplatform.hu/en>

## Fact sheet no. 3: “Impresa 4.0” National Plan (Italy)

“Impresa 4.0” is a National Plan aimed at supporting Italian companies that are willing to embrace the opportunities offered by Industry 4.0. The Plan covers every step of the life cycle of companies that want to improve their competitiveness through the support of their investments, the promotion of digitalisation of industrial processes, improvements in workers’ productivity, as well as the development of new skills, new products and new processes.

Due to the dominance of traditional methods of production in the Italian food industry, digital innovation is still moving more slowly in this sector compared to others. The key to adapting to Industry 4.0 in the food industry could be to use digitalisation in a way that connects technology and automation with tradition. The main investments associated with Impresa 4.0 for the food industry are currently related to the implementation of systems for the protection of company data and for food traceability purposes. Impresa 4.0 aims at pushing firms toward technological innovation and digital culture through financial incentives and through awareness-raising of the importance of innovation. One of the aims of the plan is, in fact, to deal with the threats that might affect workers in the digitalised food industry, not least of all the envisaged shift in the requirement for workers’ skills. The intention is to manage this shift through investments in schools, universities and research - aimed at innovating study curricula to train students in new digital skills - and Impresa 4.0. Tax credits for “training 4.0” programmes for firms that give their professional workers the possibility to participate in specialized training designed to acquire and/or consolidate the knowledge of the technologies present in the Impresa 4.0 plan (big data, data analysis, cloud, fog computing, cyber security, cyber-physical systems, augmented reality, advanced robotics, added manufacturing, internet of things and of machines and digital integration of processes).

The system of Higher Education Technical Institutes is also due to be strengthened, thereby entrusting them with a higher technological specialisation, introducing technicians in strategic sectors of the

economic and productive system, developing methods for innovation and tech transfer to SMEs, prioritising a teaching methodology based on practical experience.

Since employment will increase in the countries which are able to invest in digital skills and decrease in those where such skills are not adequately acquired by the labour force, Impresa 4.0 aims at managing the risk of technological unemployment and at maximising new employment opportunities generated by the Fourth Industrial Revolution, by developing new digital skills. In this context, the “Training 4.0” initiative represents a practical tool to protect and reinforce employment, through a 40% tax credit on the labour costs of workers taking part in training courses in Impresa 4.0 topics.

Training is mainly planned to be done through the “*technological transfer centres*”, i.e. certified bodies or companies which provide training and technological consultation activities, supporting the technological transfer to companies in the operational areas defined by the Ministry of economic development (e.g. additive manufacturing, augmented reality, internet of things, cloud, cybersecurity, big data analysis, e-commerce, digital payments and online traceability). To be classified as “*technological transfer centres*”, such entities must be certified by officially accredited national certification bodies.

## Fact sheet no. 4:

# Vocational Education and Training for Industrial Slaughter (Denmark)

The Meat Trade College (part of the Zealand Business College) in Denmark offers vocational education and training (VET programmes) for several positions targeted at the meat sector: Industrial Slaughterer and related fields of specialization, Retail butcher, Sausage maker and Cook.

The vocational education to become Industrial Slaughterer is very practically oriented and provides the apprentices with hands-on experience during the schooling. Training and education is also provided in English. The Meat Trade College has full scale education and training facilities: training slaughterhouse and de-boning facilities, meat processing facilities for sausage production and for smoked and cured products and food shop.

The full-scale training facilities for slaughtering, deboning, cutting and meat production fulfil all veterinarian and hygienic requirements stipulated by the EU. The teachers of the vocational training have a background from industry or technical backgrounds supplemented by pedagogical education.

The training for Industrial Slaughterer takes two years and six months and is organized as an apprenticeship. The apprentice signs a contract with a company in the Danish meat industry. The company will provide the salary for the apprentice who, in return, works and trains in different departments of the company. Training in the company includes operating automated equipment and using digitalised systems. At the Meat Trade College, the apprentice is provided with theoretical skills and vocational training. Apprentices will obtain solid trade-related skills, including insights and practical experience in working with technologies and robots and understanding of the production processes taking place in a meat company.

