A.U.T.O. 4.0

Co-funded by the Erasmus+ Programme of the European Union

AUTO 4.0 project

Understanding and Achieving Automotive Training Outcomes 4.0

2017-1-IT01-KA202-006187

Erasmus+ Programme - VET Field - KA2 Development of Innovation

European Automotive Technology & Skills Foresight 4.0

(Intellectual Output 1)

Part I

This project has been funded with support from the European Commission.
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This intellectual output has been conceived and developed by the Strategic Partnership AUTO 4.0 under the coordination and responsability of Steinbeis (GER) and with the co-leader role of Ilmiolavoro srl (IT).

Thanks to all partners for their precious contributes.

Campli (TE) – Italy, January 2020

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AUTO 4.0 project – Summary

I01: European Automotive Technology and Skill Foresight 4.0 (AUTO 4.0)

AUTO 4.0 project summary

Digital transformation is structurally changing the market and the nature of work. In the industry the work (from the workers to the engineers and administratives), will increasingly consist in the design, maintenance and supervision of smart-machines capable of assisting people in carrying out their tasks. This will require different competences than those used and predictable today (COM 180/2016).

Future work will require a broad and cross-disciplinary combination of competences. Basic, transversal and technical aspects that VET systems are not fully able to provide (COM 381/2016).

Automotive sector plays a key role in Europe. Workers must be prepared for the needs of greater competitiveness (COM 636-2012). Various studies showed that, from the perspective of Industry 4.0, there are significant gaps in skill levels and qualifications of workers (R. Crapelli of Roland Berger Italy, Labor Commission Hearing of the Italian Chamber of 16.02.2016 – Boston Consulting Group, 2015 - Spöttl G., 2017 - European Parliament, 2015,). The automotive industry is heavily impacted by the changes expected by Industry 4.0 (RolandBerger, 2014). The criticality is that it is NOT clear what the required skills will be in 3/5 years, what will be the jobprofiles needed for companies. Failure to provide such skills can slow down or prevent underlying transformation in Industry 4.0 with consequent negative impacts (declining automotive industry competitiveness, giant unemployment increase).

Although some attempts to anticipate skills needs have been completed (ESB, 2015-Boston Consulting Group, 2015-European Sector Skills Council, 2016) the problem that the project addresses is: the information produced remains at a general level of "skill needs" and does not allow to define specific training contents.

On the one hand, skilled workers (skilled workers) are at risk of being left out of the labor market (Frey CB-Osborne MA, 2013), on the other hand, companies needs huge number of workers with the "right skills" to make Industry 4.0. The aforementioned

experts, the cluster organizations of automotive companies and the unions involved consider the re-training of the workforce as priority number 1. After then the introduction of new human capital (World Economic Forum, 2016-Accenture, 2015-European Parliament, 2015) may be the second priority.

On the side of workers, too, they are somewhat disoriented, they don't perceive adequately the risks of leaving the labor market that Industru 4.0 determines. There is a need for awareness-raising, support for re-training decisions (guidance) and more general management of working career. (Frey C.B. Osborne, M.A., 2015). In response to these needs, two simultaneous needs emerge:

- to know in detail the key cross-cutting skills and new works that will make it possible for companies to realize industry 4.0 (requirements);
- to understand what are the training specifications for a re-training of the workforce to be carried out with sufficient anticipation over the needs.

Emerging needs concern all automotive sector, even qualified, workforce. The overall objective of the project is to develop OERs that will allow the development of worker's capacities 4.0 and the competitiveness of European automotive ecosystem companies.

Partners will strive to achieve the following specific objectives:

- Developed and tested a method that will clarify and describe in detail the "key enabler competences" and job profile 4.0 that will be used by the automotive cluster companies involved;
- defined conscious choices of re-training and career by the workers involved;
- created OERs capable of promoting the development of key enabler competences by employees, strategic compared to Industry 4.0 transformation of the involved value chains.

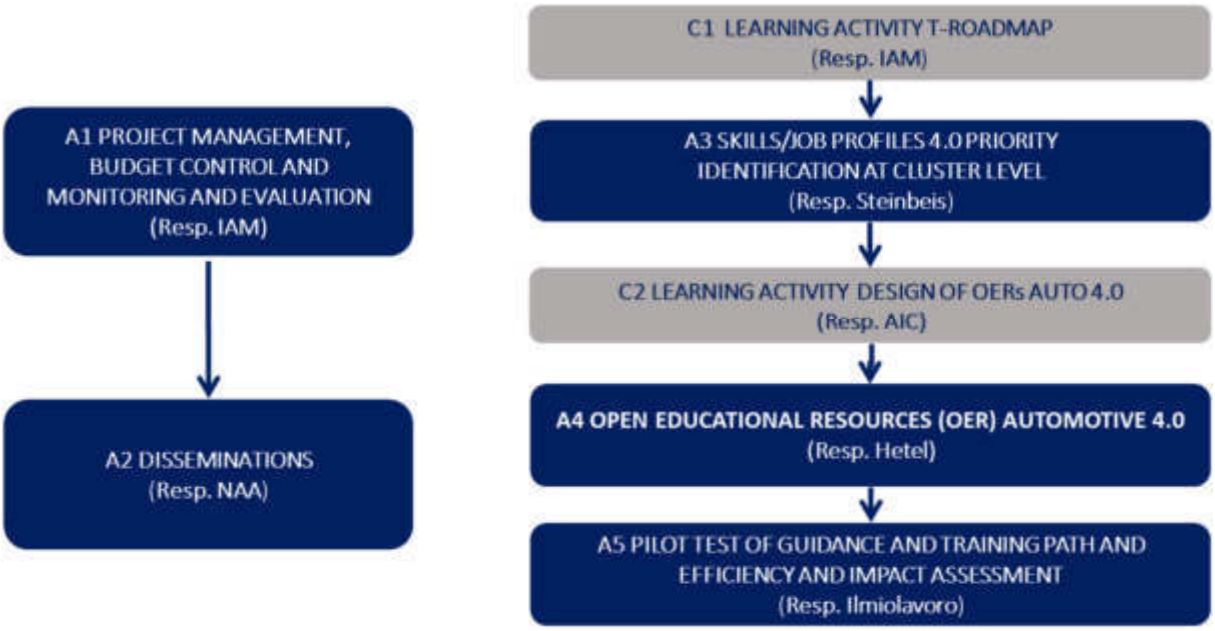
The target group to which the project is directed consists of skilled workers who are vulnerable but can be updated to Industry 4.0.

In order to reach the specific objectives, the strategic partnership developed two Intellectual Outputs:

IO1 European Automotive Technology & Skill Foresight 4.0: it included detailed information about key enabler competences and job profiles that will be required by automotive companies of European cluster in Industry 4.0 perspective.

IO2 European Automotive 4.0 cross-skills Open Education Resources: it provided training contents coherent with the knowledge and abilities requirements. Are Open Education Resources that promote the development of enabler competences Automotive 4.0 that skilled workers need.

In order to develop these intellectual output the following Activity Plan have been implemented.



Two International Learning Activities that took place in Italy (Santa Maria Inbaro – CH) and in Spain (Amorebieta – Bilbao) added value to the partners staff in order to learn to apply the technology roadmap and to build Open Education Resources.

During the project a lot of results dissemination activities were developed, included four Multiplier Events that took place in each partner's countries.

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The Intellectual Output "*European Automotive Technology & Skill Foresight 4.0*" - Summary

The Intellectual Output 1 summary

This intellectual output contains specific and accurate informations on enabler competences and jobprofiles that will be used by European automotive cluster companies that will undertake transformation 4.0.

The informations contained in the study is supportive of decisions on investment in training that can be done by companies, workers, and people interested in entering the automotive industry.

Enabler competences 4.0 are competences that automotive skilled workers will have to be able to act with different levels of mastery. These are related to emerging needs arising from the transformation of ways of conceiving, producing and selling the product.

Job profiles 4.0 are the new business profiles that will be used by automotive companies implementing the 4.0 transformation.

The intellectual output was realized through a survey to develop some case studies and by borrowing the methodology called Technology Roadmap (PHAAL R., T-Plan: the Fast Start to Technology Roadmapping). T-Roadmapping is a powerful technique - introduced by Motorola in the 1970s - to plan the technological capabilities of an organization or group of organizations (clusters or supply chains) to ensure that they meet their business or strategic goals. The graphical nature of roadmaps supports the strategic alignment and dialogue between organizations.

Introduction and activities carried out

Intellectual Output n. 1:
European Automotive Technology and Skill Foresight 4.0 (AUTO 4.0)

Introduction: Sector-related Empirical Identification of Skill Needs

In order to elaborate which skills are required on the shop-floor due to 4.0 transformation, a qualitative empirical survey was conducted based on case studies and/or expert interviews and roadmaps were developed at automotive business clusters level or at single shopflor level.

A questionnaire was applied for the case studies and the expert interviews. The questionnaire helped to identify the need for qualified skilled workers in the companies due to digitalization. In order to get adequate answers, the experts to be interviewed and the cases had to be carefully selected. Each partner of a region had to select cases in his/her region as they could well assess which companies – and which key persons – would be adequate and available. The access to each company was controlled by each of the partners.

The structure below was recommended for the documentation of the results.

Structure for presentation of results

1. Basic Data of the company
2. Description of the Company
3. Organisational Unit on Process Level

General Structures

Company-related Changes and Innovations

4. **Where we are**? Implementation of „industry 4.0“ in the sector in the region.
   a) Assessment of current technologies in the sector (what technologies are used?
   b) How new they are? In which processes are these technologies used? Existing limitations?

c) Identification of technologies not currently used but considered important for the future. Which opportunities exist? What benefits could they bring? Why they are not used yet? What would be necessary to implement them in the sector?
d) Work and business processes on different employment levels. Which is the level of vertical integration in the sector? How quickly are decissions taken? Are different departments connected? In which way? Is information received by one department automatically shared with other departments which may be involved?
e) General qualification structures in the sector. Which is the level of qualification in the sector? How ready are current employees to be able to implement new technologies, adapt to new processes?

5. **Where do we want to go**? Automotive cluster strategy
   a) What are the objectives/strategies of the sector for the next 3-5 years? In terms of: product/services, processes, vertical integration (within departments in the company) and horizontal integration (with clients, providers, allies)
6. **How can we get there**? Identification of cross skills and job profiles for the automotive cluster.
   a) Identification of intermediate actions and resources necessary to achieve the objective/strategy.
   b) Roadmap of the region (time based graph)
   c) Identification job profiles and associated skills: to implement new technologies, to adapt to new organizational ways, to develop transversal skills (flexibility, autonomy, problem solving…) adapted to the detected strategies of the sector.

However, this structure was only applied in a modified version. The partners rather concentrated on a direct presentation of the results. The results were composed of the following key issues:

- A “technology” roadmap (Germany)
- A “shop-floor” roadmap (Italy) and
- 19 occupational profiles (all partners).

In Italy a competences roadmap was developed also at single business level.

The elaboration of a total of 19 occupational profiles based on the surveys was quite surprising. The aim had previously been to name one or two new profiles per partner

country. The high number of profiles seemed to have motivated the generation of a “European Core Occupational Profile” from the 19 profiles.

The contents ot the intellectual output

This intellectual output describe the results that the AUTO 4.0 Strategic Partnership got during the first phase of the project.
The report is divided in sections.
The first section called "Automotive 4.0 Enabler Competences and Comparative Analisys among countries" that describe:
- the process and the method for the determination of Qualification Profiles and the key enabler competences 4.0 in the automotive eco-system;

- a comparative analysis of the job profiles between the different countries;
- the process used for the conceiving of the European Core Profile;
- the key enabler competences 4.0 divided in broad competences (as “new basics”), context-specific competences and “abstract” competences.

The second section contain the detailled description of the European Core Profile called "Automotive Digital Mechatronic X.0" and the description of the other job profiles 4.0 descripted during the project in the involved countries.
The third section is a collection of the 4.0 job profiles described in the different countries.
The fourth section present the results of the Roadmap Tools tested during the project in the different countries at cluster level and at business level (Italy).
The fifth section contain the methologies and tools applyed to get the results described in the intellectual output.
The different sections are preceded by an introduction that describes the project in summary and by a brief description of the activities carried out to develop this intellectual output.

Activities carried out

I01: European Automotive Technology and Skill Foresight 4.0 (AUTO 4.0)

Sector-related Empirical Identification of Skill Needs

In order to elaborate which skills are required on the shop-floor due to digitalization, a qualitative empirical survey was conducted based on case studies and/or expert interviews. A second objective of the empirical phase was the development of shop-floor specific roadmaps.

A questionnaire was applied for the case studies and the expert interviews. The questionnaire helped to identify the need for qualified skilled workers in the companies due to digitalization. In order to get adequate answers, the experts to be interviewed and the cases had to be carefully selected. Each partner of a region had to select cases in his/her region as they could well assess which companies – and which key persons – would be adequate and available. The access to each company was controlled by each of the partners.

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d) General qualification structures in the sector. Which is the level of qualification in the sector? How ready are current employees to be able to implement new technologies, adapt to new processes?

5. **Where do we want to go? Automotive cluster strategy in (NAME OF THE REGION)**
   a) What are the objectives/strategies of the sector for the next 3-5 years? In terms of: product/services, processes, vertical integration (within departments in the company) and horizontal integration (with clients, providers, allies)
6. **How can we get there? Identification of cross skills and job profiles for the automotive cluster in (NAME OF THE REGION).**
   a) Identification of intermediate actions and resources necessary to achieve the objective/strategy.
   b) Roadmap of the region (time based graph)
   c) Identification job profiles and associated skills: to implement new technologies, to adapt to new organizational ways, to develop transversal skills (flexibility, autonomy, problem solving…) adapted to the detected strategies of the sector.

