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Skills in Metal and Electro Industry – skillME

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GENERAL DOCUMENT OF RESEARCH RESULTS OF WP WITH SELECTED SKILLS

WORK PACKAGE: WP 2 – Defining skill gaps and training needs

General report of findings

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TABLE OF CONTENT

1. INTRODUCTION

Despite the high level of unemployment, the metalworking and electro industry still lacks employees. Technology and science develops rapidly, so it becomes increasingly harder for companies to find skilled workers whose skills meet the business needs of the manufacturing process. The skills shortage is partly due to an out-dated education system and lack of flexibility. *SkillME* project is designed to address these issues and to reduce the skills shortage in the sector. The main purpose of the project is to identify skill gaps in metal and electro industry's advanced manufacturing sector, to create curriculums which will fill the skill gaps and to permanently integrate the curriculums into VET education systems in countries participating in the project and throughout Europe.

The project content development is implemented through Work package (WP) 2, whose main goal is to provide an overview of the current state of skill gaps in advanced manufacturing processes in the electro and metal industry in countries participating in the project (in detail) and the rest of EU (depending on data existence and organizations' willingness to participate) and to finally select 4 skills for which joint curriculums will be created in WP3.

The first step in defining existing skill gaps was to thoroughly research relevant data sources and collect existing data on skill gaps and the industry's needs in the metal and electro sector by analysing national and international studies, databases and other data sources and by contacting peers in other EU countries to acquire relevant data on the topic. After the collection and the analysis of initial data in each of the partner countries of the project, the focus groups with companies in electro and metal industry were organised and interviews with HRM staff and production line leaders in such companies. Information and data obtained in all these activities were used to identify those 4 skills for which joint curriculums will be developed in WP3.

The current report presents results of data search, focus groups and interviews, and includes the final selection of 4 skills for which curriculums will be created in WP3. The document will serve the activities in WP3 and provides all necessary input data needed for the start of creation of curriculums.

2. DESK RESEARCH PROCESS AND RESULTS

2.1. Desk research methodology

One of the most essential research project settings was to use the existing data analyses and databases in order not to collect such data and information, which has previously been obtained and analysed, again. To do this, the desk research methodology was developed and implemented. This methodology was based on the so-called secondary data analysis approach that foresees that the data and information (as well as their interpretations) applicable to the object are obtained from existing databases, previously prepared analytical reports, published expert views, statistics, etc.. The main objective of the desk research was to determine what is already known about the given research topic and what new data are required. This, in turn, allowed to define more precisely further research project implementation steps and methodologies.

In this case, as another desk research objective was to collect and analyse information on research methodologies used in other studies on similar topics so that to approbate them during the next implementation phases of the project for the needs of the given research. Therefore, the desk research included not only thematic and analytical reports and databases, but also methodology reviews and explanations.

Data and information collected within the desk research, as well as outlines of previously applied methodologies allowed us to define more precisely the current project methodology in order to avoid risks that may threaten the quality of research and to improve the quality of obtained results and their usability.

In this case, the following desk research sources were used: national and international databases, statistics on the web (such as databases of national statistical bureaus, the Eurostat database, the World Bank database, etc.), scientific publications, opinions and analytics of experts in the field of employment, economy, education and labour market, reviews in the field of education and employment, as well as strategic plan documents.

The desk research was carried out using three successive logical phases: (1) collection of national data on identified skill gaps, (2) collection of data on skill gaps from 24 EU states, and (3) creation of a general report on findings.

The first desk research phase involved a collection of national data on identified skill gaps - collection of national (countries participating in the project) data on identified skill gaps in advanced manufacturing processes of the electro and metal industry. Within the framework of the first step, all the partners involved in the project summed up the information and data available to them in specific countries over the last five years concerning the implementation of studies, analytical reports, databases, developed strategic documents in regard to skills provided in the labour market and skill gaps in advanced manufacturing processes of the electro and metal industry. The project partners in their countries contacted (by phone and/or e-mail) local statistics bureaus, representatives of the responsible ministries and educational institutions, as well as local experts in the field of employment and education, and asked to provide information and data or references to such sources of information that provide data on skill gaps.

The second desk research phase involved a collection of data on skill gaps from 24 EU states. Within the framework of this phase, each project partner contacted (by phone and/or e-mail) representatives of different state and regional level institutions responsible for education, economics and/or work issues in other six EU countries and asked to provide information on studies implemented in specific countries over the last five years, along with analytical reports, prepared databases, developed strategic documents in regard to skills provided in the labour market and skill gaps in advanced manufacturing processes of the electro and metal industry. Consequently, the aim of this desk research step was to supplement the information gathered within the first desk research step about the project partner countries having an identical information and data on at least other 12 EU countries in order to provide much more information and database for in-depth analysis of the research topic and to clarify the methodology of further project activities.

The third desk research phase envisioned summarization, structuring and logical analysis of all the information and data obtained in both the previous phases on the basis of which the general report of finding was prepared, and that report is integrated in given document.

