Chapter

AUTO 4.0: Anticipation of Skills for Employees Due to Digitalization - Identification of "Occupational Profiles"

Georg Spoettl

Abstract

Europeanization is a politically supported process which includes mobility of the labor force, high-service quality, fast use of modern technology, and a chance of interaction of companies and other stakeholders. The economic activities of companies are worldwide and global—the world as a global village. The new world is change-driven, and radical developments for businesses based on the use of high-technology and data are supported by countries and companies. It is expected that with the help of Industry 4.0 the business processes will be more efficient and productive. "Globalization is the thread that ties nations together, with innovation around technology imperatively affecting trading activities" (Kalio). One of the main questions is about the impact of training on the development process of Industry 4.0 and all its implications. This question is in the focus of this paper dealing with Industry 4.0 in the automobile industry in European countries.

Keywords: AUTO 4.0, skills, occupational profiles, digitalization, industry 4.0

1. Introduction

Europeanization is a politically supported process which includes mobility of the labor force, high-service quality, fast use of modern technology, and a chance of interaction of companies and other stakeholders. The economic activities of companies are worldwide and global—the world as a global village. The new world is change-driven, and radical developments for businesses based on the use of high technology and data are supported by countries and companies. It is expected that with the help of Industry 4.0[1] the business processes will be more efficient and productive. "Globalization is the thread that ties nations together, with innovation around technology imperatively affecting trading activities" ([1], 167). One of the main questions is about the impact of training on the development process of

[1] Industry 4.0 is the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems (CPS), the Internet of things (IoT), and cloud computing. The term is mainly used for manufacturing processes in different sectors. For the description of the overall changes in societies, the term "4th Industrial Revolution" is in use, and for the concrete changes in different business fields, the term "digital transformation" is applied.

Industry 4.0 and all its implications. This question is in the focus of this paper dealing with Industry 4.0 in the automobile industry in European countries.

2. Dimensions of change through digitalization

There still is an ongoing discussion of the impact of digitalization[2]. A very common statement: "For the majority of workers and employees, the immediate effects of Digitalization are probably not visible yet" ([2], 86). Besides there are convincing indicators regarding the progress of digitalization with the economy (cf. ibid). More and more companies are running their business with the help of digitalization, among them, Microsoft, Apple, Facebook, Uber, and others. Even small and medium-sized companies are increasingly relying on digital technology. An example: In the city of Hamburg, around 92,000 companies are registered. Ninety percent of these companies apply digital equipment to optimize the business and work processes (cf. [3], 14). An empirical study shows this movement. In order to assess the diffusion depth of "Industry 4.0" and thus its presence in companies of the metal and electrical industry, including the automotive industry, the authors of the bayme vbm Study ([4], p. 56) have developed an instrument for the assessment of the diffusion of technology and work organization. The former encompasses seven technology dimensions such as sensor technology/actuating elements (networking CPS), networking (entire value-added chain), radio technology (communication), Big Data (data analysis), cloud computing (date storage, data speed), workplace intelligence CPS (share of man and technology) up to data safety (data sovereignty). Within expert workshops, each of these dimensions was assessed by experts with a view to the diffusion depth of "Industry 4.0" in companies. The result (cf. **Figure 1**) is the midpoint value of all experts. Thus a reference system was created which allows for a clear-cut characterization of the development steps towards "Industry 4.0" related to the dimensions of technology. The result presented in **Figure 1** indicates the implementation depth of "Industry 4.0's" technology as assessed by the experts.

Figure 1 also indicates that sensor technology and actuating elements have reached the highest markedness. This means that the communication of the CPS via

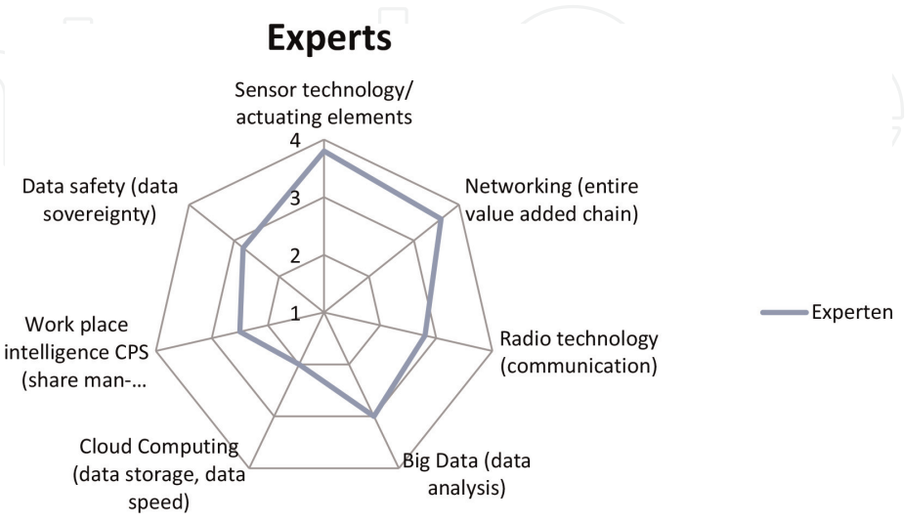

Figure 1.
Diffusion steps of technologies—Assessment by experts (source: [5]).