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Section 1

Automotive 4.0 Enabler Competences and Comparative Analisys among the countries

I01: European Automotive Technology and Skill Foresight 4.0 (AUTO 4.0)

A.U.T.O 4.0 – Anticipation of skills for Employees due to Digitalization – The Transfer Towards a "European Core Occupational Profile"

1 Introduction

Europeanization is a politically supported process which includes mobility of the labor force, high service quality, fast use of modern technology, a chance of interaction of companies and other stakeholders. The economic activities of companies are worldwide and global. 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 4.01[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" (Kalio 2019, 167). 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 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

[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 cf. Spöttl 2017).

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

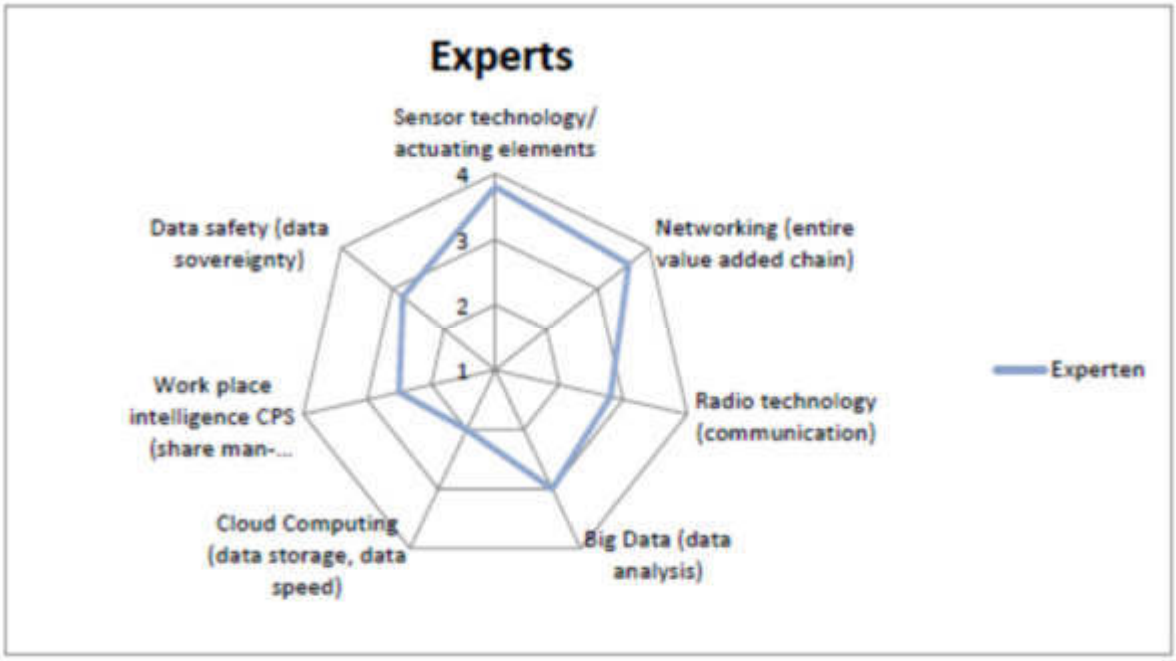
Digitalization are probably not visible yet" (Harteis 2019, 86). Besides there are convincing indicators regarding the progress of Digitalization with the economy (cf. ibid). More and more companies are running their business with the help of Digitalization, among them Microsoft, Apple, Facebook, Uber 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. 90 per cent of these companies apply digital equipment to optimize the business and work-processes (cf. Hamburg 2019, 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 (2016, 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), work place 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 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 work place intelligence were also low-rated. The reason for the low rating of work place 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. Spöttl 2017).

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, of organizational structures, leadership mechanisms and corporate culture (Cevik et al. 2018, 137).

According to Schwab (2016), ubiquitous mobile supercomputing, intelligent robots, self driving cars, neuro-technological brain enhancement, genetic editing, are evidence for a global dramatic change taking place at exponential speed (cf. Kalio 2019, 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" (Schwab 2016). He expects that all disciplines in economies and industry and the quality of life will be confronted with these changes.

Figure 1: Diffusion steps of technologies – assessment by experts (Source: Spöttl 2017)



[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 .

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 (2014) 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. Kalio 2019, 170). In this context work-based learning and the use of virtual technology, simulation, digital media and others becomes more and more important. Learning from the future is taking a different dimension. The integration of learning, work requirements, virtual 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.

[4] This includes social and ethical dimensions.

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. (Spoettl 2018)

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. European Commission 2018) are highly relevant because of Industry 4.0:

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

The new guidelines (cf. COM 2016-381) 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.

4.1 The Target Group and Requirements

In the Project A.U.T.O. 4.0 these statements were in the centre of activities. One of the core objectives of the project A.U.T.O. 4.0 (Understanding and Achieving Automotive Training Outcomes 4.0) with partners from Italy, Spain, Great Britain and Germany was the identification of "enabler competences 4.0", of the “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 – was 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 4th Industrial Revolution. As a requirement 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 1st tier suppliers – the so called system suppliers) and car manufacturers should be given priority. Within the survey instruments were applied such as:

- technology roadmaps development;
- case studies in well selected companies and;
- expert discussions.

To ensure to get a deep insight into the changes in companies because of 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,
- recruitment experts,
- skilled workers,
- experts for training.

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

- car manufacturers (1 case)
- system suppliers (1st 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. Furthmore some technology roadmap have been developed that drawn down some future development routes of technology and of competences.

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

4.3 Results of the Survey and TRoadmap Phase

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 profiles” 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 1.

The following profiles were developed in the individual partner countries:

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 (Opeerating 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 1). 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).

Figure 1: “Qualification”-Profiles “Industry 4.0” for the European Automotive Industry

	ES	DE	IT	UK
1 Design Project Leader	X (L 5/6)			
2 Maintenance Team Leader	X (L 4/5)			
3 Quality Technician	X (L 5)			
4 Production Supervisor/Shift Supervisor	X (L 5/6)			
5 Mechatronic expert	X (L 4)			
1 Data and Process Management		X (L 5/6)		
2 IT Systems and Networks		X (L 5/6)		
3 Traubleshooting and Eleminating		X (L 5)		
4 Maintenance and Repair		X (L 5)		
1 Mechatronic Operator 4.0 (Opeerating Technician in Automotive …)			X (L 5)	
2 Supplier Quality Assurance 4.0			X (L 6)	
3 Technologist New Production Processes			X (L 5/6)	
4 Cyber Security Technician			X (L 6/7)	
5 Data Scientist			X (L 6/7)	
6 Data Architect			X (L 6/7)	
1 Design Engineer				X (L 6/7)
2 Project Engineer				X (L 6/7)
3 Operatior Manufacturing				X (L 4/5)
4 Senior Technician				X (L 5)

ES = Spain; DE = Germany; IT = Italy; UK = United Kingdom

3.2 Requirement Level of Competence Profiles

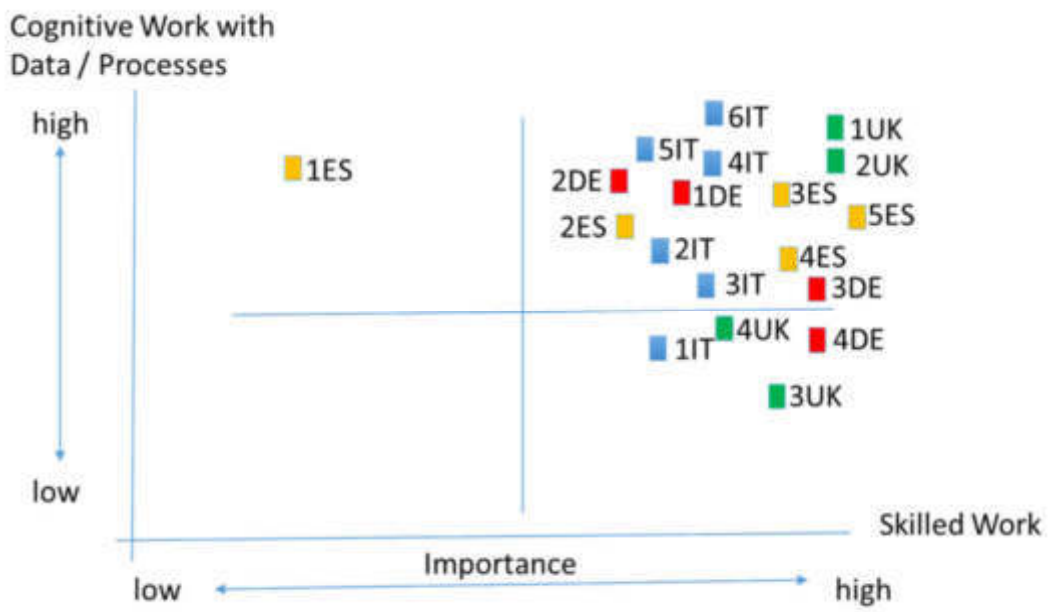
The result of the allocation of all of the profiles is shown in more detail in Figure 2. It is obvious that mainly levels 4, 5, 6, and 7 are applied. Thus the profiles not only cover the requirements that are playing a role in vocational initial training and further training. In addition, also academic 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 one 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). 14 profiles of this criterion 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.

Figure 3: “Competence Quality” of the Occupational Profiles



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

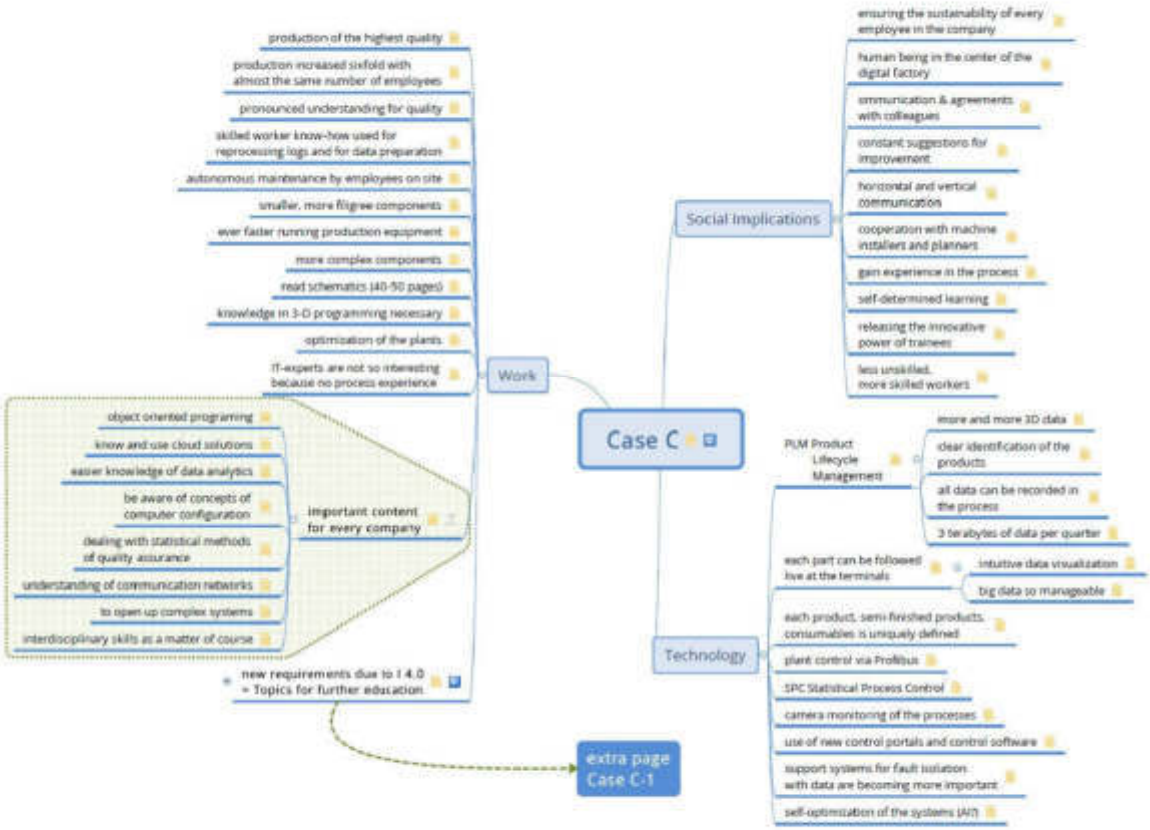
- increasing implementation of Industry 4.0, by the
- intensification of the work processes and an
- increasing networking of data.

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 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 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.



4 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. An analysis of the individual profiles shows that based on the “Operations Area”, five individual profiles can be identified that reveal high affinity

- in terms of competence requirements and
- in terms of contents priorities.

Figure 3 gives an overview. The “operation area” consists of the following profiles:

- Mechatronic expert,

- Maintenance Team leader,
- Mechatronic Operator 4.0 and
- 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.
With the aid of a contrastive analysis, the similarities of the profiles were worked out which form the core of a European profile.

Figure 4 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.

Figure 5: Core Profiles for Generating a European Profile

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		
Mechatronic Expert		L 4			
Quality Area					
Quality Technician		L 4/5			
Supplier Qualtiy Assurance				L 6	
Data Area					
Data and Process Management			L 5/6		
Data Archtitect				L 6/7	
Data Scientist				L 6/7	

This European Core Profile excels by the following innovative elements:

- access to interconnected new technology via software;
- 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 and

- “abstract” competences.