Information and data acquisition was carried out in two directions: (1) directly contacting industry representative bodies, (2) performing a desk research and identifying publicly available databases and research registries to identify studies and surveys that directly or indirectly correspond to the given topic and project settings. The inspection of institutions was implemented by each project partner contacting their national and regional institutions and asking for information on available researches, data, surveys, databases on skill gaps and the metal and electro industry challenges in each particular country. In general, more than 25 different institutions were contacted.

Unfortunately, the institutions were less responsive than the project partners had hoped by including such exploratory activity in the project work plan. Only a few institutions responded to the call to provide information. Main reasons for this was the fact that most institutions haven`t done any researches particularly about skill gaps, especially in sectoral division.

Three significant methodological problems were identified by looking through the answers given by the institutions. Firstly, each institution has collected information and data on sectors using different methodologies and providing very different levels of details (ranging from very detailed and specific to the very general and non-specific). Secondly, the information and data is mainly available in local/ national language, and is not translated into English, which is understandable for all project partners. In turn, translation of these data and information requires disproportionate investments of time and financial resources. Thirdly, since only a few institutions responded, information provided cannot be considered as representative of the situation of the industry in broader EU context (because it reflects only the views of particular institutions). Having regard to those considerations, as well as a low responsiveness of institutions, the project partners decided to base the research activities on studying and analysing public databases and compilations of information.

In general, more than 20 different studies, surveys, scientific articles and databases were gathered within the overall assessment of public databases and registers of researches (see annex for gathered and analysed data and information sources).

2.2. Main conclusions of desk research

In desk research process it was identified that there's only one study that has been carried out on the metal and electric industry, however it does not emphasize the aspect of skill gaps, but looks at the labour force issues in the industry as a whole. Various available researches and data summaries rather provide information in very general lines - how satisfied employers are with a labour force availability and its qualification, what sort of training is provided, what general skills employers expect from employees, etc.. None of the studies and surveys viewed within the framework of the desk research gives a detailed-level analysis of skills – in addition, it concerns not only to the metal and electric industry but also to any other industry. For example, a study carried out in the UK[1] shows that in the manufacturing sector in total 16% of employees have skill gaps without specifying these existing skill gaps. While the studies that look at specific skills still define them in general, rather than

[1] UK Commission For Employment And Skills. *Sector Skills Assessment: Manufacturing*. The Sector Skills Council Manufacturing Consortium (UK). 2012. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/306443/briefing-paper-ssa12-manufacturing.pdf

specifically – for example, indicating that there are skill gaps in employees' knowledge on the materials used or their ability to work with new, innovative materials (without concretizing these materials), etc. (see below for illustrations of the general definition of skills analysed in sector studies). There's an observation that a large part of sector studies highlights directly business management skills (the need to adapt to new global markets and conditions of competition/ the "green economy" conditions, multicultural collective management, etc.) but relatively little attention is paid to hard skills of technical staff.

Table 1: Example of skills gaps defining in survey reports: Future skills needs in micro and craft(-type) enterprises up to 2020[2]

Work process Core process –	**Technical -**	**Orga. / legal**	**Social**	**Personal**
Acquisition of new customers	Evaluating material	Problem solving	Customer service communication	Multi-tasking
Managing quality	Adequate handling of tools	Documenting and monitoring tasks	Negotiating with suppliers and producers	Working under pressure
Sector specific knowledge	Implementing work process technology	Calculating costs	Leading co-workers	Developing creative ideas
Identifying trends	Implementing ICT	Dealing with legal norms / standards	Training (untrained) workers	Managing risk
Analyzing known tasks		Meeting new health and safety requirements	Cooperating with enterprises	Self motivation / self engagement
Broaden range of offered products		Complying with environmental standards	Communicating with foreign partners	Willingness to continue learning
Knowledge about foreign markets		Securing own innovations and patents	Using ICT in communication	Balancing business and family
			Working in project groups and team structures	Time management
				Entrepreneurial thinking
				Motivating employees in their job
				Assuming new tasks or new responsibilities
				Willingness to travel and to be mobile

Increasing future skills needs (top 10) from the perspective of the three groups (yellow: companies, red: business organisations, green: training institutions, blocked: common perspective)

[2] Detlef Buschfeld et al. *Identification of future skills needs in micro and craft (-type) enterprises up to 2020. Final Report*. 2011. Available: http://ec.europa.eu/enterprise/policies/sme/promoting-entrepreneurship/files/skillsneeds_final_report_final_180211_en.pdf

Table 2: Example of skills gaps defining in survey reports: Emerging competencies[3]

Social/cultural	Technical	Managerial
• Intercultural skills • Team work • Self management • Entrepreneurship and innovativeness	• ICT and E-skills (both at user and expert level) • Skills/knowledge related to new materials and new processes • Health and green skills (related to health and climate and environmental solutions)	• Intercultural management • International value chain management • International financial management • Green management (implementing and managing climate and environmental friendly policies and solutions)
+ Multiskilling and new combinations for skills and competencies (E.g. combining two sets of skills normally belonging to two different occupations in the same organisation)		