[2] The term can be understood as the technological issue of Industry 4.0.

digital communication devices has already been networked within the value-added chain and that this is highly relevant for the level of skilled work. A minor rating—markedness level 2—was assigned to the dimension of cloud computing. Data storage has so far mostly been taken care of by the companies themselves and still has a considerable potential for development. Both radio technology and workplace intelligence were also low-rated. The reason for the low rating of workplace intelligence could lie in the fact that it is just being implemented at an early stage. Data safety is an issue linked to a lot of trust which can apparently not yet be guaranteed (cf. [5]).

The target of digitalization/Industry 4.0[3] is to make business processes more efficient and productive. However, an adoption of Industry 4.0 will result in rapid change of the job tasks triggered by automation. There will be a deep impact on lower-skilled jobs. This transformation will require a significant change of the workforce's skills, organizational structures, leadership mechanisms, and corporate culture ([6], 137).

According to Schwab [7], ubiquitous mobile supercomputing, intelligent robots, self-driving cars, neuro-technological brain enhancement, and genetic editing are evidence for a global dramatic change taking place at exponential speed (cf. [1], 169). Schwab's statement: "We are at the beginning of a revolution that is fundamentally changing the way we live, work and relate to one another" [7]. He expects that all disciplines in economies and industry and the quality of life will be confronted with these changes.

3. Impact of industry 4.0/digitalization on vocational education

Looking at industry 4.0 and globalization, it is hard to say that organizations are ready to adapt to the big change of the future, knowing that they bag a heavy load of challenges with respect to technological, social, and ethical advancement.

Marr [8] emphasized the need to upgrade skills at the workplace and we must learn to understand and collaborate with the intelligence of machines at our disposal.

The changes in the world of work have a deep impact on the training needs. Three categories are the core of these changes:

1. Technology

2. Work organization

3. Social and ethical dimensions

They form the transformation of the workplace. An organization of the future is one in which employees will no longer be able to rely on simple skill training or facts of discipline, but development as an integral part of the job will necessitate on-the-job-training and retraining up with the demands (cf. [1], 170). In this context work-based learning and the use of virtual technology, simulation, digital media, and others become more and more important. Learning from the future is taking a different dimension. The integration of learning, work requirements, virtual

[3] In the article the term "Industry 4.0" will be used with high priority because of the production sector of the automobile industry as a subject of survey.

technology, and different methods of learning will become more important. Workplaces require highly skilled workers for a broader[4] and technology-driven organization:

"Industry 4.0 can rightfully be referred to as a production paradigm, since we have on the one hand intelligent factories and on the other hand production and logistics processes which are globally interconnected over the internet. This enables a flow of materials which can be optimized and interconnected to a degree so far unknown.

Due to digitalization and enrichment with information, work- and business processes, web-based and mobile as well as services based on intelligent analyses of large data bases are becoming more and more important and they achieve a remarkable impact on the design of high-tech work environments and hence on the workplaces involved.

This kind of technological development has definitely to be addressed as a long-term strategical project, which intends to create intelligent closed processes in production, the neighboring fields as well as finally within the entire value-added chain of production. This calls for innovative concepts of interaction between man and machines in order to direct work processes in the future [9].

Industry 4.0 is creating a vacuum of knowledge and capabilities for the employees, especially for those within the challenging environment in companies with a higher diffusion of digitalization technologies.

In order to find convincing answers for the qualification of the workforce on shop floor level in the context of Industry 4.0, it is crucial to clarify the need for qualification for the skilled workforce in the companies.

4. Identification of "occupational profiles" for industry 4.0

Vocational education and training (VET) has high priority due to the manifold requirements of industry. The VET priorities of the European Commission (cf. [10]) are highly relevant because of Industry 4.0:

- The aim is to provide workers with continuing training programs for upgrading of their skills and in order to respond quickly to emerging needs.