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

Table 1: Different Type of Competences

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, integration of various machine data / manufacturer data, • 'Third hand' will gain importance in the industrial context (e.g. lightweight robots), • Maintenance, monitoring, 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 & 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 2: Generic Competences

• 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 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?**

5 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

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Section 2

European Core Profile

Job profile Auto 4.0

Name of the European Core Occupational Profile: **Automotive Digital Mechatronic X.0**

Overall description

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.

Detailing

1. ***Main activities carried out***	2.***Output/Outcome***	3.***What learners needs to know***	4.***What learners must be able to do***	5.***What organisational behaviour is required?***
1. Measure, grade of raw materials into production machinery/process	Correct batches result in the desired outputs	How to weigh/mix/count/measure approrpiate raw materials for each batch feed	Record how much raw material has been used during production and the number of items produced;	Attention to detail, accurate measuring & recording
2. Operate production line equipment such as	Operation is in accordance with	Start up & shutdown sequence; How to fit parts to machinery and	Communicate safety guidance to his team and communicate any issues to the maintenance team.	Teamwork & effective communication with co workers

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
conveyor line, hoists, airlines and robots	quality, safety & ecological standards	equipment? How to use and shape parts and tools? Understanding and awareness of working with collaborative robots		
3. Operate machine tools such as lathes, grinders and borers; use moulding machines which are pre-set to carry out certain tasks; set & operate hand-controlled or computer-controlled Machine parts/components.	Operation is in accordance with quality & safety standards	How to make use of different tools and machines? How to cut and shape parts and tools. How to operate different types of machines? How to keep the machines in function?	Communicate safety guidance to his team and communicate any issues to the maintenance team.	Teamwork & effective communication with co workers
4. Workings in collaboration with machine-robots (supervision)	Product quality Process improvement Improving productivity Zero interruptions Production continuity	Operating logic of man-machine interfaces Deep knowledge of the activities and production processes of the robot machine Basic IT knowledge Machine-robot management software Knowledge of basic English language	Interact with the machine to perform operations Driving the machine in unplanned operations Perform precision manual operations Understand devices worn instructions (glass)	Precision and expertise in operations Respect for procedures
5. Monitor the production process and carry out basic	The production process runs to specification,	How to ensure parts are to the correct tolerances and meet customer and internal standards and	Adjust machine controls whilst monitoring the production process and outputs and planning; carry out	Contribute to continuous improvement activities.

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
testing and quality checks	Monitor KPIs for the process performance	specifications; how to report equipment faults to maintenance staff. Understanding of Big data and internet of things so that he/she can communicate it to the manager. Understanding of benefits of simulation techniques to support new installations. Knowledge of Advanced Product Quality Planning (APQP), Production Part Approval Process (PPAP). Awareness of TS16949, Awareness of ISO9000, Understanding of ISO14001. Data Processing Applications. Knowledge of the technical characteristics of the product Product specific requirements (codes)	cleaning and basic maintenance of work areas and the machines Implement changes within his processes Ability to take on the simulation techniques, working with the engineers. Ability to feed back and contribute to design optimization. Store, extract and read big data from machines Processing and interpreting portions of big data (those relating to emergencies or requiring immediate intervention) Use manual and/or electronic measuring instruments	Take the initiative to identify issues, prioritise work and implement changes using the new technologies. Accuracy Quality orientation
6. Ensure compliance and assist with adherence to the Quality Management system.	Policies Knowledge Environmental mentality / compromise. Work Producers	Financial acumen with ability to balance material usage. Knowledge of Health & Safety legislation including ISO14001 and responsibilities.	Able to identify root cause of any losses. Ability in application of Health & Safety legislation. Use of Quality standard TS16949, ISO 9001	Ability to plan, analyze and challenge. Essential Health, Safety & Environmental constraints, critical thinking.

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
Comply with the Health, Safety and Environmental Policies	Registers Quality policies	Knowledge of Quality standard TS16949, ISO 9001		Ability to collaborate in a dialogical way.
7. Carries out diagnostics for troubleshooting	Fault detected	Basic IT knowledge Machine Management Software	Start the machine diagnosis procedure. Interpreting the results of the diagnosis. Anomaly Management Knowledge of basic English language. Continuous improvement oriented mindset.	Self and time management. Openness to problem solving of complexity. Adaptability and capacity for change. Ability to communicate in online workshops.
8. Correct software faults and errors (bugs)	Machine repaired	Basic IT knowledge Machine Management Software. Understanding and awareness of cyber security issues and how they could have an impact on the facility. Understanding of internet of things and ways in which they can capture more data and how the data might be used for maintenance.	Use the industry-specific software products of production planning and preventive maintenance (PPS, ERP, MES, CAQ)	Ability to use collaborative problem solving tools Ability to collaborate

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
9. Performs predictive-preventive maintenance	Maintained machine Executes the maintenance of all parts and systems with remote monitoring, with diagnostic tools, with simple tools	Knowledge of advanced device tools. Basic IT knowledge. Machine Management Software. Machine specification, maintenance procedures. Security procedures. Knowledge of technical English language Understanding of benefits of preventive maintenance and the use of data.	Write to basic PLC / java Replace worn parts/materials using specific tools. 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. Plant and machine statuses can be queried on the move and displayed in virtualized form (with the help of clouds, Big Data or augmented reality, for example).	Self and time management. Respect for safety procedures Working remotely
10. Exchange of data between different network interfaces and manufacturers (gateways), Update production data (technological and constructional) applied in the intelligent manufacturing systems.	Optimized exchange of data between different network interfaces and manufacturers and updated production by use of data.	Skilled workers have to focus on their thinking by starting from the processes and from the software and thus optimize plants and their functions. This requires an entirely different understanding compared to monitoring mechanically-electrically operated plants. This other understanding is highly relevant for both the operation and the optimization of the plants and their integration into the overall production process.	Industry 4.0 requires the programming of plants, machines, their components and process sequences. This requires a variety of programming tasks. It is therefore necessary to develop plant-related overview knowledge for robot programming, object-oriented programming and, for example, for Java programming. The focus must be on developing an understanding of program structures related to systems to be able to optimize intelligent manufacturing systems.	Availability to a continuing training

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
		Know how about the network of the plants and how to optimize the work that has to be done.		
11. Propose the solutions for application of Big Data in the production process by referring to the existing knowledge of the physical, technological and business (commercial) interrelation.	Machinery / plant has to run 24 hours without interruptions	Sound understanding of the interlinkage of process sequences and the interconnection of control of plant control units, the network of technology for interlinkage of machines, the handling of data to guarantee data security, data protection, WLAN networks, professional buses and IT technology.	An efficient plant operation calls for skilled workers to carry out parametrization tasks on their own. The correction of programming sentences and/or data analyses are also part of their field of tasks. The most important thing is to master the various combinations of software, to read displays, to check where a sensor does not work and to correct such a fault. Analyze the internal function of a plant and ensure the operation via organizational activities Identify where to collect data	
12. Use the data from the cloud or Big Data for the formulation of inquiries as well as to evaluate the data. Benchmark and compare production	Optimized monitoring of the machinery and plants by use of data in different formats. Benchmark of the efficiency with different workplaces.	The monitoring of plants – also of several plants simultaneously – counts among the important tasks for skilled workers. Above all the flawless operation of plants must be safeguarded. This means that the available real-time data must be	Reading, analyzing, and processing of machine data and their preliminary data is an important task. Data are most important for the setting-up of a machine and for a quality-based operation of plants.	Acting with behaviour in line of internal regulations of data security which follow existing laws.

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
data on the level of workplace and on the level of enterprise		continuously monitored, analysed and evaluated and the overall operation of the plants must be monitored and corrected if necessary.	Deviations from standard values have to be identified and dealt with immediately in case of malfunctions. The statistical process control (SPC) in networked production systems is no longer just focused on an individual machine but more and more on entire production sections under the responsibility of the skilled workers.	
13. Protect customers' data in the case of production of personalized products in order to ensure, that personalized products would not get into mass production.	Be able to modify and test drive the different possible settings and parameters in a process by using available data. the planning of work, Creation of new algorithms and applications in order to link many things and common synchronization with the entire value stream. Ensure data security.	The network structures within the value added chain and the use of sensors and actuators are exactly planned and realized. It is also important to consider all preceding and subsequent processes and to make sure that all data important for the overall process (programs, interface configurations, statistical data, data for quality check and networking) can also be processed by skilled workers.	The available real-time data must be continuously monitored, analysed and evaluated and the overall operation of the plants must be monitored and corrected if necessary. The monitoring of noise generation by machines is as important as data providing information on production monitoring and production quality within the production processes and the products to be manufactured. Application of identification systems (e.g., RFID, QR code) as well as system and communication interfaces (OPC UA, ODBC). Deal with safety-relevant process steps and the corresponding steps in the software application.	Ensure and maintain the access of customers to monitoring and controlling of their own production process, including the production schedule and costs.
Management skills				

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
14. Be aware and work to achieve the KPIs Complex Kaizen development	Result of KPI´s assesment	Excellent organization skills Excellent problem-solving skills Ability to manage a wide variety of activities at the same time Ability to plan, analyze and challenge Commercial understanding of the impact of failure/downtime on production and ultimately customer delivery Complex problem solving tools Quick PDCA SPC Knowledge of basic English language Techniques and data interpretation processing	Completed a recognised indentured apprenticeship in maintenance management Experience of working with facilities management Write in English language	Demonstrate excellence in approach to work and people activities Good understanding of customer expectations and deliverables with an awareness of the impact of failure/cost of poor quality Able to identify root cause of any losses Practical hands-on approach to problem solving

Experts of partners staff	**Partner organization**	**Experts of partners staff**	**Partner organization**
Georg Spöttl	*Steinbeis*	Marc Nicolaisen	*Steinbeis*
Fabrizio Coccetti	*Ilmiofuturo*	Malte Starmer	*Dekra Akademie*
Matteo Paradisi	*Ilmiofuturo*	Jon Galarza	*AIC*
Iole Marcozzi	*Ilmiofuturo*	Tamara Rodriguez	*Hetel*
Jon Leunda	*Goierri School - Hetel*	Leire Belar	*Hetel*
Rowan Egan	*NAA*	Federica Rossetti	*IAM*
Aitor Ruiz	*AIC*	Jeff Thompson	*NAA*

Section 3

Automotive 4.0 job profiles and competences

A.U.T.O. 4.0

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New competences and Job Profiles

AUTO 4.0 Job Profiles described in Spain

Design Project Leader
Maintenance Team Leader
Quality Technician
Production Supervisor/Shift Supervisor
Mechatronic expert

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Job profile Auto 4.0

Name: **Maintenance Team Leader**

Overall description

What he does

Responsible for ensuring that a given section of the facilities, layout and machinery used to produce new and existing parts run to their maximum efficiency and output. Includes total preventative maintenance, managing breakdowns of mechanical, electrical and robotic equipment (including software programming).

Responsibility

Assist in the management of the day to day workload for the maintenance team to ensure an effective and efficient service is delivered and departmental targets are achieved, including the planning and resourcing of Planned Preventative Maintenance (PPM) and maintenance shutdown.

Results

- Knowledge of raw materials
- Data collection and interpretation
- Audition of material and processes
- Monitoring product quality
- Testing of product and process

Additionally, mechanical and technical skills are helpful for these professionals, as they commonly use specialized tools and read and interpret blueprints and technical documents.

Value

Designing processes, systems, methodologies, components…to enhance the overall component performance for the customer.

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Carry out production tests	Quality Product KPIs for the process performance	initiative/judgement in work methods and in interpreting and delegating work requirements/goals/data…	Development of production plans	initiative Organizational skills Prioritazitation of work
Provide technical support in the area of machine pre-delivery inspection, Production line and Quality line	Re-work reduction First time through results	Self-supervising within the guidance and expectations of direct management but at the same time be excellence in approach to work and people activities	Knowledge of lean manufacturing techniques and recognised QC (Quality Control) tools Production knowledge	Work independently and is reviewed infrequently with minimal supervision Ability to coach, counsel and lead a team of people To lead and develop people Ability to communicate with clarity, both verbally and in written form
Ensurance all products flow throught the inspection department	No stops in production line The planned volume of goods produced	Practical hands-on approach to problem solving	Strong PC skills and experience of packages such as SAP (Standard Analyses: Purchasing Information System) Mechanical, electrical, electronic or software background with a working knowledge of the other disciplines	Ability to communicate with clarity, both verbally and in written form Self-supervising within the guidance and expectations of direct management
Be aware and work to achieve the KPIs	KPI´s	Excellent organization skills Excellent problem-solving skills Ability to manage a wide variety of activities at the same time Ability to plan, analyze and challenge	Completed a recognised indentured apprenticeship in maintenance management Experience of working with facilities management	Demonstrate excellence in approach to work and people activities Good understanding of customer expectations and deliverables with an

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
			Commercial understanding of the impact of failure/downtime on production and ultimately customer delivery	awareness of the impact of failure/cost of poor quality Able to identify root cause of any losses Practical hands-on approach to problem solving
Ensure compliance and assist with adherence to the Quality Management system (TS16949/ISO9001) Comply with the Health, Safety and Environmental Policies	Policies Knowledge Enviromental mentality / compromise Work Producers Registers Quality policies	Financial acumen with ability to balance material usage Able to identify root cause of any losses	Knowledge of Quality standard TS16949, ISO 9001, etc. Knowledge of Health & Safety legislation including ISO14001 and responsibilities	Ability to plan, analyse and challenge. Essential Health, Safety & Environmental constraints, critical thinking,

Notes

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Job profile Auto 4.0

Name: **Quality 4.0 Technician**

Overall description

What he does

Inspects and tests incoming parts from companies comply with the quality standards and requirements of the client. They support the Quality Engineers by providing production expertise to resolve issues with the production operation.