All the above-mentioned allows to claim that studies and surveys conducted so far do not provide specific, concrete information about skill gaps of the metal and electric industry, which, in turn, means that the given subject and methodology of the project is innovative not only in a particular sector but also in the context of the whole national economy. It should be noted that already during the design phase of the project it was identified that no specific, detailed information about employees' skill gaps in the metal and electric industry was available; therefore for preliminary identification of skill gaps to enable a focused research a short survey was implemented by project "representative partners" prior to the project. In this survey the following skills were identified as missing by companies in countries participating in the project:

- intelligent installations,
- "zero loss" circuits,
- wireless transfer of electricity,
- reverse engineering,
- prototyping and automation of processes for electro sector and computer assisted (CA) modelling,
- CA design,
- CA manufacture,
- modern joining techniques, robotics (milling, welding, manipulation),
- reverse engineering,
- prototyping and automation of processes for metal sector.

[3] Oxford Research for DG Employment, *Social Affairs and Equal Opportunities. Final Report - Transversal Analysis on the Evolution of Skills Needs in 19 Economic Sectors*. 2010. Available: http://ec.europa.eu/social/BlobServlet?docId=4687&langId=en

Although the content of the desk research did not provided a detailed information on current industry skill gaps, the general analysis of the contents of these studies allowed to identify several important methodological challenges that one may encounter when performing an in-depth, detailed study of the industry labour force skills and its improvement opportunities and conditions. They, in turn, allowed specifying and approbating further activities of WP2, particularly with respect to primary data collection via focus group discussions and interviews.

When it comes to sufficiently or insufficiently acquired skills, the prepared summary of researches and databases shows that one must reckon with a very wide range of skills - from very specific technical skills to work culture and even behaviour culture in general. There are two types of skill sets - soft skills and hard skills, meaning that soft skills are a person's ability to socialize and communicate with others, while hard skills are specific technical abilities and competencies. However, analysing specific industries, it is clear that each of these general skills segments includes a very large number of more detailed ones. Although any employer, of course, wants an employee to have both soft skills and hard skills, it is clear that attempts to cover that wide range of skills would require very considerable time and financial resources. It is therefore necessary to focus the study subject. One way to do it is a segmentation of industry skill sets. In a study carried out in Taiwan[4] professional skills and competencies of industry (in this case - the solar industry) were divided into so-called professional dimensions, where each general competency group consisted of certain skills (see the example in the table below).

Table 3: The professional competency dimensions and connotations (example)

Dimension	Competency connotation
(1) Materials development and application competency	(1) Understand the materials development process (2) Understand the solar cell principle (3) Understand solar light-absorbing material type and characteristic differences (4) Understand polymer characteristics and energy development (5) Understand the polymer application technology
(5) Chemical technology competency	(1) Understand the principles of chemistry, physical chemistry, analytical chemistry, and organic chemistry (2) Understand interdisciplinary engineering-related processes (3) Have constructed an energy integration platform (4) Understand materials analysis techniques (5) Understand physical and chemical technologies
(9) Regulation competency	(1) Understand relevant solar power policies (2) Understand relevant renewable energy policies (3) Understand the renewable energy incentives
(11) Work attitudes and values	(1) Have a sense of mission and a passion for work (2) Have positive work values (3) Exhibit a positive professionalism (4) Have a sense of integrity and business ethics (5) Embody the spirit of innovation and research

[4] Chin-Guo Kuo and Chi-Cheng Chang. *Building Professional Competencies Indices in the Solar Energy Industry for the Engineering Education Curriculum*. International Journal of Photoenergy, Volume 2014 (2014). Available: http://www.hindawi.com/journals/ijp/2014/963291/

It allows structuring and analysing a wide range of skills and competencies of a particular industry in context with other skills groups. However, also in this case the overall skill base remains very wide, which determines the need to choose only a specific professional dimension as a minimum, within the framework of which the problems and needs of the industry should be analysed. Therefore, the project partners agreed to concentrate on the development of technical skills rather than soft skills as they are more specific and allow a focused approach, but concluded to do so in a way that would promote and improve employees' social skills[5]. An additional reason for the choice to highlight hard skills is also a fact found out in the UK'S study that in the electromechanical sector new hard, technical skills will be more substantial than soft skills in the medium and long term. In turn, the retention of soft skills as a background is based on identified findings of the same study that new combinations of skills will be more essential than soft skills.