The new guidelines (cf. [11]-381) require:

- To build resilience through the development of key skills and higher and complex skills
- To focus on the skills needed by full and complete digitalization of industry and services
- To strengthen enterprises, VET providers, and partnerships

In Project AUTO[5] these statements were in the center of activities.

[4] This includes social and ethical dimensions.

[5] It is an ERASMUS Project with the title: AUTO 4.0—Understanding and Achieving Automotive Training Outcomes 4.0 - *Erasmus + Programme 2017-1-IT01-KA202-006187.*

4.1 The target group and requirements

One of the core objectives in the first period of the project AUTO 4.0 (Understanding and Achieving Automotive Training Outcomes 4.0) with partners from Italy, Spain, Great Britain, and Germany was the identification of "qualification profiles" and/or "occupational profiles" for workforce in the automobile production. This objective was linked to the question of the kind of methodological approaches that should be applied in order to achieve insights and results. With regard to the participating partnership, this question was not marginal. The situation of the partners and thus the access to the automobile industry—the topic the project concentrated on—were as follows:

- Partners from Italy: Access above all to component manufacturers
- Partners from Spain: Access to car manufacturers and component manufacturers
- Partners from Great Britain: Access to a network of manufacturers in the automobile sector
- Partners from Germany: Access to car manufacturers and component manufacturers

In order to answer the central questions of the project, the project consortium agreed on a common empirical approach (see below). The target was to identify occupational profiles (or other solutions) as an answer to the changes within the fourth industrial revolution. It was defined that the holder of competences – based on occupations or other solutions – are able to master the relevant tasks of his/her field of activities, that he/she can contribute to a high quality of the product and that he/she is especially creative. Thus it contradicts the general opinion of occupations and professionals of the trade. In order to safeguard this development, it is necessary to keep ordinances—i.e. the control mechanisms for a vocational education—up to date.

4.2 Method for the determination of qualification profiles

In order to ensure that all partners concentrated their activities on the identification of skills and occupational profiles of comparable fields, it was agreed that the surveys of component manufacturers (preference on first tier suppliers—the so-called system suppliers) and car manufacturers should be given priority. Within the survey, instruments were applied—such as case studies in well-selected companies and expert discussions—to ensure a deep insight into the changes in companies due to the use of Industry 4.0-driven technology.

Two categories of guiding questions were developed for the surveys. Guiding questions were necessary because the surveys concentrated on expert conversations. On the other hand, the guiding questions were important for the conversations with different target groups in the companies.

The guiding questions for expert discussions were aiming at managers and experts of Industry 4.0.

In each partner country, five managers and five experts were interviewed. The discussions were strongly focused on the impact of Industry 4.0 on the companies and on how the employees were qualified for these new challenges. The results of these interviews were applied to identify the need for qualification.

As for the case studies, separate guiding questions were developed to interview the following target groups in companies:

- Human Resources Directors (HR Directors and experts of Industry 4.0 implementation)
- Recruitment experts
- Skilled workers
- Experts for training.

An example of the guiding questions for experts and HR Directors is attached in Annex I.

Each partner country planned case studies in the following kinds of companies:

- Car manufacturers (1 case)
- System suppliers (first tier) (1 case)
- Suppliers on a lower level (1 case)

With the aid of the case studies, the developments in the selected companies could be thoroughly opened up. The focus was above all on the technological and work-organizational changes that have taken place in the companies. In addition, the surveys revealed the measures taken by the companies to qualify their staff for the new requirements. All partners conducted expert interviews (in total 25). As for the case studies, however, some gaps remained.

The findings of these surveys formed the basis for the design of qualificational profiles.

4.3 Results of the survey phase

4.3.1 Identification of competence profiles

A form which was used by all partners for the documentation of the identified competence profiles was developed in order to facilitate the agreed documentation process and the results of the empirical surveys as requirement profiles across all countries. Apart from this, it was possible to develop supplementing documents.

The “qualification” or “competence profiles” developed with the uniform format helped to document the requirements in employment fields which are intensively permeated by Industry 4.0 and call for competences so far not necessary for employees.

Competences were generated from the requirements for the employees and formed the basis for the description of competence profiles and/or occupational profiles.

Thus a total of 19 occupational profiles were identified which are playing a role in the surveyed companies and which are initiated by the development of Industry 4.0.

The topics of the 19 profiles are concisely shown in **Figure 2**.