Responsibility

The Quality 4.0 Technicians, assist/support the Quality Engineers by providing production expertise to resolve quality issues within the production operation. Ensure that the product meets customer's requirements at each stage of its manufacturing process, carrying out relevant testing and where necessary take corrective action to rectify non-conformance issues. Report quality issues data, ensuring the Quality Management System is adhered to at all stages.

Results

- Knowledge of raw materials
- Data collection and interpretation
- Audition of material and processes
- Monitoring product quality
- Testing of product and process

Additionally, mechanical and technical skills are helpful for these professionals, as they commonly use specialized tools and read and interpret blueprints and technical documents.

Value

Designing processes, systems, methodologies, components…to enhance the overall component performance for the customer.

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Carry out product tests and thorough independent final inspection of finished assemblies to defined procedures, formally reporting all defects	Tested products Tested assemembly Procedures Pegistries	Undestanding of quality system	How to inepect a product and an assembly line	Self organization Analysis capacity Problem Solving
Provide technical support in the area of machine pre-delivery inspection, Production line and Quality support activities	Technical support and knowledge	Knowledge of Advanced Product Quality Planning (APQP), Production Part Approval Process (PPAP), Failure Mode and Effect Analysis (FMEA) Lean Manufacturing knowledge Awareness of TS16949 Awareness of ISO9000 Understanding of ISO14001		Teamwork & effective communication with co workers Analysis capacity Attention to detail, accurate measuring & recording Teamwork & effective communication with co workers
Ensurance all products flow throught the inspecion department	The planned volume of goods is produced to the quality/cost/delivery (QCD) requirements	Knowledge of measurement Understanding of engineering drawings Understanding manufacturing processes Ability to work in a diverse and dynamic environment Planning and prioritising activities	Strong pc skills and experience of package of SAP Mechanical electrial and electronical background	Be able to work at line speed & maintain quality at all times
Be aware and work to achieve the KPIs	Reports KPI´s	Good communication and interpersonal skills Problem-solving skills	Experience in working with facilites management	Contribute to continuous improvement activities

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
		Understanding of Health and Safety practices	Commercial undestanding of the impact of failure on production and customer delivery	Take the intiative to identify issues and implement changes using the new technologies Ability to comunicate.
Ensure compliance and assist with adherence to the Quality Management system (TS16949/ISO9001) Comply with the Health, Safety and Environmental Policies	Policies Knowledge Enviromental Compromise	Ability to work on own initiative Analytical skills Team working skills Analytical skills Understand lean manufacturing	Knowledge of health and safety legisltaion, including ISO 14001 and responsibilities	Esential health, safety and environmental constraints Critial thinking Practical hands-on to problem solving

Notes

Facilitator/s	Participant/s	

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Job profile Auto 4.0

Name: **Production Supervisor**

Overall description

What he does

Responsible of the components' manufacturing on an specific line. This position usually includes people management, reporting, etc. They work as a project leader at factory level.

Responsibility

Assist the Production Manager responsible for the operation of an assigned area in terms of production, quality, cost, delivery, technical, safety, and human resources, whilst respecting the defined goals. Responsible for the day to day management of people within production, to ensure company's targets and objectives are met to meet customer requirements, ensuring that staff comply with health, safety and standard operating procedures. Strive to continually improve using Lean tools to reduce costs, improve production and quality. Act with minimum supervision. Decisions and results have an impact on the function and their success. Performance affects the function's image.

Results

- General and global knowledge of the company, specially in:
    - Quality
    - Cost
    - Delivery
    - Safety

- Continous improvement of the company
- Lean Manufacturing
- Working independency

Value

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Ensure safe working practices are maintained and 'Standard Operations' adhered to	Ergonomic enviroment Accident prevention	Safety at work procedures and policies	Process audition	Decision making Problem Solving Assertiveness
visual management, delivering shift briefs with focus on quality, cost and delivery, and gathering ideas for improvement	Reports Work procedures Improvement ideas	High level of numerical and analytical ability Strong analytical and problem solving skills and able to establish logical practical solutions Computer literate with good numeric skills	Ability to communicate at written leve, focusing in the methods and summarizing goals in quality, cost and time	Problem solving Decision making Self organization
Drive performance of team members, giving direction and feedback to aid good performance		High level of numerical and analytical ability ability to lead and motivate a team of people to succeed by utilising appropriate interpersonal styles including leading by example, setting objectives and defining responsibilities to give a clear sense of direction	Ability to sustain and develop team working and team based problem solving Ability to build effective relationships with work colleagues Excellent communication skills	Problem solving Decision making Self organization Empathy Orientation to results

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
utilisation of lean manufacturing techniques, strive to exceed the Company targets in productivity, efficiency and quality on a continuous basis. Support the implementation of engineering changes, production trials, model change and pilot build	VSM KPI´s	Ability to show resilience and a flexible approach Strong analytical and problem solving skills and able to establish logical practical solutions Experienced with a number of systems, expert in at least one area and working knowledge of a number of other areas of specialisation	Adaptable to change and varying situations	Self organization Problem solving Delegate Goals Management
Identify and eliminate root cause using robust countermeasures. Sustain the corrective actions to eliminate repeat issues	New procedures Corrective actions	High level of numerical and analytical ability Full understanding of design and production costs to include waste, downtime, scrap and re-work Knowledge at FMEA (Failure Mode Effects Analysis), Kaizen/A3 (continuous improvement and problem solving), process improvement and Poka Yoke (error proofing) techniques	Full understanding of customer expectations and deliverables with an awareness of the impact of failure/cost of poor quality	Able to achieve results by setting high standards and committing to clear objectives

Notes

A.U.T.O. 4.0

Co-funded by the Erasmus+ Programme of the European Union

New competences and Job Profiles

AUTO 4.0

AUTO 4.0 Job Profiles described in Germany

Data and Processes Management
IT Systems and Networks
Troubleshooting and Problem Solving
Maintenance and Repair

Co-funded by the Erasmus+ Programme of the European Union

Job profile Auto 4.0

Name: **Expert of Data and Process Management**

Overall description

What does he/she do?

An important task for skilled workers in terms of plant surveillance and plant operation is to safeguard continuous process flows. This means that skilled workers must continuously monitor processes with the help of data. In case of identified malfunctions they have to repair them immediately or to eliminate them by preventive maintenance. One of the most important prerequisites for these tasks is an overview of the entire plant control, a sound knowledge of the functions, the flow and the operation of the plant as well as closely watching the monitoring systems. The skilled workers must be able to read, analyze, and interpret data transmitted via these systems. Reading, analyzing, and processing of machine data and their preliminary data is another important task for skilled workers. Data are most important for the setting-up of a machine and for a quality-based operation of plants.

Skilled workers must be able to read, analyze, and interpret all relevant operational data (loads, machine and consumption modes). Deviations from standard values have to be identified and dealt with immediately in case of malfunctions. The statistical process control (SPC) in networked production systems is no longer just focused on an individual machine but more and more on entire production sections under the responsibility of the skilled workers.

Responsibility

An efficient plant operation calls for skilled workers to carry out parametrization tasks on their own. The correction of programming sentences and/or data analyses are also part of their field of tasks. Skilled workers must continuously monitor processes. One of the most important prerequisites for these tasks is an overview of the entire plant control, a sound knowledge of the functions, the flow and the operation of the plant as well as closely watching the monitoring systems. The skilled workers must be able to read, analyze, and interpret data transmitted via these systems.

Results

The “Data and Process Management” produces the following results:

- to exchange data between different network interfaces and manufacturers (gateways),
- to update the new production data (technological and constructional) applied in the intelligent manufacturing systems,
- to propose the solutions for application of Big Data in the production process by referring to the existing knowledge of the physical, technological and business (commercial) interrelation,
- to use the data from the cloud or Big Data for the formulation of inquiries as well as to evaluate the data,
- to benchmark and compare production data on the level of workplace and on the level of enterprise / sector.
- to protect customers data in the case of production of personalized products in order to ensure, that personalized products would not get into mass production,

Value

To work with the visualization and assistance systems, to use data, to remote monitoring technologies to control the equipment, components and individual parts with CPS helps to make production safe and transparent.

Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
Exchange of data between different network interfaces and manufacturers (gateways), Update production data (technological and constructional) applied in the intelligent manufacturing systems.	Optimized exchange of data between different network interfaces and manufacturers and updated production by use of data.	Skilled workers have to focus on their thinking by starting from the processes and from the software and thus optimize plants and their functions. This requires an entirely different understanding compared to monitoring mechanically-electrically operated plants. This other understanding is highly relevant for both the operation and the optimization of the plants and their integration into the overall production process.	Industry 4.0 requires the programming of plants, machines, their components and process sequences. This requires a variety of programming tasks, for which persons must be qualified. It is therefore necessary to develop plant-related overview knowledge for robot programming, object-oriented programming and, for example, for Java programming. The focus must be on developing an understanding of program structures related to systems to be able to optimize intelligent manufacturing systems.	Know how the network of the plants is interconnected and how an optimization work has to be done. Continuing training has to be ensured in this field.
Propose the solutions for application of Big Data in the production process by referring to the existing knowledge of the physical, technological and business (commercial) interrelation.	Machinery / plant has to run 24 hours without interruptions	Sound understanding of the interlinkage of process sequences and the interconnection of control of plant control units, the network of technology for interlinkage of machines, the handling of data to guarantee data security, data protection, WLAN networks, professional buses and IT technology.	An efficient plant operation calls for skilled workers to carry out parametrization tasks on their own. The correction of programming sentences and/or data analyses are also part of their field of tasks. The most important thing is to master the various combinations of software, to read displays, to check where a sensor does not work and to correct such a fault. Skilled workers are needed for these tasks who are particularly committed, who are constantly learning new things and deal-	Analyze the internal function of a plant and ensure the operation.

Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
			ing with plant operation, and who ultimately know all the details of a plant sequence.	
Use the data from the cloud or Big Data for the formulation of inquiries as well as to evaluate the data, Benchmark and compare production data on the level of workplace and on the level of enterprise	Optimized monitoring of the machinery and plants by use of data in different formats. Benchmark of the efficiency with different workplaces.	The monitoring of plants – also of several plants simultaneously – counts among the important tasks for skilled workers. Above all the flawless operation of plants must be safeguarded. This means that the available real-time data must be continuously monitored, analysed and evaluated and the overall operation of the plants must be monitored and corrected if necessary. The monitoring of noise generation by machines is as important as data providing information on production monitoring and production quality within the production processes and the products to be manufactured.	Reading, analyzing, and processing of machine data and their preliminary data is an important task for skilled workers. Data are most important for the setting-up of a machine and for a quality-based operation of plants. Skilled workers must be able to read, analyze, and interpret all relevant operational data (loads, machine and consumption modes). Deviations from standard values have to be identified and dealt with immediately in case of malfunctions. The statistical process control (SPC) in networked production systems is no longer just focused on an individual machine but more and more on entire production sections under the responsibility of the skilled workers.	Companies need internal regulations of data security which have to follow existing laws.
Protect customers' data in the case of production of personalized products in order to ensure, that personalized products would not get into mass production.	Be able to modify and test drive the different possible settings and parameters in a process by using available data. the planning of work, Creation of new algorithms and appli-	The network structures within the value added chain and the use of sensors and actuators are exactly planned and realized. It is also important to consider all preceding and subsequent processes and to make sure that all data important for the overall process (programs, interface configurations, statistical data, data for quality check and networking) can also be processed by	This means that the available real-time data must be continuously monitored, analysed and evaluated and the overall operation of the plants must be monitored and corrected if necessary. The monitoring of noise generation by machines is as important as data providing information on production monitoring and production quality within the production processes and the products to be manu-	Ensure and maintain the access of customers to monitoring and controlling of their own production process, including the production schedule and costs.

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Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
	cations in order to link many things and common synchronization with the entire value stream. Ensure data security.	skilled workers.	factured. Application of identification systems (e.g., RFID, QR code) as well as system and communication interfaces (OPC UA, ODBC). Deal with safety-relevant process steps and the corresponding steps in the software application.	

Notes

The requirements have in focus a person linked to competence level 5 & 6 of the EQF.

Facilitator/s	Participant/s	

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Job profile Auto 4.0

Name: **Expert of IT-Systems and Networks**

Overall description

What does he/she do?

IT experts must be able to evaluate the technical function, the possibility of and the weak points of individual IT-system components within production and in connection with the other processes of the value chain in order to draw the right conclusions in the event of malfunctions and to eliminate the malfunctions in a targeted manner. Plant operation must not be disrupted in the process.
Behind IT-systems are complex router configurations, firewall technology, error identification with the help of software, address systems of CPS components and their integration into the MES system.
Digitalized plant networking is playing an increasingly important role in production in companies. Employees must be able to control networked systems in such a way that process reliability is guaranteed. Overall: Monitor and control networked systems.

Responsibility

The overall responsibility is: Depending on the situation, to eliminate IT disruptions in the production! It has to be ensured that the multiple highly complex systems are running without an interruption. IT Systems and components within the production lines have to be checked and their error-free function has to be ensured. Malfunctions have to be prevented before they occur or before they develop into major defects.

Results

The “Expert of IT Systems and Networks” produces the following results:

- ensures the function of production lines,
- controls and monitors networked systems,
- supports optimization of production lines,
- solves malfunctions/ breakdowns immediately,
- ensures the function of the components of the IT systems.

Value

Ensuring process sequences and the control of plant control units, the control of network technology for networking machines, the handling of data to guarantee data security, data protection, WLAN networks, professional buses and IT technology.