After two years and six months, apprentices may choose to specialize as an Industrial Slaughterer (pork); Industrial Slaughterer (beef); Industrial Slaughterer (meat processing). In 2015, 36 apprentices completed the training for Industrial Slaughterer after two years and six months of education, and 16 completed

the additional training for Industrial Slaughterer (specializing in pork). The specialization takes an extra twelve months.

[www.zbc.dk](http://www.zbc.dk)

## Fact sheet no. 5:

# Industry 4.0 Sample Factory Programme (Hungary)

The Hungarian Industry 4.0 Sample Factory flagship programme provides know-how for micro, small and medium-sized manufacturing companies (SMEs) to become familiar with industry 4.0 technologies, their applicability and thus enhance their competitiveness. The GINOP 1.1.3-16 Sample Factory Project is implemented by the IFKA (Industrial Development Nonprofit Ltd.) and IVSZ (The ICT Association of Hungary) consortium. Programme duration: June 2017 - December 2019.

The goal of the programme is to support the automation and digitalisation development efforts of enterprises, increase their openness towards industry 4.0 technologies and help them to join the fourth industrial revolution in line with their level of development, through the transfer of practical and theoretical knowledge.

The free programme - education and industry 4.0 background survey - provides key practical experiences and knowledge (industry 4.0 production and technology basics) to SMEs in the convergence region. The aim of the programme is to place the companies in a position to use the resources from structural and other funds to prepare their own modernization and to compensate for the labour shortage and therefore increase their competitiveness by reducing operating costs, increasing productivity and minimizing passive production times.

Hungarian micro, small and medium-sized enterprises (SMEs) can participate in the programmes, on the condition that they are active in the manufacturing industry and have their headquarters or location outside the Central Hungarian region. Domestic manufacturing SMEs operating in the non-convergence region may also register for the programme but may only participate in the demonstrations and events outside the developer programme (e.g. Night of Modern Factories, Industry 4.0 Roadshow, download professional materials and latest news/events of Industry 4.0 on the website, subscribe to Industry 4.0 newsletter, etc.).

The benefits for food companies include experts who provide company-specific practical advice to SMEs. Participants will have the opportunity to visit a variety of Model Factories and one Technology Centre, where they get to know the latest technologies and gain practical knowledge. In the final phase of the programme, SMEs will be awarded a silver or gold medal, depending on their performance.

The silver grade is awarded to all SMEs participating in the training (up to 350 SMEs) who prepare the simple development plan (A3 size) with the help of mentors. Gaining a gold grade (up to 50 SMEs) is the greatest benefit of participation, since this means that a delegated industry 4.0 consultant conducts a complete implementation study after assessing four priority areas: production management, automation, logistics and maintenance.

The benefit for employees: participation in lean methods training (located at Roto, Eltec, Continental and Festo), production practices training and company management training, as well as and participation in workshops located in Industry 4.0 Technology Centres.

[www.ipar4.hu](http://www.ipar4.hu)

## Fact Sheet no. 6:

### Pedagogical guide to new ways to work (Belgium)

*New ways of working and trade unions practices* – a pedagogical guide is a booklet published by the Belgian trade union SETCa in 2016. The booklet is unique because it makes concrete recommendations to trade unionists on how to deal with the implications of the new ways of working as a result of the introduction of Industry 4.0 and the platform economy. The intention of the booklet is to give tangible support to develop the trade unionism of the 21st century that reflects the huge changes in the food sector, as well as all other sectors, brought about by digitalisation and automatization. In the booklet, SETCa also addresses the issue that the majority of the staff and representatives turned out to have limited knowledge of the implications of the new ways of working.

The booklet addresses the difficulties that trade unions are faced with because new ways of working make it hard to define the common ground and policies, as well as to organise and mobilize members, since the very sense of togetherness is diminishing. In the booklet, the recommendations to address these challenges are set out by describing a four-step procedure.