The following profiles were developed in the individual partner countries:

	Qualification Profiles	Countries			
		ES	DE	IT	UK
1	Design Project Leader	(L5/6)			
2	Maintenance Team Leader	(L4/5)			
3	Quality Technician	(L5)			
4	Production Supervisor / Shift Supervisor	(L5/6)			
5	Mechatronic Expert	(L4)			
1	Data an Process Management		(L5/6)		
2	IT Systems and Networks		(L5/6)		
3	Trouble Shooting and Problem Solving		X (L5)		
4	Maintenance and Repair		(L5)		
1	Mechatronic Operator 4.0 (Operating Technician in Automotive …)			(L5)	
2	Supplier Quality Assurance 4.0			(L6)	
3	Technologist New Production Processes			(L5/6)	
4	Cyber Security Technician			(L6/7)	
5	Data Scientist			(L6/7)	
6	Data Architect			(L6/7)	
1	Design Engineer				(L6/7)
2	Project Engineer				(L6/7)
3	Operator Manufacturing				(L4/5)
4	Senior Technician				(L5)

Figure 2.
"Qualification": Profiles of "industry 4.0" for the European automotive industry. ES = Spain, DE = Germany, IT = Italy, UK = United Kingdom.

1. **Spain:**

   Design Project Leader

   Maintenance Team Leader

   Quality Technician

   Production Supervisor/Shift Supervisor

   Mechatronic Expert

2. **Germany:**

   Data and Processes Management

   IT Systems and Networks

   Troubleshooting and Problem Solving

   Maintenance and Repair

3. **Italy:**

   Mechatronic Operator 4.0 (Operating Technician in Automotive)

   Supplier Quality Assurance 4.0

   Technologist New Production Processes

   Cyber Security Technician

   Data Scientist

   Data Architect

4. **Great Britain:**

   Design Engineer

   Project Engineer

   Project Engineer

   Operator Manufacturing

   Senior Technician.

Based on the description of competences, it is possible to allocate the individual profiles to the levels of the European Qualifications Framework (EQF) (see **Figure 2**). This was done by an expert assessment of project members rather than by a systematical comparison of individual indicators. Example: (L 5/6) means that the quality of the profiles is between level 5 and 6 of the European Qualification Profile (EQF).

4.3.2 Requirement level of competence profiles

The result of the allocation of all of the profiles is shown in more detail in **Figure 2**. It is obvious that mainly levels 4, 5, 6, and 7 are applied. Thus the profiles not only cover the requirements that are playing a role in vocational initial training and further training. In addition, also academic profiles come into effect. Thus the profiles cover a very comprehensive spectrum. It is remarkable that profiles on levels 4 only play a minor role and profiles on level 3 are mentioned once only.

Consequently it can be said that cognitive profiles and theoretical and more demanding profiles are dominating. **Figure 3** underpins this general assessment in more detail. When asking about the role of cognitive challenges during data processing and in work processes, the majority of the named competences underline a very high level (Quadrant I of the Matrix). Fourteen profiles of this criterion

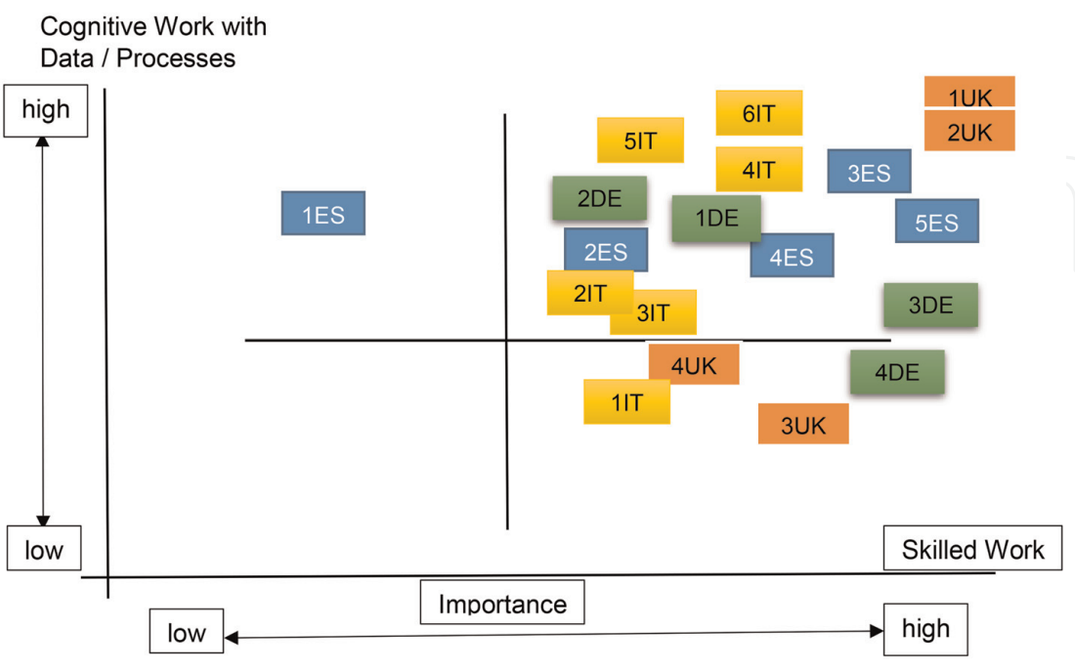

Figure 3.
"Competence quality" of the occupational profiles.