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Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
Ability to ensure the function of production lines	Save and continuous process of the machinery/ plant	Competences needed to deal with plant monitoring in the field of mechatronics and electronics: • To apply remote monitoring technologies to control the equipment, components and individual parts with CPS. • To work with visualization and assistance systems. • To ensure and maintain the access of customers to monitoring and controlling of their own production process, including the production schedule and costs. • To ensure mutual transparent monitoring of the production management systems.	Above all the flawless operation of plants must be safeguarded. This means that the available real-time data must be continuously monitored, analysed and evaluated and the overall operation of the plants must be monitored and corrected if necessary.	Know how the network of the plant is interconnected as background for fast reactions if needed
Controls and monitors networked systems in different production environments	Machinery / plant has to run 24 hours without interruptions	Sound understanding of the interlinkages of process sequences and the interconnection of control of plant control units, the network of technology for interlinkage of machines, the handling of data to guarantee data security, data protection, WLAN networks, professional buses and IT technology.	The skilled workers must make sure that all mechanical, hydraulic, pneumatic, electrical and electronic functions are safeguarded so that the plant can operate flawlessly and that it can be integrated into the production network. They also have to ensure the data availability of sensors, actuator and process data in production systems (PPS, MES, SCADA, ERP, SAP).	The IT infrastructure has to be organized in a transparent way by following defined standards

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Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
Supports optimization of production lines	The machinery / plant has to be organized in a way that the highest possible quality rate is reached without interruption of the process	Behind IT systems are complex router configurations, firewall technology, error identification with the help of software, address systems of CPS components and their integration into the MES system. The ability to understand the interconnection and the functions of all the units is a must!	Employees must be able to control and optimize networked systems in such a way that process reliability is guaranteed. Further requirements: • execute intelligent process control by using autonomy devices and adaptive systems. • use the process interfaces of the assistance systems as well as devices with local intelligence and decision capability. • use of the QR/RFID codes of production systems. • apply identification systems (e.g., RFID) as well as system and communication interfaces (OPC UA, ODBC). • To deal with safety-relevant process steps and the corresponding steps in the software application. • establish the access protection for automation systems as well as set-up of IT networks using network routers.	Work cross functionally & collaboratively with partners in the production lines; a variety of activities have to be managed
Solves malfunctions/ breakdowns immediately	Fault-free production process based on a save IT infrastructure. Solving problems in a short time and ability to ensure a safe and efficient	Mechanical, electrical, electronic or software background with a working knowledge of the other disciplines; knowledge of the function of plants and components and the specific role of software. Knowledge of a software based diagnostic process.	Ability of faults diagnosis and its repair. As soon as malfunctions occur – e.g. caused by flawed products or process flows – skilled workers must be able to identify and remove eligible causes. This implies that they are able to master diagnostic procedures which not only encompass mechani-	Practical hands-on approach to problem solving; experience of a software based diagnostic process

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Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
	process of the production unit and all the different components		cal and electrical/ electronic basic functions but also the digital control of the production process. This is why malfunctions can no longer be identified and repaired directly at the sensors, actuating elements or cabling but rather via IT-systems or within the networking of the production.	
Ensures the function of the components of the IT systems to support production processes	Bring about more real time decision making & focused PPM activity	Is able to use the industry-specific software products of production safeguarding and preventive maintenance (PPS, ERP,MES, CAQ) to handle the production work process at workplaces, Understands the communication between components and the internet of things,	Has the competences to ensure save function of the signals in IT networks to ensure downtimes Is responsible for ensuring security of data and reducing the risk of cyber security threats. Cooperates in failure repair actions with engineers and teams from different disciplines.	Knows about the impact of failure & downtime on production and costs and customer delivery time. Aware of the importance of cyber security

Notes

The requirements have in focus a person linked to competence level 4 & 5 of the EQF.

Facilitator/s	Participant/s	

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Job profile Auto 4.0

Name: **Expert in Troubleshooting and Eliminating / Repair Malfunctions (= profile 3 and 5)**

Overall description

What does he/she do?

Skilled workers must be able to apply standardized diagnostic procedures and to develop individual search strategies to diagnose malfunctions in technically complex systems. Fault diagnosis refers to mechanical, hydraulic, pneumatic, electrical/ electronic and software components of networked systems. This requires the cognitive penetration of an observed system on the level of the technical architecture as well as on the level of the logical software architecture. This means that diagnostic work requires not only knowledge about the physical connections of the system elements and about the data flows occurring in the system, but also the ability to access such structures. These prerequisites enable the acting specialist to interpret directly perceptible information (e.g. noise qualities of systems) as well as technically conveyed information (e.g. fault messages or actual values), to uncover causal relationships between events and to identify the causes of faults. On this basis, measures for the proper restoration of the target condition shall be determined. Target perspective: Diagnosis, troubleshooting of the networked systems.

Responsibility

Trouble shooting and repair. Skilled workers must be able to apply standardized diagnosis procedures as well as to develop individual trouble shooting strategies in order to diagnose malfunctions in technically complex systems.

Abstract interconnections in plants must be analysed and the malfunction has to be repaired. It is most important to master the multiple combinations of software, to determine and to interpret process data, to carry through adequate checks and to repair the identified causes for malfunction. Malfunctions in mechanical components must not be neglected.

Results

The “Expert in Troubleshooting and Eliminating / Repair Malfunctions” produces the following results: He/she

- Knows the principles for identification of standard faults and difficult faults,
- Carry through different modes of diagnostic procedures (standardized, not standardized),
- Analyses technically complex systems and IT architecture,
- Solves malfunctions/breakdowns immediately,

Value

As soon as malfunctions occur – e.g. caused by flawed products or process flows – skilled workers must be able to identify and remove eligible causes. This implies that they are able to master diagnostic procedures which not only encompass mechanical and electrical/ electronic basic functions but also the digital control of the production process. This is why malfunctions can no longer be identified and repaired directly at the sensors, actuating elements or cabling but rather via IT-systems or within the networking of the production.

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Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
Knows the principles for identification of standard faults and difficult faults	Able to differentiate between different types of faults and their consequences and how to diagnose them	Fault diagnosis refers to mechanical, hydraulic, pneumatic, electrical/ electronic and software components of networked systems. This requires the cognitive penetration of an observed system on the level of the technical architecture as well as on the level of the logical software architecture.	Different types of malfunctions must be known and the ability to apply standardized diagnostic procedures and develop individual search strategies to diagnose malfunctions in technically complex systems has to be a well developed competence	Software based diagnostic processes have to be supported by the company and all partners
Carry through different modes of diagnostic procedures (standardized, not standardized)	Fault-free production process based on a save IT infrastructure. Solving problems in a short time and ability to ensure a save and efficient process of the production unit and all the different components	Knowledge of the function of plants and components and the specific role of software. Know about the interlinkage of mechanical, electrical, electronic or software for the function of the machinery and the risk for different types of faults. Knowledge of how to analyze the whole machinery of a plant in case of a malfunction	Skilled workers must be able to identify and remove eligible causes. This implies that they are able to master different modes of diagnostic procedures which not only encompass mechanical and electrical/ electronic basic functions but also the digital / software control of the production process. This is why malfunctions can no longer be identified and repaired directly at the sensors, actuating elements or cabling but rather via IT-systems or within the networking of the production.	Practical hands-on approach to problem solving; experience of a software based diagnostic process
Analysis of technically complex systems and IT architecture	With the help of a permanent analytical process it has to be ensured that the plant runs without interrup-	Deep understanding of the interlinkages of process sequences and the interconnection of control plant units, the network of technology for interlinkage of machines, the handling of data to	Diagnostic work does not only require knowledge about the physical connections of the system elements and about the data flows occurring in the system, but also the ability to access such structures with the help	The network of the plant and its interconnection has to be transparent for fast reactions if needed

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Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
	tion	guarantee data security, data protection, WLAN networks, professional buses and IT technology. Know how to use this knowledge for a diagnostic process.	of diagnostic instruments. These prerequisites enable the acting specialist to interpret directly perceptible information (e.g. noise qualities of systems) as well as technically conveyed information (e.g. fault messages or actual values), to uncover causal relationships between events and to identify the causes of faults.	
Solves malfunctions/breakdowns immediately	All the faults and malfunctions or other breakdowns will be solved / repaired in the shortest possible time	Knows about a save function of the signals in IT networks, the software, the components and the whole machinery. Is able to analyze the function and to react very fast if the processes are disrupted by any fault. Takes over responsibility for ensuring security of data and reducing the risk of cyber security threats.	Abstract interrelationships within plants are analysed and malfunctions repaired. It is important to master the multiple combinations of software, to determine and to interpret process data and to carry out adequate checks in order to repair the identified causes for malfunctions. Malfunctions of mechanical components must not be neglected.	Knows about the impact of failure & downtime on production and costs and customer delivery time. Aware of the importance of cyber security

Notes

The requirements have in focus a person linked to competence level 4 of the EQF.

Facilitator/s	Participant/s	

Co-funded by the Erasmus+ Programme of the European Union

Job profile Auto 4.0

Name: **Experts of Maintenance and Repair**

Overall description

What does he/she do?

The tasks for skilled workers encompass simple 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 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, and visualization of operational and production data and should be ready to be applied at the production work places at all times. In addition skilled workers must also master virtually organized maintenance tasks and must apply assistance systems for trouble shooting, documentation and knowledge transfer.

Responsibility

Skilled 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 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.
To perform individualized maintenance of components of machines and plants by using continuous process 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.

Results

The “Experts of Maintenance and Repair” produces the following results: he/she

- 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.

Value

Maintenance and repair tasks in networked plants and individual machines are as a rule carried out by maintenance teams. These teams are specialized in such 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.

Main activities carried out	***Output/Outcome***	***What he/she needs to know***	***What he/she must know how to do***	***What organizational behavior is required?***
Evaluate the information on the wear and tear of plant parts from a continuous monitoring of the machines by sensors.	Avoids damage and interruption with the help of a permanent analytical process of plant parts and plant systems by use of sensor data, visible inspection and experience.	Skilled workers must have access to the function of plants and must be able to cope with (metal-technological, electrical, IT-based) maintenance tasks in plants composed of different technological systems. They have to be able to understand the function of hybrid systems.	To perform individualized maintenance of components of machines and plants by using continuous process of data acquisition with the help of sensors and by use of implemented visualization software. Evaluation and execution of maintenance of autonomous plant systems with a remote monitoring have to be performed.	The evaluation processes have to be supported by the company and all partners. Necessary tools must be available.
Supporting the production work process by use of the industry-specific software products of production planning and preventive maintenance.	Use the industry-specific software products of production planning and preventive maintenance (PPS, ERP, MES, CAQ) to handle the production work process at the workplace. Executes the maintenance of all parts and systems with remote monitoring, with diagnostic tools, with simple tools …	Performing individualized maintenance of components of machines and plants by using continuous process of data acquisition and implemented visualization software. Understanding of benefits of preventive maintenance and the use of data.	Difficult maintenance and repair tasks in networked plants and individual machines are as a rule carried out by maintenance teams. These teams are specialized in such 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.	Understands the impact of optimized maintenance work on production and ultimately customer delivery
Carry out preventive maintenance prepared by recording, processing, and visualization of	To execute maintenance of the production control systems based on Big Data and clouds.	Sound understanding of the interlinkages of process sequences and the interconnection of control plant units, the network of technology for interlinkage of machines, the han-	Systematic exchange of information between plant manufacturers, operators and maintenance personnel is very important. This is the only way for the skilled	The network of the plant and its interconnection has to be transparent for efficient maintenance tasks.

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Main activities carried out	*Output/Outcome*	*What he/she needs to know*	*What he/she must know how to do*	*What organizational behavior is required?*
operational and production data.		dling of data to guarantee data security, data protection, WLAN networks, professional buses and IT technology. Know how to use this knowledge for a diagnostic process.	worker to deal with problem cases within the work process and ensure the exchange of knowledge. Plant and machine statuses can be queried on the move and displayed in virtualized form (with the help of clouds, Big Data or augmented reality, for example).	
Execute maintenance of the production control systems based on Big Data and clouds.	Highly efficient maintenance procedures by using clouds, Big Data and cyber security issues.	Knows the development of planned maintenance or preventative maintenance (PPM) schedules using cloud computing and big data programmes. Understanding and awareness of cyber security issues and how they could have an impact on the facility. Understanding of internet of things and ways in which they can capture more data and how the data might be used for maintenance.	Skilled workers master procedures for the identification of malfunctions (data analysis), causes for malfunction and their repair in complex, networked plants. Skilled workers are able to use the data from the cloud or Big Data for the formulation of inquiries as well as for efficient maintenance. Skilled workers perform individualized maintenance of components of machines and plants by using a continuous process of data acquisition. Skilled workers ensure: preventive, foresighted maintenance for multi-functional machines, assessment and use of different data and data formats.	“Tools” for efficient maintenance have to be available

Notes

The requirements have in focus a person linked to competence level 5 of the EQF.		
Facilitator/s	Participant/s	

A.U.T.O. 4.0

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New competences and Job Profiles

AUTO 4.0 Job Profiles described in Italy

Mechatronic Operator 4.0 (Opeerating Technician in Automotive …)
Supplier Quality Assurance 4.0
Technologist New Production Processes
Cyber Security Technician
Data Scientist
Data Architect

Job profile Auto 4.0

Name: Operating technician 4.0 in automotive rotating machines

Overall description

What he does

The Operating technician 4.0 is the worker of the future, when the factory will be completely interconnected. It is a mechatronic, a job profile that integrates at least three different job profiles today:

- Qualified worker;
- Mechanical maintenance technician;
- Electronic maintenance technician;

He mainly deals with machine control, feeding of the machines, maintenance and troubleshooting.