- The first step is defined as “preparations” and one recommendation is to develop “network-trade unionism” in which the trade union takes into consideration the needs and demands of all the workers/employees and not just a specific group.
- The second step is “negotiations” and recommendations include proposals to use new ways of communication to keep members informed and to demand a test-period in order to ensure that a process works before it is fully implemented.
- The third step is “implementation” and recommendations include proposals to ensure equality amongst the workers/employees, since experience shows that pilot-groups might obtain special advantages.
- The fourth step is “long-term” and two of the recommendations refer to follow-up actions in the form of small surveys evaluating the implications of the implementation of new technologies and the use of the new technologies themselves to monitor the results.

The booklet is the result of an academic study of the social and economic impacts of new ways of working and was published simultaneously with a report on the study. 53 % of the participants believe that the new ways of working cause problems related to injustice and 93 % are in favour of the right to disconnect (and be offline). SETCa is Belgium’s oldest trade union for employees, technicians and managerial staff and has 21 regional sections. It is composed of several sectors, including industries, commerce, finance and logistics.

Formally, the study was requested by the Wallonia Minister of Economy and it was conducted by LENTIC (l’Innovation et le Changement) at the Management School at Liège University, in close cooperation with SETCa. In the study, the researchers at LENTIC have taken into consideration their findings in literature on new ways of working from a number of EU countries. The methods of the study and the way the booklet is structured make it possible for trade unions in other EU countries to benefit from both the insights and the recommendations.

[www.setca.org](http://www.setca.org)

## Fact Sheet no. 7:

# Trade unions join forces to establish funds for financing the training of food workers (Italy)

In Italy, Law no. 388/2000 establishes the existence of joint funds, providing the possibility of continuous professional training for employees. According to this law, a company can decide to set aside 0.3% of the social security contributions to be allocated to the National Social Welfare Institution (INPS) to finance training activities for its employees. Currently, there are 22 joint funds in Italy, involving 900,000 companies, which employ more than 10 million workers. Approximately 4,460,000 of these workers are members of Fondimpresa, which therefore manages around half of the resources allocated to the joint funds. Fondimpresa is an inter-professional fund for continuous training, jointly created by the labour unions, CGIL, CISL and UIL and the Confederation of Italian Industry (Confindustria). The fund includes more than 185,000 companies, 98.5% of which are SMEs. The companies which join Fondimpresa have access to different financing channels and there are three tools available to support the funding of training:

- **Training account (conto formazione):** This is an individual account for each participating firm, in which 70% or 80% of the resources of the 0.3% allocated to INPS are pooled and can be autonomously managed by the company. In this case, the company is free to choose who is going to provide the training (either internal or external to the company).
- **System account (conto di Sistema):** This tool collects the residual share of the 0.3% which is not allocated to the Training account and is used to finance calls for tenders for training programmes. These calls, which focus on a particular topic (e.g. environmental sustainability, technological innovation, competitiveness), are published periodically; companies usually participate in groups, with one project leader. This tool is specifically designed to help smaller enterprises.
- **Notices with additional contributions (avvisi con contributo aggiuntivo):** If a company does not have enough resources in its Training account to implement a training plan, Fondimpresa allows it to combine the resources available in the Training and in the System accounts and adds

an additional contribution to this (up to a fixed amount), thereby making it possible to achieve the objectives set out in the training plan.

The Fondimpresa training fund has demonstrated the capacity to provide skills that are also relevant for the up-skilling of workers in food industry 4.0. Between 2016 and 2017, Fondimpresa provided 6.5 million EUR of funding to 14 training plans, involving 750 food companies in 16 Italian regions, for a total of 26,030 hours of courses to the benefit of 4,264 workers in the food industry.