have to be allocated to Quadrant I. As for "skilled work," the estimation of the quality of competences is very high (Quadrant I as well). This means that the workers are not only performing simple mechanical skills but must above all master processes and the handling of data.

Only four profiles indicate less demanding, but still high cognitive requirements and are therefore allocated to Quadrant IV. However, the skills are still comparatively demanding in these four profiles. One of the profiles shows considerably less requirements for skills but comparatively high cognitive demands. This profile was allocated to Quadrant II.

As a summary it can be noted that all profiles are influenced by the:

- Increasing implementation of Industry 4.0
- Intensification of the work processes
- Increasing networking of data

This leads eventually to very demanding competence profiles, starting with EQF level 5 and higher.

Figure 4 documents the outcome of a case study of a German supplier. It is remarkable that a clear differentiation between requirements of technology, work, and social implications is possible. It is a demonstration that technology is not the only driver of the implementation process of Industry 4.0. For a successful implementation, the structure of work organization and the requirements of work are

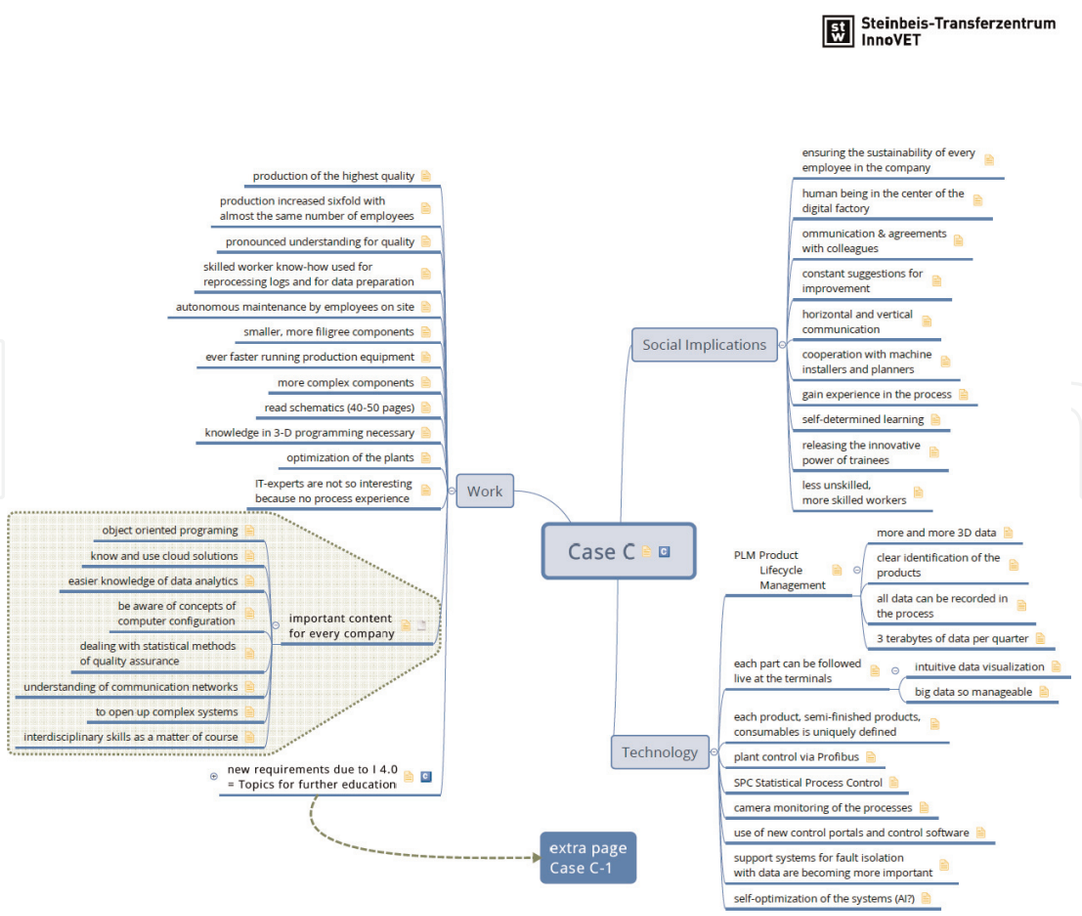

Figure 4.
Example of occupational requirements (source: Case study, Germany).