By setting the study analysis frame for specific technical skills only, still other methodological problem remains, namely how to evaluate certain skills shortages in the industry. Scientific and professional research literature describes different methods how to carry out quality assessments of skills – it can be done both by basing on a subjective appraisal of industry and developing a detailed, approbated methodology for getting unbiased assessments in close cooperation with industry experts, making international comparisons, etc.. At the same time, there is no single, specific methodology that researchers and industry representatives consider to be the most appropriate and equitable one. For example, you can perform an employee test, determining the level of competencies on a particular performance scale (1 - beginner, 5 - expert, or so on), or you can make an evaluation of experience on the time scale (1- no experience, 10 - a very long experience in the industry, or so on), etc..[6] However, researchers generally agree that several aspects should be taken into account in the assessment of competencies and skills - it should be based on a combination of professional training, practical experience, and academic qualifications[7]. Therefore, this research project also has a rating scale developed to assess skill gaps existing in the metal and electro industry – the level of the importance was measured on a 4-point scale. The selection of such a scale is based on fundamental methodological grounds. It does not only focus on one measurement of a specific aspect (for example, the proportion of employees who lack particular skills or so on), but include a set of different aspects - by evaluating the importance, one must take into account both how greatly specific skill shortages are expressed in the labour market at present and whether they will

[5] MINUTES of the Kick-off Meeting in Ljubljana, CCIS, January 20th 2015.
[6] Graham Coates et al. *A Study Of Capturing The Skill Competencies Of The Workforce Within A Small Manufacturing Engineering Company*. International Conference On Engineering Design, ICED'07 (2007).
[7] *Ibid*.

potentially be required in the future. This fixes a problem that skills required today may not be required in the future, therefore the investment of resources in mastering them would be useless in the long term, while the skills required in the future may not be so clearly necessary currently, and consequently non-identification of these skills would endanger the sustainability of the project.

And finally, trying to identify the existing lack of skills and competencies in the industry, there's a crucial issue regarding how unified or different the skills of specific industries are, namely, whether the necessary skills across the industry are the same or maybe their importance differs in varied sectors of the industry or even at an individual business level. The aim of the project is to make a positive contribution to the development of the whole industry, and therefore the focus is on skill gaps, which are in sight for the whole metal and electro industry, not only for its individual representatives or sub-sectors.

These methodological challenges identified were taken into account in designing and implementing further activities of WP2, as well as they should be taken into account in developing methodologies in similar surveys in the metal and electro industry or/and other industries.

3. FOCUS GROUP PROCESS AND RESULTS

3.1. Focus group methodology

After information and data collection of the desk research and elaboration of methodological recommendations into methodology of project further activities, two focus group discussions were organized in each of the partner countries in order to identify and to research ore in detail skills gaps in the companies' working environments. Total number of participants in focus groups was 69, from which - 46 were representatives of metal industry, 10 - electro industry, but 13 - metal and electro industry. 19 from 69 respondents were representatives from large companies, 26 - from medium size companies, but 24 - small companies. To ensure the representativeness, participants were selected representing companies of different sizes. In each project partner country members of the focus groups met twice – once to establish the scope and course of the monitoring of skills and second time to discuss the results and to develop the recommendations for the final selection of skill gaps. For each of the focus groups the guidelines for questions and the form for fixing results were elaborated (attached in the annex to this report). It was important to organize discussions as spontaneous discussions, not accurately prepared questioning. The first questions were more general to involve all participants. During the discussion, the questions became more specific and important. At the end of the discussion the moderator summarized the discussion. After all focus groups in all project partner countries were finished the general report of findings was prepared, and that report is integrated in given document.

3.2. Main conclusions of focus groups

Within the focus groups, first participants were asked to provide general views on electro and metal industry work environment and labour force, as well as its qualification (skills).

Table 4: General assessment of participants of focus groups on labour market and labour force qualification

Do your employees possess all the necessary skills for current production processes at your company?
Slovenia: Less than a quarter of the companies are fully satisfied with their workers' skills levels or are of the opinion that they have enough workers to cover all production tasks in order to successfully perform all business functions. This coincides with the results of the *knowME* survey, which showed that there are 18% of such companies. Most of the focus group participants agreed that although they are generally satisfied with their workers' skills levels, there are still some areas in which their workers need to be further trained (the results of the *knowME* survey reveal 58% of companies share this opinion). Some participants showed dissatisfaction with their workers' qualifications and capacities (*knowME* survey: 22%), yet none of them expressed full dissatisfaction with their skill levels. This result is supported by the *skillME* survey, which states that only 2% of companies are fully dissatisfied with their workers' capacities.

Latvia:
Yes- 6
No- 4

Slovakia:
No

Croatia:
Electro:
Now they have, but when they were employed, they did not and company had to train them.
Re-training and additional training lasted up to 2 years.
If employees came immediately from school, they had poor work habits, did not know work safety regulations and had to be additional trained.

Metal
Mainly no.
It take at least two years for adjustment to conditions needs of some specific work places

What technical skills do your employees miss?

Slovenia:
Companies stated that the technical skills their employees miss the most are, among others, skills in *quality measurement and control, basic plan reading, performing measurement protocols*, parameterization of process computers (reading, monitoring, setting), the knowledge of new technologies is insufficient etc. Some companies also mentioned insufficient manual dexterity, the lack of certain soft skills (mainly languages) as well as knowledge in the field of safety and quality.