[www.fondimpresa.it](http://www.fondimpresa.it)

# APPENDIX 4

## SELECTION OF CASE STUDIES

- Bonduelle (Hungary)
- Bonafarm (Hungary)
- Lantmannen Unibake (Denmark)
- Amadori (Italy)
- Bük/Nestlé (Hungary)
- Danish Crown (Denmark)
- Patfrut (Italy)
- Pizzoli (Italy)

## Case study no. 1

# Bonduelle Ltd. – Experiences from the implementation of automated sorting systems (Hungary)

Bonduelle Ltd. is one of the leading food processing companies in Hungary. The company was established in 1853 by a French family and has been present in Hungary for more than 20 years, employing 1,000 people in Nagyköros, Békéscsaba and Nyírszőlős. The plants produce processed vegetables for the Hungarian market and also for export. The proportion of employees with higher education is about 10%, the proportion of skilled workers is about 30% and the proportion of semi-skilled workers is about 60%. However, although this cannot be expressed as a percentage, it is estimated that - with new technology and automation - two thirds of the semi-skilled workers can be employed in other work processes, which can help to compensate for the shortage of labour.

The company recruits its workforce from primary schools, secondary schools and universities which are involved in continuous education. To attract new talents, Bonduelle Ltd. coordinates career guidance programmes in the framework of modern plant visits organised jointly with representatives of primary schools, secondary schools and universities. Dual education is regularly organized in cooperation with universities to prepare people for the challenges of the modern food industry. In order to maintain a sufficient workforce there are regular re-trainings and leadership trainings in the framework of talent care programmes.

The company has established a common source of professional knowledge through the apprentice education programmes, which involves working alongside qualified and experienced colleagues, thereby ensuring the presence of skilled workers in production and skilled electricians or mechanics in maintenance (in core activities of automatic equipment handling and preventive maintenance). Today, 2 out of 9 workers have already taken part in the education programme. The management has implemented automation, robotics and ICT enabled technologies in areas which previously required monotonous physical work, for example in the areas of material dosing, supervision of product heat treatment, product filling into cans/ jars and palletizing.

Automation has provided increased opportunities, notably with regard to employment, skills, professions and career paths. There is now a requirement for higher proficiency in machine management and the number of skilled workers in the production area and maintenance has increased, making it possible for employees to do more quality work in a better-rated position.

Automation has helped to use the workforce more effectively. New job functions - with mutual benefits for workers and the company – have emerged in the field of automatic equipment handling and preventive maintenance, making it possible to reach dynamic production levels and flow optimization during the parallel production of different product types.

[www.bonduelle.com](http://www.bonduelle.com)

## Case study no. 2

# Bonafarm Ltd. – Experiences from the implementation of automated sorting systems (Hungary)

Bonafarm Ltd. is the management company of the Bonafarm Group. As an equal partner of the member companies, it encourages cooperation through consultation, emphasizing innovation, ensuring quality raw materials and effective operation. Pick Szeged Co., a meat processing company that belongs to the group, produces its branded products using selected basic ingredients. The majority of the raw material (pork) is supplied by the high-quality pork producers Bóly Co., Dalmand Co. and Fiorács Ltd., as well as the pig breeding farms operating within the integrated systems.

Number of employees: over 8,000 in total. Out of this number, the proportion of employees with higher education is about 30%, the proportion of skilled workers is about 50% and the proportion of semi-skilled workers is about 20%. It is expected that with the introduction of the new technology, the proportion of semi-skilled workers will be around 5-10% in 10 years. To attract new talents, representatives of the Bonafarm Group regularly visit primary schools, secondary schools and universities to promote awareness raising programmes. Furthermore, continuous education takes place at technical colleges and universities. In order to maintain a sufficient workforce there are regular re-training and leadership training programmes.

The Bonafarm Group's main products are meat and milk, where the level of integration is the highest. There is substantial integration and automation in these areas, covering digitalised procurement, warehouse material handling, barcode reader systems and automatic production lines in order to achieve higher efficiency.