important. The shaping of the work organization decides which level and differentiation of the qualification are needed. It is also important to consider the social impact and to prepare the workforce for these tasks. Communication, cooperation, innovation, higher cognitive skills, acquiring experience in operating complex technology, continuous quality improvement, etc. are some of the social implications the workforce has to be trained for. Another issue is dealing with different kinds of software. This task requires workers who are able to make use of software, who take care of minor program modifications, or who are analyzing statistical messages which are transported via the software. Therefore workers have to be trained to enable them to shape their work in a successful way.

5. European core profile

Another question in the project was whether it would be adequate to generate a European Core Profile on Levels 4 or 5 of the European Qualifications Framework out of the numerous individual profiles. The analysis of the individual profiles shows that based on the "operation area", five individual profiles can be identified that reveal high affinity in terms of competence requirements and in terms of contents priorities.

Figure 5 gives an overview. The "operation area" consists of the following profiles:

- Mechatronic expert
- Maintenance team leader
- Mechatronic operator 4.0
- Maintenance and repair

The profiles are all linked to levels 4 and 5 of the EQF-Levels. The quality of the profiles is comparable, and the contents of work do not differ much. All the profiles have the aim to ensure the operation of plants.

The "operation area" is the level where plants are taken in and kept in operation by exclusively employing skilled workers who have undergone training and further training below the academic levels and who are working on the shop floor.

Core Profiles	ES	DE	IT	UK
Operation Area				
Mechatronic Expert	L 4			
Maintenance Team Leader	L 4/5			
Operator Manufacturing				L 4/5
Mechatronic Operator 4.0			L5	
Maintenance & Repair		L 5		
Quality Area				
Quality Technician	L 4/5			
Supplier Quality Assurance			L 6	
Data Area				
Data Architect		L 6/7		
Data Scientist			L 6/7	

Figure 5.
Core profiles for generating a European profile.

DOI: http://dx.doi.org/10.5772/intechopen.90185

With the aid of a contrastive analysis, the similarities of the profiles were worked out which form the core of a European profile. **Figure 5** shows the five profiles of the "operation area" which were used by the contrastive analysis to generate the European Core Occupational Profile.

The profiles of the "quality area" and the "data area" are new profiles which differ in their quality level, contents of work, and linkage to the work organization of companies. These profiles have a new character to support Industry 4.0 in different fields and should stand alone.

After the contrastive analysis of the profiles of the operation, a detailed description of the competence profile was drafted. The result is documented in Annex 2. The project consortium has decided to name this profile **Automotive Digital Mechatronic X.0.**

This European Core Profile excels by the following innovative elements:

- Access to interconnected new technology via software

The "new basics": broad competences	
Learn to **think starting from the software** Get to know **network structures** Learn how to master **Big-Data technologies** Learn how to work with a **variety of data formats** Understand and **master processes**	Learning how to take over **more self-responsibility** Learning how to **cooperate and communicate better** Learning how to **initiate innovations** Understand and consider the **environmental and social impact** of technology choices and innovations Make use of **innovation** potential! Support **shaping competence**!
Context-specific competences	
In addition to their experience in plant operation, however, it is important that such persons develop further in the following areas of competence: • Problem solving • Understanding of integrated systems and their interconnections (from the own company but also from external systems) • Linking of different system controls • Think and work across disciplines • Getting involved in new tasks • To master processes • Application of IT technology as a tool • Necessity to think through the processes	In addition to their experience in plant operation, however, it is important that such persons develop further in the following areas of competence: • Use of the cloud and integration of various machine data/manufacturer data • "Third hand" will gain importance in the industrial context (e.g., lightweight robots) • Maintenance, monitoring, and care of drive technology • Consideration of the entire value chain • Data as raw material; use it and attach more importance to it • To work in the delimitation of space and time • Digitization must be designed • Target perspective: Mastering multifunctional plant operation
"Abstract" competences	
Creativity Creation Critical thinking Communication Collaboration (in teams) Modeling skills Data gathering and mining Respect of procedures Relational communication skills	Investigative character Analytical spirit Storytelling skills Lateral thinking Curiosity Leadership Innovative management Vision and communication Understand business problems

Table 1.
Different types of competences.