Latvia:
Increasing efficiency
Developing robot technologies
Painting technologies
Quality assurance
CNC programming and preparing files to ensure procedure
Knowledge about materials and use of them
Metalworking technologies
Work organization methods
Use on CNC technologies

Latvia
Electro sector:
Infrared lens producing
Knowledge about manufacturing processes
5S basics
Technical knowledge

Slovakia:
Reading the technical documentation, norms and handouts in Slovak and English languages
Performing specialised working tasks with high expertise in foreign language

Croatia

Electro

At the moment, there is no such thing, because if they missed something they were trained.
One participants mentioned that technician for mechatronics miss – diagnostics and maintenance of controller part of machines

Metal

Proper use of tools
Specific technical knowledge (mechatronics)
Use of technical and technological documentation

Do you monitor the development of the technologies?

Slovenia:

Monitoring and knowledge of the development of new world technologies is considered to be highly important by all participating companies (94% of the companies in the *skillME* survey also shared this opinion). This is why they all pay close attention to the development of new technologies both at home and abroad.

Latvia:

Yes – 10

Slovakia

Yes

Croatia

Electro

Yes

Metal

In line with development plans and possibilities

Do you offer training for the employees? If yes, how often?

Slovenia:

All companies often organize trainings for their employees as they all strive to improve their worker's knowledge, skills and competency levels. The *knowME* survey, offering a more representative view, shows that such training is offered by 57% of companies. Companies train their employees in the following ways:

- External training (*knowME* survey: 45%)
- Education and information events (*knowME* survey: 53%)
- Education of workers in institutions (*knowME* survey: 14%)
- Expert training programs (*knowME* survey: 31%)
- Mentorship programs (*knowME* survey: 17%)
- Seminars and workshops (*knowME* survey: 36%)
- On-the-job training (*knowME* survey: 53%)
- Training courses (*knowME* survey: 29%)
- Non-formal forms of training, such as workplace change (*knowME* survey: 27%)

Latvia:

Yes, in-service training 4 times a year - 2
Yes, regularly - 4

Yes, once a year - 2
Yes, employees have on-line courses
Yes, once-twice a year

Croatia

Electro

Yes, when the need arises and when it is determined that some need training. In majority cases, it is in-company trainings.

Metal

Mainly for perfections of IT, language and communication competences
All other are performed in-company

What current technical skills have to be improved (updated) for future needs in metal and electro industry (in 3-5 years) and new VET programmes have to be designed for them?

Slovenia:

The companies stressed the need for improvement of the following technical skills and programmes (sorted by areas):

Metal industry

Hydraulics

Use of CAD technologies

Use of CAM systems in production

Knowledge of renewable energy source systems

New measurement and control technologies

Knowledge of metallic and non-metallic materials in the metal industry

Basic plan reading

Knowledge of new technologies

Knowledge about trends in the sector, problems, risks, materials

Reading/performing measurement protocols

Electro industry

Reading electrical diagrams and introducing changes

Implementation and maintenance of intelligent installation elements

Use of electronic measuring instruments for testing and eliminating defects

Implementation and maintenance of programmable logic controllers (PLC)

Knowledge of renewable energy source systems

Assembling and painting specialists

Constructors –technologists

Manufacturing managers

According to sectoral needs

Latvia

Metal sector:

Robotisation and automatization

Basing

Choice of instruments

Choice of manufacturing regimes

Technical graphics

Welding specialists

Innovation technologies

Turning

Milling

Online and remote control and guidance

Electro sector:

Producing infrared crystals

Slovakia

Establishment of specialised study branches: Electrotechnology and Electroenergetics
Provision of training for graduates (e. g. lift truck and others)
Automatisation in electrotechnics
Involvement of employers in textbooks development

Croatia

Electro

Reading and documenting technology documentations
Development of electronic schemes based on blueprint
Application and controlling PLC and motor drivers

Metal

CAD/CAM technologies
CNC technology
Robotics
New technics of joining materials

What new skill needs will be essential for future in metal and electro industry (in 3-5 years) and new VET programmes have to be designed for them?

Slovenia:

The identified skills were sorted by priority in order to make a selection of those that will be implemented as a pilot, expectedly in the school year 2016/17, and permanently integrated into vocational schools curricula approximately a year later. Members of the focus group agreed it is difficult to make a selection due to the wide specter of the required skills, but came to an agreement about the selection of the most important ones at the end of a detailed discussion.
The areas in which skill gaps in education programs will be attempted to be filled and included in the existing vocational programs with partial curricula have been ranked in the following way:

Use of CAM systems in production

Knowledge of hydraulic systems

Implementation and maintenance of programmable logic controllers (PLC)

New measurement and control technologies

Knowledge of metallic and non-metallic materials in the metal industry

Latvia:

Knowledge about materials
There is no need for new programmes, it is needed to update the current ones
LEAN, Haizen, 5S

It is needed to improve the existing skills

Welding

New technologies and methods equipment

Remote control and guidance

Heat treatment

Technical graphics

There is no need for new programmes, it is needed to update the current ones

Slovakia

Soft skills (conflict solving and negotiation, communication skills and ability to learn, motivation and others required for masters)

Croatia

Electro

Program for anticorrosive and anti-static protection
Development and maintenance of technical documentation
New employees do not have sense of need for optimisation of production processes
Application of modern materials in production

Metal

Quality assurance (measurement)
Optimisation of production processes
Application of international regulation
Ecology

In each country focus group participants identified the major skill gaps, assessing them in level of importance scale (1 'Not important' to 4 'Crucial'). Compiling ratings contained in focus groups of each country, total assessment/ranking of skill gaps was drawn up, allowing to identify those relevant skills that are identified most frequently among all project partner countries.