Automation leads to higher proficiency in data collection, data reliability, low error rate, planning, dynamic production, high transparency and machine management and helps to use the workforce more effectively. New job functions have been created in the field of fully automated measurement, data flow management, analysing and reporting. However, there are regular re-training and leadership training programmes for the current workforce, despite many members of the workforce emigrating to the west in order to earn more money.

The aim of Bonafarm Zrt. is to enhance the integration of employees within a supportive, professional community and establish a common base of professional knowledge (such as IT, marketing, HR, procurement). There is regular cooperation with educational facilities, including primary schools, secondary schools and universities which are involved in continuous education. There are unique research and development projects with Kaposvár University and visits are organized regularly for student groups from secondary and high schools in order to show them modern production facilities in slaughterhouses and meat processing plants. The company's internal training is continuously modified in order to meet the consumers' expectations of the modern food industry. The most important task is to recruit and retain professionals for the new jobs which are performed in the framework of a coordinated and controlled system, from arable crop production to food processing. The company has established a common source of professional knowledge on automation and digitalisation through apprentice education programmes, which include working alongside qualified and experienced colleagues, thereby ensuring the presence of workers with an increased skill level in the slaughterhouses and meat processing plants, where automation has been implemented in areas requiring the handling and lifting of heavy carcasses.

[www.bonafarmcsoport.hu](http://www.bonafarmcsoport.hu)

## Case study no. 3

# LANTMÄNNEN UNIBAKE – Developing Business Platform 2.0 across factories in many countries (Denmark)

Lantmännen Unibake is the second largest bakery company in Europa and is part of the leading international cereals group Lantmännen, owned by 27,000 Swedish farmers. Lantmännen Unibake operates 36 modern bakeries around the world, with a turnover of 1.1 billion EUR. Lantmännen Unibake employs 6,000 people across 20 countries.

As a producer of baked goods, it is important for Lantmännen Unibake to employ skilled workers, including bakers. Skilled labour is recognized for understanding the process of baking, having a feeling of the dough and a sense of working with flour and yeast. These skills are needed to ensure that automatic production lines produce baked goods and bread of a high and uniform quality.

Lantmännen Unibake is currently implementing a new Business Platform 2.0 (BP2.0) in all countries. It is a standardization project for all critical business procedures and also includes an ERP system implementation. The BP 2.0 is enabling the development of internal standards across all the bakeries. The BP 2.0 will connect the automated production lines with the company's ERP system and, in this way, will link shop floor workers with the other departments and plants in the group. The aim is to eliminate "pen and paper" as the new system is based on hand-held devices, scanners, computers, and shared data sets. In this way, real-time data about production and flow of goods is collected and can be used to optimize and control production. All goods are scanned with an ID identifying the goods from production to finished product. But the ID can only be traced back to the team that has produced the goods, not directly to the worker "who pushed the button".

To benefit from the BP 2.0, it is essential that the workers be closely involved in the process of implementing the system and that those manning the work stations on the shop floor are workers who easily adapt to technology. The workers are provided with training by the company to learn about the new BP 2.0. As the BP 2.0 is an internal, albeit international, platform applied across the company, key super-users

are also offered the possibility to go to bakeries in other countries to learn more about how the BP 2.0 functions in a connected system. For example, workers from Poland have visited a bakery in Finland and the UK to learn. Besides training the workers in using the new BP 2.0 platform, Lantmännen Unibake provides internal training to the workers. The latter involves rotating the workers to carry out different functions. Lantmännen Unibake believes that multi-skilled workers are the best workforce because tasks in production are becoming more complex.

A central element in the training programme is to build cognitive skills, such as systematic problem solving by the workers, so that the workers are equipped with skills to think and act proactively. In this way, workers can solve problems on the shop floor by themselves and without slowing down the production flow. English is the corporate language of Lantmännen Unibake and the BP 2.0 will, by default, be set-up in English. It is the experience of the company that workers are willing to learn English if they use the language as part of their job, for example for the purpose of quality control or internal reporting.