- Use of augmented reality (visual component)
- Predictive analysis in real time
- Virtual diagnosis
- Management of manifold formats of data
- Data protection (plus laws!)
- Sustainability and productivity
- Understanding of the whole work process of a company

Based on empirical work of the project Auto 4.0, the following competences were generated:

- Broad competences (as "new basics")
- Context-specific competences I and II
- "Abstract" competences

These competences are listed in **Table 1**. Based on these competences, the project group has generic competences that were generated (**Table 2**) which form the basis for the development of learning assignments for the European Core Profile "Automotive Digital Mechatronic X.04."

• Understanding of integrated systems and their interconnections (from the own company, but also from external systems), • Linking of different system controls. **1 Where?**	• Necessity to think through the processes, • To master processes, • 'Third hand' will gain importance in the industrial context (e. g. lightweight robots), • Consideration of the entire value chain, • Target perspective: mastering multifunctional plant operation. 2 Why
• Application of IT technology as a tool, • Use of the cloud, integration of various machine data / manufacturer data, • Maintenance, monitoring, care of drive technology, • Data as raw material' – use of it and attach more importance to it. **3 How?**	• Problem solving, • Getting involved in new tasks, • Think and work across disciplines, • To work in the delimitation of space and time, • Digitisation must be designed. **4 Who?**

Table 2.
Generic competences.

DOI: http://dx.doi.org/10.5772/intechopen.90185

6. Conclusions

The empirical work of the project partners facilitated the development of a number of qualification profiles for different levels and core points in the field of Industry 4.0 in selected companies. In order to get a transnational core profile above all for Level 5, the core profile "Automotive Digital Mechatronic X.0" was generated from the country- and company-specific profiles.

The innovative character of this profile could be underpinned, and the relevant competences were identified. This profile forms the basis for learning units and learning scenarios.

ANNEX I: Interview Guidelines for Survey AUTO 4.0

Guiding Questions for Expert Conversations in Companies (HR Directors, Industry 4.0 Experts)

Short Version

A) General questions on the company and personal questions

Company
- Products
- Branch

Person
- Field of tasks
- Function in the company
- Occupational background

Employment structure in production (changes)
- Number of employees
- Employee structure (shares & changes)
  - Skilled workers
  - Semi-skilled workers
  - Engineers (process engineers, test engineers),
  - ...

B) Experience and the technological development in the company

- State of the introduction of „Industry 4.0 "in the company?
- What are the most important drivers for the application of principles of Industry 4.0?
- How have processes been changing during the past years (ICT, networking, automation)?
- Which technologies (for data/ information transfer, networking or the optimization of work processes, automation) have already been implemented in your company?
- Which ones? Where? In which areas? What is the objective?

C) Impact on the business and work process

- Which were your tasks during the implementation process? What did you do? How? With which tools? Were external IT-services involved? Have the stakeholders (skilled workers) been involved in the process?
- How do you involve your skilled workers in implementation processes? Which competence profiles must these specialists have? Which qualifications must they have?
- What are the tasks of skilled workers or engineers? Have roles changed in this area?
- Is your company vertically integrated from the perspective of:
  - Sales (data-driven demand prediction)
  - Product (data-driven design to value, integrated product development ...)

D) Qualification requirements and support

- Which new requirements for employees and tasks do you expect?
- Which employment level will be predominantly affected by changes? Will some of the levels vanish?
- Which most important competences should be imparted in future training? Are there differences compared to today?
- How do typical qualification paths in companies look like?
- Which additional qualifications are necessary?

ANNEX II: European Core occupational profile.

European Core Occupational Profile Auto 4.0: "Automotive Digital Mechatronic Tabstopp X.0".

Name of the European Core Occupational Profile:
Automotive Digital Mechatronic X.0.
Overall description.
Detailing[6].

What does he/she do?

The tasks for qualified workers at the level of *Automotive Digital Mechatronic X.0* encompass maintenance tasks in order to safeguard a flawless plant operation. This means that they must have access to the function of plants and must be able to cope with (metal-technological, electrical, IT-based) maintenance tasks and diagnostic in plants composed of different technological systems. Difficult repair tasks are exempted and are task of the trouble shooters. The maintenance tasks also encompass preventive maintenance prepared by recording, processing, analyzing of data and visualization of operational and production data and should be ready to be applied at the production work places at all times. In addition qualified workers must also master virtually organized maintenance tasks and must apply assistance systems for trouble shooting, documentation and knowledge transfer. Has extensive knowledge of the production processes and may be able to set up/ programmes and carry out diagnostics.

Manufacturing is understood as: Produces goods and parts from raw materials by using different production processes. This may include some setting up of machinery and basic programming.