Table 5: Summary on the most significant skills in the industry

Selected skills for the research	NQF level	The level of importance (4-1)				Points in total
		4	3	2	1	
Development and maintenance of technical documentation *(reading and development of blueprints – sketching) (E); in mother tongue and in foreign language)*	4	2	1			11
Use of CAM systems in production	4	2				8
Knowledge of metallic and non-metallic materials in the metal industry	4	1		1		6
Use of mathematical knowledge solving problems		1				4
Working and manipulating dangerous and non-dangerous waste (E)	4	1				4
Operation of lift truck		1				4
Merging in line with schemes (linking contents and practical skills) (E)	4	1				4
Running CNC machines/CNC programing (linking with machine circuits); application of knowledge of digital	4	1				4

electronics (M/E)						
Project assignment – as a form of teaching class (E)	4	1				4
Knowledge of elementary electrotechnics Electro energetics (power production and transfer) E	4	1				4
Automatisation in electrotechnics;		1				4
Manual skills		1				4
Use of CAD technologies in production			1			3
Knowledge of hydraulic systems				1		2
Knowledge of systems of renewable energy sources				1		2
Linking of manipulation of man and robots (robotics) (E)	4				1	1
Quality management (measuring and control, quality control, work responsibility) (M/E)	4			1		1
New measurement and control technologies	4			1		1
Welding techniques					1	1

Consequently, most relevant skill gaps identified in focus groups were:

- Development and maintenance of technical documentation;
- Use of CAM systems in production;
- Knowledge of metallic and non-metallic materials in the metal industry .

In focus groups participants also pointed out the necessity to strengthen soft skills, as key skills identifying – conflict solving and negotiation, communication skills and ability to learn, motivation and others required for master, logical thinking.

4. INTERVIEW PROCESS AND RESULTS

4.1. Interview methodology

In parallel with focus group discussions in each project partner country individual in-depth interviews with HRM representatives of electro and metal companies which did not participate in the focus groups were carried out. Representatives from both large, and medium and small size enterprises in each country were interviewed. In total 25 interviews were carried out in metal industry and 17 in electro industry. The guidelines for interviews and the form for fixing results were elaborated (attached in annex to this report). After all interviews in all project partner countries were finished the general report of findings was prepared, and that report is integrated in given document.

4.2. Main conclusions of interviews

Within the interviews, respondents were asked to name all the skills/knowledge which are lacking, thereby creating the most comprehensive list of skills gaps (in this stage of the stage it was not arranged or/and evaluated).

Table 6: Opinions of respondents on lack of skills in sectors

Country	Metal industry	Electro industry
Croatia	– Reading technical documentation – Corrosion protection (ACP) supervision of the implementation – Operational resolving failures – Understanding of the technical documentation – Materials – Welding Techniques – Measurement – Attitudes toward work – Programming of CNC machines – Knowledge of tools and devices – Approaching the real conditions – Quality assurance – Reading of the draft – Measurement and control – Optimization of production and production technology	– Identifying plans of mechanical and electrical equipment and field application – Lack of basic knowledge in the field of electrical components, relays, contactors, detectors, motors – Electrical machinery (rewinding, mechanical work, mechanical components) – Practical knowledge (following the latest technology) – The use of new planning tools
Latvia	– CNC technologies for processing, CNC equipment and parameters control – Wet painting – Reading technical documents,	– Technical drawing – Energy efficiency – Knowledge of materials

Country	Metal industry	Electro industry
	technical drawings – Roboting processing technology, Robot welding – Technical measurements – Welding – CAD/CAM systems – Knowledge about materials – Heat treatment – Exact processing – Energy efficiency – Non-standard mechanical processing procedure – Understanding about whole processes, construction equipment – Skills for working with a wider range of equipment: cutting, inflexion, drilling – Powder painting – Information and production flow – Inventory work – Work safety – Environment protection – Quality control – Renewable energy – Biomass burning process – Metal structure assembling – Cutter change – Programming logical controlling (controllers) – Tooth cutting technology – Use of mathematic skills – Programming language – Use of skills in practice	
Slovenia	– Computer knowledge, – Measurement procedures, – Process management, – Basic knowledge of pneumatic and hydraulic components, practical applications of these components, – Reading of hydraulic and pneumatic plans, – Proportional technique, – Knowledge of businesses operating system, – Knowledge of quality importance, – Work organisation,	– Knowledge of basic concepts of elements and devices in PLC and electro- installation equipment – Identifying plans of mechanical and electrical equipment and field application – Lack of basic knowledge in the field of electrical components, relays, contactors, detectors, motors – Lack of knowledge of PLC, purpose of equipment, programming – Lack of practical training in the field of robotics (making trajectories, use of robots in manufacturing)