[www.lantmannen-unibake.com](http://www.lantmannen-unibake.com)

## Case study no. 4

# Digitalised systems for innovation and new factory-layout for better working conditions in the poultry industry – the case of Amadori (Italy)

Amadori is an Italian company operating in the poultry sector. Founded in 1969 in the Emilia Romagna region, it is now one of the major players in the Italian agro-food sector. To date, the company's supply chain is composed of: 6 feed mills, 6 incubators, 6 processing plants, 19 distribution points throughout Italy, 3 primary logistic platforms (Cesena, Teramo and Santa Sofia) and more than 800 breeding farms. The company employs more than 7,800 workers and by 2018 Amadori's turnover had reached 1,255 million EUR.

Amadori has created its own Corporate Academy for the development of key skills by employees. The Amadori Academy works on innovative projects which involve different worker groups inside the company and the training it provides is based on new technologies. Some of the training activities provided targets the building of social skills, digital skills, English training and technical training within quality, food safety and working environment. The continued efforts of the company to promote better and safer work stations has led to an almost 50% reduction in work accidents over the last 15 years. Together with the Bologna Business School, Amadori organises a training programme for young graduates, who are trained with the aim of being hired by the company.

The company has recently implemented a comprehensive digitalisation project across its factories. The system includes an ERP program (Enterprise Resource Planning) and PLM programme (Product Lifecycle Management). The reason for the investments was to remain competitive on the market and to improve product innovation management. Before the implementation of the PLM system, the management of recipes was fragmented, whereas they are now integrated in a single: once the recipe has been created on the PLM, the staff involved in product development have to validate the recipe and then send it to the ERP system for it to be introduced in the factories. The same process is also used to manage labelling and to control in-going goods for the production process.

In 2017, Amadori invested 45 million EUR to build a new plant for poultry processing, the so called "cutting

room" near Milan. The plant covers 1.4 hectares and it is organised on two floors. The plant is for the cutting and packing of poultry; it will be equipped with automated technologies and is designed to process 25 tonnes of meat per hour. The plant has a modern approach in terms of process design and factory layout. The 18 production lines are designed to always be interconnected. Big Data are generated in "real-time", thus providing information for the continuous improvement of the production and interaction with the supply chain.

Working conditions were an integrated element in the design of the new factory, leading to better daily conditions for the more than 450 workers employed: Amadori cooperated with the Politecnico (Technical School) of Milan in order to improve the ergonomics of the work stations, to increase the space between production lines to improve the temperature and sanitary conditions and last, but not least, make the plant particularly quiet.

[www.amadori.it](http://www.amadori.it)

## Case study no. 5

### Bük factory (Hungary)

The Bük factory in Hungary is one of Nestlé's most advanced and automated plants of its 418 factories worldwide. The factory in Bük produces pet food under the brand Purina. The Bük plant has a strong focus on quality and safety, especially worker safety. The introduction of automation was motivated by business, a safer working environment and product quality. Competition in the industry is a key driver for automation, since loss of competitiveness means loss of individual jobs. Factory management has removed the non-LEAN and non-safe parts of the production. The factory is experiencing challenges in terms of recruiting a sufficient number of workers, even within a radius of 100-150 km. The Bük factory runs 24/7. Market demand has led to the need to increase production capacity and so Nestlé decided to invest in automated technologies for production.

Workers' experience was used to improve line efficiency and to find solutions to make the transition from a semi-automated to a fully automated production environment. Investments led to the creation of more than 50 new jobs at the plant. The job functions in production changed from workers "being present on the line" to becoming operators adding value to operations. The new automated lines have been designed in collaboration with the workers. The Bük plant has added multiple automated packaging lines and more jobs have been created on the packaging line following the new investments. Automation has led to improved worker safety and less repetitive work and, as a consequence, there have been no accidents in the factory for more than 800 days. The team is continuously striving to achieve a new safety record.