Responsibility

It has the responsibility of guaranteeing production, avoiding machine stops, intervening directly in case of failures / errors.

Results

The Operating technician 4.0 automotive rotating machines produces the following results:

- Machine feeded by raw materials
- Repaired machine
- Zero interruptions
- Conforming product
- Improved product
- improved process

Value

Produces the product in compliance with the requirements ensuring the level of productivity required in interaction with the interconnected machines.

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
Carries out diagnostics for troubleshooting	Fault detected	Basic IT knowledge Machine Management Software	Start the machine diagnosis procedure Interpreting the results of the diagnosis Anomaly Management Knowledge of basic English language	Self and time management Openness to problem solving of complexity Adaptability and capacity for change
Correct software faults and errors (bugs)	Machine repaired	Basic IT knowledge Machine Management Software	Write to basic PLC / java Write in English language	Ability to use collaborative problem solving tools Ability to collaborate
Performs predictive-preventive maintenance	Maintained machine	Knowledge of advanced device tools Basic IT knowledge Machine Management Software Machine specification maintenance procedures Security procedures Knowledge of technical English language	Write to basic PLC / java Replace worn parts/materials using specific tools	Self and time management Respect for safety procedures Working remotely
Control and monitoring of production processes	Decisions on the production process	Deep knowledge of activities and production processes Big data processing and interpretation techniques (basic) Data Processing Applications	Store, extract and read big data from machines Processing and interpreting portions of big data (those relating to emergencies or requiring immediate intervention) Knowledge of basic English language	Ability to communicate in online workshops Ability to collaborate in a dialogical way Openness to complex problem solving

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
				Continuous improvement oriented mindeset Adaptability and capacity for change
Product quality controll	Compliant product	Knowledge of the technical characteristics of the product Product specific requirements (codes) Knowledge of basic English language	Use manual and/or electronic measuring instruments	Accuracy Quality orientation
Workings in collaboration with machine-robots (supervision)	Product quality Process improvement Improving productivity Zero interruptions Production continuity	Operating logic of man-machine interfaces Deep knowledge of the activities and production processes of the robot machine Basic IT knowledge Machine-robot management software	Interact with the machine to perform operations Driving the machine in unplanned operations Perform precision manual operations Understand devices worn instructions (glass) Knowledge of basic English language	Precision and expertise in operations Respect for procedures
Problem identification and analysis in multi-level teams Complex Kaizen development	Improvement plan	Complex problem solving tools Quick PDCA SPC Techniques and data interpretation processing Knowledge of basic English language	Participate in a dialogue process Apply the 7 advanced tools Use collaborative digital collaboration tools Finding solutions to complex problems	Openness to diversity of opinion Ability to handle ambiguity Cross-fuction collaborative relationship Reporting capabilities

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
				Communicate effectively

Notes

Facilitator/s	Partecipant/s	
Fabrizio Coccetti	Gallo Angelo	Defilippis Rosanna
	D'Alessandro Giuseppe	De Sanctis Vincenzo
	Laccetti Sandro	

Job profile Auto 4.0

Name Supplier Quality Assurance 4.0

Overall description

What he does
The SQA4.0 almost exclusively verifies suppliers in production, identifies specific emerging critical issues and supports them in solving problems in connection with the process engineer, also through physical and remote audits..

Responsibility
Promote the growth of suppliers ensuring quality and delivery for the customer

Results
Knowledge of the product / raw material
Complete knowledge usable and transferable (manual, guidelines ....)
Prediction of potential critical issues
Non-compliant product forecast
Weak signals (critical issues) of the supplier in terms of Quality, Delivery

Value
Capabilities and supplier performance growth

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
Get to know the supplier's product in depth	Knowledge of the product / raw material	Connection system with the supplier's data base	Access product projects Evaluate designed quality Evaluate the finished product / raw material	Expertise
Know the supplier process in depth	Complete knowledge usable and transferable (manual, guidelines ....)	Basic mechanics, electrical, electronics and automation System connects to the supplier's data base	Read and interpret on-going process indicators	
Supplier big data process permanent remotely monitor	Prediction of potential critical issues	Basic statistics (mean, median, fashion, variance, mean square deviation, relative / absolute error) and advanced statistics etc. Machine Learning Use of computer libraries Elements of cybersecutity Sensemaking capability	Use programming methods for descriptive analysis. .). Use of computer analysis libraries, such as Python, Pandas, Numpy to recognize the premonitory anomalous data Use of Machine Learning advanced modeling tools	Collaborative ethics
Make predictive analysis using machine learning model	Non-compliant product forecast	Machine Learning, Statistics, Mathematics, advanced tools	Use of Machine Learning advanced modeling tools. For example, knowledge of the advanced libraries scikit-learn, scipy, TensorFlow etc.	Future forecasting capacity Attention and concentration Curiosity
EDER (Early detection, early reaction)	Weak signals (critical issues) of the supplier in terms of Quality, Delivery	Elements of industrial design	Being able to remotely: - Process FMEA / NQAR - Evaluate production capacity	Being able to work in a team Effective communication

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
Get to know the supplier's product in depth	Knowledge of the product / raw material	Connection system with the supplier's data base	Access product projects Evaluate designed quality Evaluate the finished product / raw material	Expertise
Know the supplier process in depth	Complete knowledge usable and transferable (manual, guidelines ....)	Basic mechanics, electrical, electronics and automation System connects to the supplier's data base	Read and interpret on-going process indicators	
Supplier big data process permanent remotely monitor	Prediction of potential critical issues	Basic statistics (mean, median, fashion, variance, mean square deviation, relative / absolute error) and advanced statistics etc. Machine Learning Use of computer libraries Elements of cybersecutity Sensemaking capability	Use programming methods for descriptive analysis. .). Use of computer analysis libraries, such as Python, Pandas, Numpy to recognize the premonitory anomalous data Use of Machine Learning advanced modeling tools	Collaborative ethics
		Experimentation Base in the rotating machines product Metrology base Knowledge of processes and technologies Knowledge of XR card	- Do the Statistic Process Controll	

Note

Facilitator	Partecipants	
Fabrizio Coccetti	Maurizio De Palma	
	Luca D'Adamo	

Job profile Auto 4.0

Name Technologist new production processes 4.0

Overall description

What he does

The Technologist new production processes 4.0 has the role of designing and supporting the implementation of new production processes 4.0. He choose the technology or mix of technologies to be connected, designs new production processes together with the manufacturer, supports process implementation and staff training. It supports process improvement..

Responsibility

The Technologist new production processes 4.0 is responsible for choosing the best process solution

Results

The results produced are different:

- complete knowledge on the process;
- knowledge on the critical requirements of the product to be considered in the definition of the production method (zero-base analysis);
- PFMEA results
- Process technical specifications including innovative technologies (4.0) with high added value
- Delivery of the plant with the expected QCD + S output
- Productive personal skills developed
- Line target installed

Value

The Technologist new production processes 4.0 helps to identify the best process strategy

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
Acquire knowledge on the new "x" basic process	Complete knowledge usable and transferable (manual, guidelines ....)	Basic mechanics, electrical, electronics and automation	Acquire and develop the basic knowledge of the process	Knowing how to use networking in the Denso group and on the outside in order to acquire information
Acquisition of knowledge on the product	Knowledge of the critical requirements of the product to be considered in the definition of the production method (zero-base analysis)	Mechanics, electrical and electronics	Acquire and develop the basic knowledge of the product	Knowing how to use networking in the Denso group and on the outside in order to acquire information
PFMEA realization	PFMEA result	Product and production process	Analyze the types of failure and methods to prevent it and intercept it	Lead an inter-functional team in a methodical and proactive way
Definition of the technical specifications of the process	Process technical specifications including innovative technologies (4.0) with high added value	- Mechatronics - Automation - Product - Process - State of the art of technology and innovation (cloud, Industrial IoT, Advanced Manufacturing, Industrial Analytics)	- Designing the flow of information and data collection with a view to 4.0 He's able to: - Draw up a thorough Process Design Review - Make a Zero-Base analysis starting from the product datums	Collect input data from other bodies to analyze them. Conduct the definition of the production process and have it approved

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
			- Scouting new technologies usable for our processes	
Implementation of activities from the design by the supplier to the installation	Delivery of the plant with the expected QCD + S output		Organize and control the planning of the entire activity	Coordinate the internal inter-departmental group and the organization of the suppliers
Personal productive training	Productive personal skills developed	Knowledge of the product / process acquired	Identify the key characteristics for training and structure them to make them accessible to operators	Adaptation to the work context Ability in transferring information
Assistance to start the new process	Target achievement at installed line	Indices of performance of a production line.	Acquisition and analysis of production data. Analyze and interpret big data Identify actions or improvement plans with an accurate analysis of root causes and necessary kaizen	Define index monitoring together with production. Good planning of improvement plans. Lead a team for improvement
Identify and define process data and parameters to be monitored	Harness the value of data to identify / prevent problems on the process	Knowledge of production processes.	Being able to analyze data to identify process problems / drifts	- Open minded; - Have interdisciplinary focus; - Strong intellectual curiosity

1. *Main activities carried out*	2. *Output/Outcome*	3. *What learners needs to know*	4. *What learners must be able to do*	5. *What organisational behaviour is required?*
Laboratory activities	Identify / test robust and definitive solutions	Knowledge the main processes and parameters for each of them	Develop prototype processes / machines to evaluate the impact of 5M + 1E	Flexibility and theoretical / logical approach.

Note

Facilitator	Partecipants	
Fabrizio Coccetti	Mario Piluso	Stefano Felice
	Francesco Di Fonzo	Silvio Scopa
	Rocco Scarinci	

Job profile Auto 4.0

Name: Cyber Security Technician

Overall description

What he does

Cyber Security Technician is the expert in cyber security and has the main task of preventing cyber threats, calculating risks, preventing or mitigating the effects of attacks and intrusion into sensitive data.
The CST has knowledge of technologies, techniques and activities that aim to ensure the protection of computer systems in terms of availability, confidentiality and data integrity.
The Cyber Security is a subset of the Information Security mainly addressed to the security aspects deriving from the exposure of services on local or external (Internet) networks (networks). The term Cyber in the IT context does not mean "cybernetic".

Responsibility:

The CST **stores and preserves** data (or information) as a strategic corporate asset in a context where the cyber risks caused by breaches of security systems are constantly increasing.
The CST is the main figure that protects and ensures security comparable to a risk management tool that deals with protecting information systems from concrete threats that have a significant probability of occurring.

Results:

- Ensure the **continuity of all services** directly and indirectly involved in information processes.
- Guarantee the **availability of data**, i.e. safeguarding information assets in terms of **guaranteeing access, usability and confidentiality of data**: eliminating the risks associated with access to information (intrusions, data theft, etc.).
- Guarantee the **Integrity of the data**, intended as a guarantee that the information does not undergo changes or deletions as a result of errors or voluntary actions, but also as a result of malfunctions or damage to technological systems.
- Guarantee **IT confidentiality**, i.e. management of security in such a way as to mitigate the risks connected with access to or use of information in an unauthorised manner.

Value:

Reliable, **solid and respected** by all customers. Data Driven Company, **competitive**, looking for greater value through digital tranformation.

1. *Main activities carried out*	**2.*Output/Outcome***	**3.*What learners needs to know***	**4.*What learners must be able to do***	**5.*What organisational behaviour is required?***
[Design] It takes care of the harmonious and coherent design of security solutions and policies.	Overview, initial investment assessment basis and future upgrades needed for the network: restructuring, remediation or expansion.	Knowledge of the existing network infrastructure in the technical details of hardware and software: equipment and protocols in use. Objective evaluation in compliance with the quality parameters of security on the basis of the future vision of the top management.	Design the security measures and policies to be adopted in the organization, with the aim of making them consistent with each other. Design the architecture as the necessary backbone for future implementations that fall within the security requirements. *[Security Architect competences]*	Critical thinking of a technical/objective type. Communication ability useful on the relation with the top management. Modeling skills.
[Implement] Implementation of technological security solutions.	Implementation of the solutions chosen to ensure security.	Clear vision of the environment on which to operate: architecture, applications and existing flows (habits). Solid system knowledge.	To make security technology solutions operational, from their production start-up to maintenance activities and support to end users. *[Security Administrator competences]*	Problem solving skills. Organisational skills.

1. *Main activities carried out*	2. *Output/Outcome*	3. *What learners needs to know*	4. *What learners must be able to do*	5. *What organisational behaviour is required?*
[Monitor] Monitoring of the systems and proposition of solutions related to the response to incidents.	Prevention of anomalies through monitoring tools.	Must have a wide knowledge of advanced monitoring tools such as intrusion detection (IDS) and intrusion prevention (IPS) systems.	Collect as much information as possible to control network traffic to prevent or counteract any security anomalies. Monitor systems for anomalies and propose incident response solutions. *[Security Engineer competences]*	Analytical spirit. Investigative character.
[Evaluate] Evaluation of vulnerabilities that may affect networks, equipment, applications and services.	Have control of the situation through risk analysis.		Gather information, know the current situation of the system. Perform process analysis by proposing solutions and practical measures to eliminate vulnerabilities that may affect networks, equipment, applications and services. Market scouting to find the most suitable solutions for specific areas of use. Verify the compliance of solutions and policies with specific regulations	Analysis skills. Data gathering and data mining skills. Market scouting skills.