Responsibility

Qualified workers have to have the capability to use the industry-specific software products of production planning and preventive maintenance (PPS, ERP, ...) to handle the production work process at the workplace. This includes to perform the maintenance of the autonomous systems with a remote monitoring. A further requirement is to carry out maintenance of the production control systems based on Big Data and clouds with the help of diagnostic instruments.

To perform individualized maintenance of components of machines and plants by using continuous processes of data acquisition and to implement visualization software.

A prerequisite of all maintenance work is to evaluate the information on the wear and tear of plant parts from a continuous monitoring of the machines by sensors.

Working to strict safety and quality requirements, help to achieve daily production requirements in terms of quality and quantity to meet customer expectations and requirements, optimizing efficiency and maintaining operational excellence. Able to work on many/all areas of the production process with little supervision.

Results

The "Experts Automotive Digital Mechatronic X.0" produces the following results: he/she

- Quality, Cost and Delivery Metrics.
- Evaluates the information on the wear and tear of plant parts from a continuous monitoring of the machines by sensors.
- Handles the production work process by use of the industry-specific software products of production planning and preventive maintenance.
- Carries out preventive maintenance prepared by recording, processing, and visualization of operational and production data.
- Executes maintenance of the production control systems based on Big Data and clouds und carries through diagnostic processes.

Value

Maintenance and repair tasks in networked plants and individual machines are as a rule carried out by maintenance teams. The qualified workers of the teams are specialized in tasks including IT-tasks such as network analyses or IT-guided trouble shooting. They also master procedures for the identification of malfunctions (data analysis), causes for malfunction and their repair in complex, networked plants. Target perspective: Considering repair interdependencies due to networking and IT-integration of machines and plants; software updates. They are also fit for all traditional tasks in ensuring the function of the machinery.

[6] The long version is available via the author.

DOI: http://dx.doi.org/10.5772/intechopen.90185

IntechOpen

Author details

Georg Spoettl
University of Bremen, Bremen, Germany

*Address all correspondence to: spoettl@uni-bremen.de

References

[1] Kalio N. The impact of globalization and industry 4.0 on training and retraining in developing and underdeveloped nations. European Journal of Business and Management. 2019;**11**(3):167-172

[2] Harteis C. Supporting learning at work in an era of digitalisation of work. In: Bahl A, Dietzen A, editors. Work-Based Learning as a Pathway to Competence-Based Education. A UNEVOC Network Contribution. Bonn: BIBB; 2019. pp. 85-8s

[3] Hamburg. Unser Leben mit der Digitalisierung. Google: Hamburg; 2015

[4] Bayme vbm-Spoettl G, Gorldt C, Windelband L, Grantz T and Richter T. Industrie 4.0 – Auswirkungen auf Aus- und Weiterbildung in der M+E Industrie,. Studie herausgegeben von bayme vbm, Die bayerischen Metall- und Elektro-Arbeitgeber, München. Universität Bremen: Bremen; 2016 Available at: www.baymevbm.de/industrie4.0 [accessed: 27-05-2016]

[5] Spöttl G. Skilled workers—Are they the losers of "industry 4.0"? In: Schlick C et al., editors. Advances in Ergonomic Design of Systems. Products and Processes—Proceedings of the Annual Meeting of GfA 2016. Selected Paper. Germany: Springer; 2017. p. 16

[6] Cevik SO, Ustundag A, Kadaifci Ç, Oztaysi B. The changing role of engineering education in industry 4.0 era. In: Ustungag A, Cevikan E, editors. Industry 4.0: Managing the Digital Transformation. Switzerland: Springer; 2018. pp. 137-151

[7] Schwab K. The Fourth Industrial Revolution. UK, USA: Penguin; 2016

[8] Marr B. Why everyone must get ready for the 4th industrial revolution. Forbes. 2014 Retrieved 14-02-2018. https://www.bernardmarr.com/default.asp?contentID=966

[9] Spöttl G. Development of "Industry 4.0"! – Are Skilled Workers and Semi-Engineers the Losers? 2017, 7th World Engineering Education Forum (WEEF), IEEE Xplore: 20 September 2018. Kuala Lumpur, 2018. pp. 934-951. DOI: 10.1109/WEEF.2017.8467033

[10] European Commission. Opinion on the Future of Vocational Education and Training Post 2020. Advisory Committee on Vocational Training; 3 December 2018; Brussels: 2018

[11] COM. 381 Communication from the Commission to the European Parliament. The Council, The European Economic And Social Committee and the Committee of the Regions. A New Skills Agenda for Europe. Working Together to Strengthen Human Capital. Employability and Competitiveness 381 Final. Brussels. 2016