Digital data are used to improve transparency and traceability and tablets are used on the shop floor instead of paper solutions. Workers' learning and problem-solving is integrated in the control panels of the new machines and lines. Internal engineers have developed the virtual training software for the education of the workers. Automated lines take away the work functions that do not add value for workers and for the business. An e-learning curriculum was provided when the equipment arrived at the factory,

making it possible to train workers via e-learning in a timely manner, so that they are able to intervene should the machine break down. When buying equipment, Nestlé ensures that the equipment is low risk equipment for the sake of worker safety and ergonomic considerations.

According to Nestlé's best practice, the adaptation of automation requires strong team efforts. Machinery suppliers provide 80 % of the technology and solutions and the customer (Nestlé) provides the remaining 20% to ensure a customized solution to meet with the needs of the specific plant lay-out and organisation of work in long-term cooperation with trade unions.

[www.purina.com](http://www.purina.com)

## Case study no. 6

### Danish Crown – Having workers’/employees’ education high on the agenda (Denmark)

Danish Crown is a farmer-owned cooperative with production facilities in Denmark, Sweden, Germany, Poland, UK and other countries. The company is the largest exporter of pork in the world and the largest pork producer in the EU. In 2018, the turnover stood at 8.2 billion EUR and the company employed 28,000 people.

It is estimated that in the future, approximately 80% of all lines will be automated to a high degree and some lines may be fully automated. The next steps to be taken relate to a more consistent use of Big Data and installing more co-bots in packing sections. A major challenge regarding new technology will be to make it fit with existing factory lay-outs and technologies. Due to the major implications of installing new technologies, the organisation of work will continuously change and in order to adapt to this constant change it will be essential for Danish Crown to utilize and further develop the employees’ knowledge and competencies within digital systems and automated equipment. Furthermore, strong social and communication skills will be increasingly important for employees, since the average workforce of a meat factory often consists of many nationalities.

Only 5% of the employees at Danish Crown factories are skilled industrial slaughterers. However, the craftsmanship skills acquired from training as an apprentice in the pork industry are highly valued and in demand in the automated factory. The craftsmanship skills and specific knowledge about the meat and working procedures are fundamental ensure the production of a good product and quality understanding and for making the most of both existing and new technologies.

Having a workforce with up-to-date skills is central to Danish Crown, as the company believes that opportunities for building skills and investing in people are attractive parameters for recruiting new workers to the company, not only in Denmark. To emphasize the importance of education, Danish Crown has introduced Education Ambassadors in each factory in Denmark. These people are workers who highlight the importance of building skills and encourage col-

leagues to take part in education initiatives.

In recent decades, the jobs and tasks in the meat industry have changed a lot and basic skills, such as Danish, mathematics, IT, digital competencies, as well as sustainable manufacturing, will have a much stronger focus in Danish Crown going forward. English is now the corporate language. This is proving to be a challenge for Danish employees. Overall, workers must have literacy and numeracy skills and be able to communicate in English before the company can tap into the digital industry. It is the experience of the company that building digital skills amongst the workforce needs to be an integrated element in everyday tasks if workers are to be fully prepared to adapt to digital manufacturing.

[www.danishcrown.dk](http://www.danishcrown.dk)

## Case study no. 7

# The impact of investments in automation on work and training – the case of Patfrut (Italy)

Patfrut is an Italian cooperative established in 2009 in the Emilia Romagna region. Patfrut has three production plants and the company's activities range from growing crops to the marketing of produce, including the management of 10 warehouses for collecting crops from growers. Patfrut's turnover was 92 million EUR in 2018.

The company has a permanent staff of 50-60 people and approximately 25 of them are factory workers who perform the technical tasks that are required throughout the year (e.g. mechanical maintenance technicians and refrigerator technicians). In addition, Patfrut employs nearly 500 temporary workers in the harvest season. The educational level of the older workers corresponds to a lower level of formal education, while the majority of young employees have attained a high school degree. Experience is not considered to be a compulsory requirement for applying for a job in the plant in Patfrut: the work can be learned efficiently in a relatively short time through coaching by experienced workers. For workers with more responsibility, basic digital skills are required. Work is organised in groups, so social skills are needed by all workers, including the temporary workforce.