1. *Main activities carried out*	2. *Output/Outcome*	3. *What learners needs to know*	4. *What learners must be able to do*	5. *What organisational behaviour is required?*
			[Security Analyst Competences]	
[Test] Implement solutions that demonstrate the vulnerabilities that the company suffers.	Confirms the inviolability of the system by simulating a cyber attack.	Security level of the single services by testing them. Ethical Hacking technics Main methods of implementation of penetration tests	Test the software by performing stress tests to detect possible quality anomalies. Identifying the procedures for demonstrating the actual danger of the vulnerabilities from which the company suffers Provide top management and executives with the necessary documentation to argue with concrete elements the weaknesses in the organization's security strategy: vulnerability reporting. Implement hacking queues to simulate malicious attacks. *[Ethical Hacker competences]*	Creative competence
[PREVENTS/AUTOMATES] Develop and monitor real-time response systems.	Strengthening of safety through Machine Learning models: preventive,	Sources from which to obtain the necessary data.	Develop and monitor real-time response systems capable of detecting and treating possible threats	Analytical spirit. Curiosity.

1. *Main activities carried out*	2. *Output/Outcome*	3. *What learners needs to know*	4. *What learners must be able to do*	5. *What organisational behaviour is required?*
	predictive and cognitive automatism.	Statistician-mathematician, knows the techniques of analytics "data science".	automatically and cognitively. *[Machine Learning Specialist competences]*	Lateral thinking. Storytelling skills.
[ENFORCE POLICIES] Ensure compliance with the policies in the requirements of the GDPR and maintains relations with the supervisory authorities.	Clear relations with the supervisory authorities: gain external confidence.	Criticality, weaknesses, presence of an action plan and method of resolution. Security policies established in the necessary quality terms.	Enforce and enforce the defined rules. Check, protect and ensure reliability. *[ICT Security Manager Competences]*	Leadership and communication skills.

Notes

Facilitatore/i	Partecipante/i	
Fabrizio Coccetti	Vincenzo De Sanctis	

Job profile Auto 4.0

Data Scientist

Summary description

What he does:

The Data Scientist extracts information from the data, models complex problems and identifies business opportunities.
Its main objective is to help the company to interpret and produce value through the processing of any type of data resulting from interconnection 4.0. The data can be present in simple or complex form. The aims of the data scientist are to optimize decision-making processes, foster innovation and competitiveness of the company, reduce costs and muda, improve customer interaction, deeply understand the client, improve productivity, quality, and profit. Data Scientist is the evolution of Data Analyst: besides having knowledge for descriptive data analysis, it also has knowledge of Artificial Intelligence (Machine Learning) for predictive and prescriptive analysis on big data.

Responsabilities:

He is responsible for the reliability and truthfulness of the data, the correct selection of the data source and choice of the best mathematical model in order to bring the correct information back to top management.

Results:

The data scientist shall develop the following results:

- Information supporting the reactive decision making of the company at different levels
- Improvement of production processes (increase in quality, productivity, development and profit)
- Improvment of the relationships with customers and suppliers
- Support for Business Analysis for new products or market expansions
- Enhancement of IT security with artificial intelligence
- Facilitation of IT reengineering through the structural modification of production processes
- Safety and environmental sustainability of the company
- Company to Data Driven / Data Revolution / Factory 4.0 oriented.
- Flexible, dynamic company, ready to adapt to the VUCA with the help of innovation (IoT, Big Data and Artificial Intelligence) in the hands of Data Scientists.

Value:

For a Data Driven company, the value developed by the Data Scientist concern to a new and emerging intelligence, new knowledge that facilitates and improves the quality of strategic and operational decisions.

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
Knowing and understanding the objectives set by top management	Clarity of objectives to be achieved: Target defined	Business knowledge and communication skills	Interfacing with the Top Management or project manager	Communicative skills. Understanding of the business problem. Alignment to clear vision
Search for and select a suitable analytical model for data processing in order to reach the target	The **roadmap** for target development: - Identify the source of the data to be collected - Individuate the type of analysis: descriptive, predictive, prescriptive or cognitive - The best Statistical Model to Use - Choice of IT tools necessary for development	Knowledge of Statistics/Linear Mathematics, Machine Learning and Advanced Programming (Computer Science)	Know how to define the ideal data mining model type: - supervised (knn classification models, decision trees, naive bayes... or linear regression and SVM). - unsupervised (clustering models with K-means and association). - Semi supervised (with graph-based and generative models).	Curiosity adaptive evolutionistically consistent.
Collection of structured and unstructured data from as many sources as possible (Big data, web, excel, blog, text, traditional databases)	Merge all data needed to process for the target from multiple sources	Domain and Computer Knowledge.	He is able to collect data from different sources, not only with SQL language techniques but also with the use of more advanced techniques such as "web scraping" or "map reduce" on big data.	Capacity for lateral thinking and team work in collaboration with other bodies.
Data wrangling and data normalization	Cleaning of the results of the analysis from unhelpful parts	Use of IT tools for advanced data analysis.	Feature engineering on the data. Use of advanced dataframe processing tools	“Engineering creativity”

1. *Main activities carried out*	2. *Output/Outcome*	3. *What learners needs to know*	4. *What learners must be able to do*	5. *What organisational behaviour is required?*
	and data adaptation for the next model (normalization).		and data matrices. For example python, pandas, numpy, jupyter notebook, zeppelin etc..	
Descriptive analysis of data by statistical model	First tangible result from historical data of a non-predictive type to analyze the present.	Basic statistics (average, median, mode, variance, standard deviation, relative/absolute error, etc.)	Use programming methods for descriptive analysis. Use computer libraries of analysis, for example Python, Pandas, Numpy	Analytical Spirit
Predictive analysis through machine learning model	Development and implementation of the predictive model of automatic learning defined "a priori" for the future forecast of the target (use of Machine Learning)	Machine Learning, Statistics, Mathematics, use of advanced tools	Use of advanced Machine Learning models tools. For example, knowledge of the advanced libraries scikit-learn, scipy, TensorFlow etc..	Future forecasting capability
Development of the test of refining and evaluation of the accuracy of the model	Verification of the quality of the self-learning model built by output comparison (between the output of the initial training data and those of the final tests of prediction)	Knowledge of statistical model evaluation methods, e.g. Accuracy, Precision, Recall, F1 Score, Jaccard, LogLoss, and AUC, etc.	Divide the collected data into several parts by creating two different groups: the model training data and the model test data. Knowing how to compare results using an evaluation method	Critical spirit PDCA Check Phase
Application of the model	Future forecast of the "dependent" data (y) as a function of the "independent" variables (Xn)	Domain Knowledge	Ability to use the self-learning model created and put into production	Ability to act (ACT) and to apply. Letter A of the PDCA
Final representation/storytelling as a support to the decision	Visualization and summary of the final results of the data processed by the statistical	Knowledge of data-viz	Knowing how to use computer tools for advanced graphic representation. For	Ability to make sense (sense-making).

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
making of the top management	model in a better form (graphic).		example, matplotlib, 3d.js, seaborn, ... Marketing skills. Communication skills.	Spreading the culture of data to bridge the cultural gap in governance. Contribute to innovative management.

Note

Facilitator/s	Participant/s	
Fabrizio Coccetti	Vincenzo De Sanctis (Denso)	
Iole Marcozzi	Guglielmo Pasquini (Denso)	
	Rosanna De Filippis (Denso)	

Job profile Auto 4.0

Name Data Architect

Overall description

What he does:

The Data Architect has the knowledge needed to build a network architecture for data storage.
Compared to the classic network system administrator or database administrator, Data Architect has more in-depth knowledge of new data distribution technologies, such as the use of Big Data, storage on scalable storage with nodular structure using map-reduce methods, massive storage of IoT data, archiving of data of different types (structured and unstructured data) or management of storage on the Cloud.

Responsibility:

The responsibility of the Data Architect lies in the design of a reliable, scalable and efficient architecture for the "maintenance" of the data within a structure suitable for the use of new technologies such as IoT, Big Data and AI.

Results:

Data storage and maintenance, as a support to other professional figures, for example "data scientist" or "data analyst" for the analysis and processing of the data itself.

Value:

Towards a competitive **Data Driven company**, in search of **greater value** through data.

1. *Main activities carried out*	2. *Output/Outcome*	3. *What learners needs to know*	4. *What learners must be able to do*	5. *What organisational behaviour is required?*
Choice of data storage technologies.	Find the best technology to reach the required target.	Techniques of analysis of sources and collection of requirements necessary for the design of the data wharehouse.	Provide information and operational specifications to manage information governance and the security associated with the systems used.	Collaboration with operation structures for the implementation of solutions.
Design of the technological architecture, with particular reference to parallel and distributed architectures.	Clearly see the benefits of design upgrades in terms of latency, scalability, high reliability, replication, data synchronization, disaster recovery, querying, load management, database optimization and overall performance.	Use technologies for data integration with other systems (Heterogeneous Data Source Integration).	Address and plan the technical evolution of the existing platform towards the development necessary for new Industrial-IoT technologies through the support of standards on the Cloud.	Creation of specifications and technical documentation to ensure the sharing of knowledge on the proposed solutions.
Implementation of the necessary storage architecture (construction of the Big Data).	Possibility of managing complex (large), structured and unstructured data with the aim of extrapolating significant patterns. Greater reliability and usability of corporate information (data on big data).	Network and storage architectures: storage types and data exchange protocols (iSCSI, SAN, NAS, DAS, FC etc.).	Divide the various skills in order to implement the project of implementing storage architecture through collaborations and external supplies.	Excellent relational and communication skills, problem solving. Analytical skills. Hard hacking skills.
Integration of heterogeneous systems through scalability (upgrade) or replacement of old data	Standardization and data security: the only repository from which to obtain useful information using the advanced tools available today.	Flow of existing traditional systems to be maintained and detail of the data to be integrated or normalized towards the new big data architecture.	Develop a system integrator by combining and integrating different non-standard or autonomous systems.	Vision and communication skills.

1. *Main activities carried out*	2.*Output/Outcome*	3.*What learners needs to know*	4.*What learners must be able to do*	5.*What organisational behaviour is required?*
maintenance architectures.	Integration to improve decision-making processes: more data available and better organized for descriptive, predictive, prescriptive and cognitive analysis with the help of specific algorithms for data analysis (data science).	Information required for the integration of multiple systems into a single standard "container". Main RDBMS and programming languages for dB, noSQL and Relational SQL systems. Drawing patterns , ETL software, Agile methodological approach, just enough documentation, iterative approach, OLAP design, script deployment and multidimensional data analysis. Popular programming languages, such as Python, Perl, PHP, C#, C++, etc.		

Note

Facilitatore/i	Partecipante/i	
Fabrizio Coccetti	Vincenzo De Sanctis	

A.U.T.O. 4.0

Co-funded by the Erasmus+ Programme of the European Union

New competences and Job Profiles

AUTO 4.0 Job Profiles described in Great Britain

Design Engineer
Project Engineer
Operator Manufacturing
Senior Technician

Northern automotive Alliance

Co-funded by the Erasmus+ Programme of the European Union

Job profile Auto 4.0

Name: **DESIGN ENGINEER**

Overall description

What he does

The Design Engineer researches and develops ideas for new products, technologies, components, processes and the systems used to make them. They work to improve the performance and efficiency of existing products. They provide support to the new-business and vehicle-launch team and work to ensure that all aspects of CAD design are created to fully meet the high specifications set.

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Responsibility

The Design Engineer is responsible for ensuring the success of the design from inception through to delivery into manufacture, using innovative engineering skills to ensure seamless integration. It's a very hands on position, demanding high levels of creativity and flexibility, working on many phases or sub-tasks of large projects working under instruction of the technical specialist engineer or entire projects of moderate complexity. Works under general supervision, reviewed at project milestones and on completion. Plans projects or subtasks so they may be tracked and presented. Results impact project/programme completion.

Design is defined as: Designing systems, processes, methodologies as well as component and vehicle designs to enhance the overall vehicle performance for the customer and environment. Transforming concepts into prototypes for testing, validating and improvement for ultimately mass volume production. This includes designing to meet costs, timing and quality requirements.

Results

The Design Engineer 4.0 produces the following results:
- ideas for new products, technologies, components, processes and the systems used to make them
- ensures the success of the design from inception through to delivery into manufacture
- improve the performance and efficiency of existing products

- support to the new-business and vehicle-launch team

with high levels of creativity and flexibility

Value
The Design Engineer researches and develops ideas for new products, technologies, components, processes and the systems used to make them.