Country	Metal industry	Electro industry
	– Computer-aided planning of production, – High- speed processing by removal of material, – Better knowledge of plastics and plastic welding, – The practical knowledge in the field of manufacturing technologies (joining, assembly procedures), – Processes of production planning, skills for assessing products in terms of manufacturability, – DFA and assembly (DFM)	– Electrical machinery (rewinding, mechanical work, mechanical components) – Technical writing – Practical knowledge (following the latest technology) – The use of new planning tools – 3d CAD
Slovakia	– Reading technical documentation with – Use of CNC technologies for material processing, – Adjusting parameters of CNC machines, – Use of 3D modelling programs, – Programming of robots and manipulators, – Use of CAD technology, – Application of CAM system in production, – Repairing machines, – Applying workplace safety regulations, – Programming robots	– Use AutoCad, – Practical knowledge, – Reading the technical documentation, norms and handouts in Slovak and English languages, – Performing specialised working tasks with high expertise in foreign language, – Knowledge of elementary electrotechnics, – Manual skills, – Logical thinking.

As it is not possible directly project currently lacking skills into the future and to claim that they will be relevant in the medium or long term, the interviewees were asked to specify the skills that they think will become relevant in their own company in the next five years. Such list of skills gives the opportunity to compare it with current skill gaps and to filter those skills that are not identified as significant in the medium term, consequently resource investments in their development would not be productive.

Table 7: Predictions of respondents on the need for new qualifications in next 5 years

Country	Metal industry	Electro industry
Croatia	– Associate engineers on site – Qualification in the field of robotics – As a core technology, seeking a wider knowledge in specific areas for these jobs – Universality	– Electrical engineer – Technologist in plastic production – Constructor for tools and lines – Tracking new developments in the field of modern electronic elements and devices

Country	Metal industry	Electro industry
	– Modeller – CNC operator – Turner with knowledge of new technologies – Millner with knowledge of new technologies – CNC technology + IT technology	– Installer mechatronics – Electrician – Electrician energetic – Electro mechanics
Latvia	– Robot welder (EQF 4th level) – Renewable energy technician (EQF 4th level) – Heat equipment specialists	
Slovenia	– Technologist, metallurgy, locksmith	– An independent repairer in the field of controlling machines and devices – Tracking new developments in the field of modern electronic elements and devices – Installer mechatronics – Electrician – Electrician energetic – Electro mechanics – Microcontroll programmer – Application programmer (smart phone, IOS, Android)
Slovakia	– Assembly worker, Technologist skilled in the area of thermal treatment of metals.	

In order to identify skill gaps more focused, interviewees were asked to rate the desirable competencies of employees (1 'Least required' to 3 'Most required') out of those which as potentially relevant were identified in the feasibility study and in focus groups. In addition to significance assessment, interviewees were asked to indicate for each of the skills whether their learning in existing education system/content is complete or incomplete. Consequently, overall rating obtained in interviews of all partner countries represents the arrangement of the most essential skills, which allows to determine what skills gaps would need attention the most.

Table 8: Summary of the most significant skills and skills gaps in metal industry

Skills	The level of importance (1-3)			Skills gap	Points in total
	1	2	3		
METAL INDUSTRY					
Reading technical documentation	1	8	16	13	78
Use of CAD technology	3	10	12	13	72
Application of CAM system in production	6	6	11	15	66
Adjusting parameters of CNC machines	4	8	9	8	55
Use of CNC technologies for material processing	1	7	10	10	55
Use of new technology for measurement and control	3	8	9	8	54

Skills	The level of importance (1-3)			Skills gap	Points in total
	1	2	3		
Knowledge of metallic and non-metallic materials in mechanical engineering industry	3	7	9	8	52
Optimization of product and operating procedures	5	6	8	10	51
Applying new technologies for joining parts in metal industry	4	6	8	10	50
Applying quality assurance procedures	2	5	8	10	46
Programming of robots and manipulators	4	4	8	8	44
Applying workplace safety regulations	0	5	6	5	33
Use of non-conventional machining procedures	2	4	5	5	30
Knowledge of renewable energy sources systems	7	3	3	8	30
Knowledge of welding techniques	0	4	5	5	28
Natural competence – awareness of nature, importance of ecology and environment protection	0	6	3	4	25
Mathematical competence - applying mathematical knowledge for problem solving	1	5	3	4	24
Reading/ implementation of measurement protocols**	1	2	5	3	23
Use of 3D modelling programs	1	1	5	5	23
Hydraulics**	3	4	2	3	20
Knowledge of 3D printing	0	3	2	5	17
Applying prescribed legal regulations and standards	4	2	1	5	16
Reverse engineering	1	3	1	5	15