In 2018, Patfrut invested 2 million EUR in a new production line equipped with a digitalised sorting system. The new system allowed product differentiation by making it possible for the workers to include more batches (different types of produce) on the same sorting and packing line. Another advantage of the new line has been the improved technology used for sorting fruits: while the previous line could only calibrate the products by measuring their weight and size, the new line can make a first qualitative sorting (i.e. dividing products in first class, second class and waste) thanks to the optical system for assessing each piece of fruit. The optical sorting is then further refined by operators. One of the results of the investment is a higher through-put. The workers required to manage and maintain the new line are skilled as machine operators and mechanicals. With the new line, the number of machine operators has increased

from one to two in order to facilitate the adaptation process within the company.

The machine was purchased in the Netherlands and the assembly, assistance and monitoring were carried out by the seller, who also provided training to Patfrut's employees to facilitate their adaptation to the new system. Once the new line was installed, an introductory 2-week course was organised to allow machine operators to use and programme the new line correctly. The support of the solution provider was essential in filling the initial technological skills gap of the workers operating in the plant.

Patfrut focusses its training efforts on the employees (30-45 years old) who have worked in the company for some time, know the production processes and are (probably) motivated to stay within the company in the medium-term. The company experiences a relatively high turnover of employees, especially among young people (i.e. people in their first job) and this is mainly attributable to the working conditions (e.g. shift work, often at short notice and sometimes on Saturday).

[www.patfrut.com](http://www.patfrut.com)

## Case study no. 8

# Computer-controlled new logistics plant leads to better working conditions at major potato processing company – the case of Pizzoli (Italy)

Pizzoli is an Italian company established in 1926 in Budrio (Bologna). It is engaged in the cultivation, processing and commercialisation of fresh and frozen potatoes and it is the largest operator in the potato sector in Italy, where it is the leader in both fresh potatoes and in frozen French fries. Pizzoli employs more than 300 workers and it is based in three locations: Budrio, Baricella and San Pietro in Casale, which are all located in the province of Bologna. The company's turnover in 2018 was 81 million EUR.

In 2017, Pizzoli invested 15 million EUR to establish a new, highly automated logistics plant in San Pietro in Casale (Bologna). The plant is the first step towards the creation of an entirely new digitalised production site, which is estimated to increase the production of frozen products from the current 35,000 tonnes to 100,000 tonnes per year, with a forecasted total investment of 50 million EUR. The ultimate aim of the new production site is to consolidate the company's activities in this location (i.e. production of frozen and fresh products, storage and logistics).

The logistics plant is centred around a fully automated refrigerating room, which is able to manage 9,200 pallets (for around 5,000 tonnes of potatoes) at a temperature of -28 degrees. Pizzoli worked with Swisslog to implement the new project, with the main aim of creating a storage facility where all production and handling activities could be carried out under an automatically controlled temperature. The main purpose of using automated solutions for the new plant was to reduce the space required for all operations in order to decrease the amount of air to be cooled down to -28 degrees. This will increase the speed, precision and efficiency of the system.

The new plant has contributed to improving the working conditions of employees, allowing them to work only in environments with temperatures above 0 degrees.

[www.pizzoli.it](http://www.pizzoli.it)



EFFAT is the European Federation of Food, Agriculture and Tourism Trade Unions, also representing domestic workers. As a European Trade Union Federation representing 120 national trade unions from 35 European countries, EFFAT defends the interests of more than 22 million workers towards the European Institutions, European employers' associations and transnational companies. EFFAT is a member of the ETUC and the European regional organisation of the IUF.



FoodDrinkEurope is the representative body for Europe's food and drink industry- the largest manufacturing sector in the EU in terms of turnover, employment and value added.

It brings together 25 national food and drink federations, including 1 observer, 27 European sector associations and 22 major food and drink companies.



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