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Ability to capture & specify design requirements	Design requirements	Excellent grasp of engineering & design principles, the qualities of metals & other materials, 3D modelling, computer aided design (CAD) software, technical drawings.	A creative, logical approach for generating new ideas & solutions, with the ability to transition through to part development; write/make convincing proposals and reports with all necessary backup material	Engages interest & participation of others & has a collaborative approach to working
Research concept ideas using mathematical modelling, simulation & augmented reality	To work out if new developments & innovations would work & be cost effective	Understanding of manufacturing processes & construction methods, MS Project, cloud computing; knowledgeable in some technical areas of the group's scope	Mathematical modelling (e.g. finite element modelling and analysis) , simulation & augmented reality (e.g. Google Glass)	Innovates to find new & improved methods; appreciates wider business demands
Analyse the Engineering & Project input in order to interrogate it	To reach an agreement & integrate it formally in a Design solution	Engineering project methods, analysis techniques (in depth), interrogation tools, design solution protocols. Use of Big data.	3D modelling, rapid prototyping, computer aided design (CAD) software, technical drawings.	Essential Health, Safety & Environmental constraints, critical thinking,
Produce design ideas, based on research, into technical plans for prototypes	Prototype plans	Use of computer-aided design (CAD) & computer-assisted engineering (CAE) software	Experience of using Auto CAD, Pro Engineer, CATIA V5, Unigraphics NX; Experience in BOM structures	Assertive, optimistic, resilient & welcomes change; comply with the Health, Safety and Environmental Policies
Analyses design proposals & the technical data to	Feasible proposals with a high form & aesthetic quality	Identify the issues arising during product development, defining & implementing adequate solutions;	Proposals are tailored for departments, customers, suppliers	Strong problem-solving skills with a high attention to detail,

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
identify issues in product development		to reach a feasible proposal; knowledgeable in some technical areas of the group's scope	and other service providers, all with a common goal(s).	seeks buy in to issues & their eradication or other solutions
Use Additive Manufacturing to design component which are designed for manufacture	Enabling improved & quicker decision making & reducing waste	3D printing, rapid prototyping & direct digital manufacturing (DDM), selective laser sintering (SLS)	Design for manufacture, work with additive manufacturing specialists, other engineers & process/product leaders	Decsion making protocols, continuous improvement/eliminate waste
Attend design reviews to present design ideas	Alternative design solutions discussed & critiqued	Design review protocols & procedures, presentation methods, dynamics of meetings	Propose design solutions, talk in data & facts, inform decision making, build concensus	Credibility, integrity, open communication
Share designs & utilise cloud computing for collaboration & communication around the design	Platform sharing of designs	Use of design software with a cloud computing interface, inclusive communication	Collate inputs from on-line & off-line forums, clarify communication, not be side tracked	Lead and/or support technicians and trainee engineers; train people within own work group

Notes

Facilitator/s	Participant/s	

Job profile Auto 4.0

Name: **PROJECT ENGINEER**

Overall description

What he does

The Project Engineer co-ordinates and controls projects from concept to post production launch of new and modified components and vehicles ensuring delivery to timing deadlines, cost and quality. They work on many phases or sub-tasks of projects or entire projects of moderate complexity, with results impacting on project completion. They work under general supervision, reviewed at project milestones and/or on completion by Senior Management.

The Project Engineer may have the greatest scope to touch all elements of IR4 technologies. For example, if they are working in the design phase, they may need to understand Big Data, Simulation, Cloud Computing, Additive Manufacturing etc. Or if they are working in the facility/product delivery phase, they may need to understand Internet of Things, Cyber Security, Autonomous Robots etc. IR4 technologies such as System Integration and Cloud Computing enables a project engineer to manage and deliver their project in a more effective manner, improving Communication with Stakeholders and improving Change Management capability as everyone is connected and data is live.

The Project Engineer(s) may still be deployed within each specific function e.g. Design Engineering, Production Engineering responsible for ensuring their area's delivery within a project or programme.

Responsibility

It has the responsibility of coordinating all project elements including engineering design, quality planning, manufacturing, installation, commissioning and final buy-off phases as well as ensuring the project remains within budget in order to meet the requirements of the customer's needs.

Results

The Project Engineer 4.0 produces the following results:

- Co-ordinates and controls projects from concept to post production launch of new and modified components and vehicles
- Coordinating all project elements including engineering design, quality planning, manufacturing, installation, commissioning and final buy-off
- Ensuring delivery to timing deadlines, cost and quality

-

Value

Complex projects are planned and delivered with required outputs on time and on budget.

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Coordinate all project elements	Projects delivered on time/on budget	In depth understanding of all phases: Engineering design; Quality Planning; Manufacturing; Installation; Commissioning; Final buy off; & how they impact on each other/their inter-dependency Where, how and why information is stored on cloud to ensure information is live. Understanding of Big Data, Internet of Things and autonomous robots.	Coordinate the project overall throughought the various phases; engages interest & participation of others; reads & understands engineering drawings, translates product drawings into process information; promote & drive continuous improvement. Share information on cloud Incorporate key requirements of customer into project plan, utilising the IR4 technologies.	A collaborative approach; self & time management; moral courage, honesty & resilience; make & manage relationships and to be an innovator, ready to accept new changes.
Manage the project within budget	The project is managed and delivered on budget	Budget protocols; budgeting software; design & production costs to include waste, downtime, scrap and rework; tracking budget spend including sub-contract hours Where, how and why information is stored on cloud to ensure information is live. Be aware of issues concerning cyber security	Budget realistically & ensure that costs are controlled; produce regular management information to assist with budgetary control; negotiate; be analytical & apply good judgement. Ensure sensitive data is protected on cloud	Liases & communicates with departments, customers, suppliers and other service providers; works to tight deadlines

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Plan project requirements & resources, including sourcing of sub-contract elements	The project is planned effectively with all nececssary resources deployed	Project planning including creating plans in MS Project & MS Excel, Advanced Product Quality Planning (APQP), Production Part Approval Process (PPAP), Project resourcing requirements & gantt charts, sub-contracting principles.	Able to scope requirements, secure all of the necessary resources, work effectively with sub-contractors; exercise latitude & technical judgement in deciding work methods.	Communicate openly and effectively, secure buy in & commitment for all elements
React promptly and effectively to changing client & product needs	Focus & progress is maintained with agreed changes in built	Practicalities and impact of changing needs, which elements or activities are non-negotiable, track tasks against the project timing plan & the critical path of the project. How to use simulation techniques and additive manufacturing.	Work with all parties to achieve what is required & whats best for the organisation; listen to feedback & needs, clarify, discuss & confirm any changes Incorporate how to use these tools to give a quick and efficient response to a change request from the team or customer.	Ability to collaborate & undertake complex problem solving, continuous improvement mindset
Anticipate any potential project risks, identifying and establishing corrective actions	Risks are managed and mitigated to ensure project success	Design and Process Failure Modes Effects Analysis (FMEA) & Risk Assessment tools, quality history reviews, robustness studies, risk management & mitigatiion methods	Share the understanding of risks with project stakeholders; specify and implement corrective actions in a timely manner	Proactive anticipation of risks; maintaining momentum and taking initiative
Produce deliverables on time to customer requirements	Project deliverables on time that meet customer requirements	Clarify customer requirements, define the customer specification as a departmental action or sub-contractor order, awareness of the	Accurately cost any changes in specifications, analyse customer & internal changes, including feasibility studies, produce clear explanations for change requests	Customer focussed & inclusive, providing clarity and being decisive, urgency relative to importance

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
		impact of failure/cost of poor quality		
Manage the Key Performance Indicators (KPI's), produce reports & present progress	KPI's are achieved: undepinned by effective project management & reporting	Defining KPI's that are fit for purpose; reporting methods & software; presentation visual methods & real time tracking	Manage KPI's daily; report & present at all meetings from board level to working group level with appropriate language & detail	Managing people both direct & in-direct reports, provide support & guidance as standard

Notes

Facilitator/s	Participant/s	

Job profile Auto 4.0

Name: **OPERATOR MANUFACTURING**

Overall description

What he does

Manufactures and/or assembles a range of components or vehicles into finished goods across production lines. Has extensive knowledge of the production processes and may be able to set up/programme and carry out diagnostics. Is likely to train other operators to required standards and may be the official trainer/assessor.

Manufacturing is defined as: Produces goods and parts from raw materials using such processes as welding; sewing; pressing; machining and painting. This may include some setting up of machinery and basic programming.

Assembly is defined as: Puts together various goods and parts to make/create a part or vehicle.

Responsibility

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, optimising efficiency and maintaining operational excellence. Able to work on many/all areas of the production process with little supervision.

Results

The Operator Manufacturing 4.0 produces the following results:
- Production/Assembly output vs. target(s)
- Quality, Cost and Delivery Metrics including Right First Time/Not Right First Time
- Skills matrix: ILU or other plan vs. actual

Value

Manufactures and/or assembles a range of components or vehicles into finished goods across production lines.

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Measure, grade and feed batches of raw materials into production machinery/process	Correct batches result in the desired outputs	How to weigh/mix/count/measure approrpiate raw materials for each batch feed	Record how much raw material has been used during production and the number of items produced;	Attention to detail, accurate measuring & recording
Operate production line equipment such as conveyor line, hoists, airlines and robots	Operation is in accordance with quality & safety standards	Start up & shutdown sequence; How to fit parts to machinery and equipment; how to cut and shape parts and tools. Understanding and awareness of working with collaborative robots	Communicate safety guidance to his team and communicate any issues to the maintenence team.	Teamwork & effective communication with co workers
Operate machine tools such as lathes, grinders and borers; use moulding machines which are pre-set to carry out certain tasks; set & operate hand-controlled or computer-controlled	Operation is in accordance with quality & safety standards	Start up & shutdown sequence; How to fit parts to machinery and equipment; how to cut and shape parts and tools. Understanding and awareness of working with collaborative robots	Communicate safety guidance to his team and communicate any issues to the maintenence team.	Teamwork & effective communication with co workers

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Machine parts/components.				
Monitor the production process and carry out basic testing and quality checks	The production process runs to specification	How to ensure parts are to the correct tolerances and meet customer and internal standards and specifications; how to report equipment faults to maintenance staff. Understanding of Big data and internet of things so that he can communincate it to the manager. Understanding of benefits of simulation techniques to support new installations.	Adjust machine controls whilst monitoring the production process and outputs; carry out cleaning and basic maintenance of work areas and the machines Implement changes within his processes Ability to take on the simulation techniques, working with the engineers. Ability to feed back and contribute to design optimisation.	Contribute to continuous improvement activities Take the intiative to identify issues and implement changes using the new technologies.
Manufacture goods on a production line	The planned volume of goods is produced to the quality/cost/delivery (QCD) requirements	How to make quality control checks on products;	Build up components and sub-assemblies into finished electrical or mechanical products; finish products such as applying protective coatings, bonding	Be able to work at line speed & maintain quality at all times

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Finish goods on a production line	The planned volume of goods is finished to the QCD requirements & readied for dispatch	How to trim excess plastic (flash) from products; how to pack goods with protective materials ready for shipment in crates, stillages or other containers	Seal containers using appropriate materials such as glue, staples or shrink-wrap; weigh and label packaged goods ready for dispatch; stack goods appropriately	Awareness of end user & customer needs

Notes

Facilitator/s	Participant/s	

Co-funded by the Erasmus+ Programme of the European Union

Job profile Auto 4.0

Name: **SENIOR TECHNICIAN**

Overall description

What he does

Ensures that facilities, layout and machinery used to produce new and existing materials and goods run to their maximum efficiency and output. This includes total preventative maintenance, managing breakdowns of mechanical, electrical and robotic equipment (including software programming). Installs, maintains, improves and repairs equipment, plant, services and building installations to set levels effectively in compliance with best practices ensuring production efficiency can be met within a safe well-presented facility

Responsibility

Respond to technical issues affecting production and maintain electrical and mechanical services through Planned Preventative Maintenance (PPM). Responsible for multiple highly complex major projects requiring innovative original solutions where results are key to successful completion of major projects. Work mostly independently with minimal supervision and work is reviewed at project milestones and/or on completion by Senior Management. May include training and assessing of other technicians and apprentices.

Results

The Senior Technician 4.0 produces the following results:
- Machine availability/OEE
- Planned preventative maintenance
- Rapid response to breakdowns/problem resolution
- Training and mentoring of others

Value

Ensures that facilities, layout and machinery used to produce new and existing materials and goods run to their maximum efficiency and output.

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
Ability to use Cloud Computing & Big Data to access machine data & functionality of facilities	Bring about more real time decision making & focused PPM activity	The development of planned preventative maintenance (PPM) schedules using cloud computing and big data programmes. Understanding and awareness of cyber security issues and how they could impact on the facility. Understanding of internet of things and ways in which he can capture more data.	Be responsible for ensuring security of data is not compromised, thereby reducing the risk of cyber security threats. Liaise with project and design engineers to ensure security of data and new projects. How and what to implement to ensure reduced downtime.	Exercise substantial initiative/judgement in work methods and interpreting goals
Carry out diagnosis of faults, the maintenance & repairs to all types of plant and equipment	In a safe, timely & professional manner return equipment to operational service	Mechanical, electrical, electronic or software background with a working knowledge of the other disciplines; Knowledge and awareness of manufacturing environments Understanding of 3D printing	Faullt find and advanced problem solving/diagnostic skills, fill in job tickets/log completion of work on the computerised maintenance management system. Ability to use 3D printing to develop efficient and timely solutions	Practical hands-on approach to problem solving; experience of leading and developing (multi-skilled) people
Identify & escalate any activity that has the potential to cause harm or damage	Limit and manage out the potential for harm or damage	Financial acumen with ability to estimate the potential exposure, appropriate risk assessment and failure modes effects analysis (FMEA) capability Understanding collaborative robots.	Able to identify root cause of any losses: report breakdown root causes, equipment faults & concerns to management, work cross functionally and collaboratively with many stakeholders.	Understands the impact of failure & downtime on production and ultimately customer delivery

Main activities carried out	*Output/Outcome*	*What he needs to know*	*What he must know how to do*	*What organisational behaviour is required?*
			Work with projet engineers to assess and risk assess robots in the factory.	
Assist with the move, install & reposition of machines and equipment	The machine & equipment layout is optimised	Facilities management know how; experience of working with facilities management teams; project planning & contingency mapping for intalls & repositions. Understanding of benefits of simulation techniques to support new installations.	Interpret CAD & layout drawings, decommission & recommission machines & equipment, work to tight deadlines in downtime & shutdown situations Ability to take on the simulation techniques, working with the engineers. Ability to feed back and contribute to design optimisation.	Work cross functionally & collaboratively with many stakeholders; manage a variety of activities as one; plan, analyse & challenge

Notes

Analysis completed for the Operating Technician role by IAM is also applicable in that the Senior Technician has to be able to do the work of a Technician, whislt recognising that it is not their primary job role or best use of time and capability.

Facilitator/s	Participant/s	

A.U.T.O. 4.0

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