** Added by Slovenia

*** Added by Slovakia

Table 9: Summary of the most significant skills and skills gaps in electro industry

Skills	The level of importance (1-3)			Skills gap	Points in total
	1	2	3		
ELECTRO INDUSTRY					
Read electrical schematics and make changes	1	3	12	10	53
Apply workplace safety regulations	0	2	8	8	36
Prepare and update technical and technological documentation	1	5	4	7	30
Assemble, adjust and maintain electronic circuits and/or devices	0	3	5	5	26
Control robots	0	3	5	5	26
Knowledge of measures and procedures that affect savings (cost reduction)	0	2	5	5	24
Detect and diagnose malfunctions in circuits and/or devices	0	0	6	5	23
Install and maintain elements of intelligent installations	1	5	2	6	23
Apply quality assurance procedures	2	6	1	6	23
Use electrical measuring instruments for testing devices and eliminating faults	3	3	2	7	22
Perform electric installations according to connection diagrams	0	2	4	5	21
Knowledge of renewable energy sources systems	3	2	2	8	21
Install and maintain PLC (programmable logic controller)	3	1	3	6	20
Natural competence – awareness of nature, importance of ecology and environment protection	0	3	2	5	17
Know the properties of electrical devices in an electric distribution system	2	0	3	5	16
Understand industrial communications	1	3	1	5	15

Skills	The level of importance (1-3)			Skills gap	Points in total
	1	2	3		
Control non-regulated and regulated electric-motor drives	2	1	2	5	15
Apply basic knowledge of electrical machines and devices as well as knowledge on the control and regulation of automation systems	1	1	2	5	14
Install sensors and actuators	2	2	1	5	14
Measure electrical quantities	1	2	2	1	12
Apply prescribed legal regulations and standards	3	2	0	5	12
Mathematical competence - applying mathematical knowledge for problem solving	2	2	0	5	11
Collect data using a computer and microcontroller and processing it	1	2	0	5	10
Measure non-electrical quantities	2	3	0	1	9
Design a simple automatic system for monitoring and controlling by a microcontroller or industrial computer	1	0	0	5	6
Connect computers and/or devices into a network	2	0	0	0	2

Consequently, most relevant skill gaps in metal industry identified in interviews were:

- Reading technical documentation.
- Use of CAD technology.
- Application of CAM system in production.
- Adjusting parameters of CNC machines.
- Use of CNC technologies for material processing.

Whereas, skill gaps relevant in electro industry:

- Read electrical schematics and make changes
- Apply workplace safety regulations
- Prepare and update technical and technological documentation
- Assemble, adjust and maintain electronic circuits and/or devices
- Control robots.

5. SUMMARY AND SKILLS SELECTION

In desk research process it was identified that there's only one study that has been carried out on the metal and electric industry, however it does not emphasize the aspect of skill gaps, but looks at the labour force issues in the industry as a whole. Various available researches and data summaries rather provide information in very general lines - how satisfied employers are with a labour force availability and its qualification, what sort of training is provided, what general skills employers expect from employees, etc.. None of the studies and surveys viewed within the framework of the desk research gives a detailed-level analysis of skills – in addition, it concerns not only to the metal and electric industry but also to any other industry. All the above-mentioned allows to claim that studies and surveys conducted so far do not provide specific, concrete information about skill gaps of the metal and electric industry, which, in turn, means that the given subject and methodology of the project is innovative not only in a particular sector but also in the context of the whole national economy.

Launching the work on identification of skill gaps, the project partners were faced with a number of methodological challenges. One of the most essential was very wide variety of skills, competencies and knowledge, which refers to the metal and electro industry. Namely, it was necessary to methodologically correctly define about what skills and how detailed data will be collected within the project. The project partners agreed to concentrate on the development of technical skills rather than soft skills as they are more specific and allow a focused approach, but concluded to do so in a way that would promote and improve employees' social skills. An additional reason for the choice to highlight hard skills is also a fact found out in the UK'S study that in the electromechanical sector new hard, technical skills will be more substantial than soft skills in the medium and long term. In turn, the retention of soft skills as a background is based on identified findings of the same study that new combinations of skills will be more essential than soft skills.

The above given observations were also repeatedly mentioned during the focus group discussions and interviews. Namely, although within the project we are talking about the hard skills and technical skills, but still their importance is not always possible to clearly distinguish from soft skills – complex development of them both is particularly essential. Therefore, it should be stressed that although within the project we focus on development of specific hard skills, improving them will be effective only if at the same time work on soft skills as basic skills will be carried out. This thesis is also confirmed by respondents' comments and recommendations obtained during the data and information acquisition process (see table below).

Table 10: Respondents'' suggestions, comments

Country	Metal industry	Electro industry
Croatia	– The financing of the education system. – Demo centres - centres of excellence. – Popularization of occupations. – Advancement through competence and not through expertise. – Accent on practical training. – Linking schools and real sector. – Educational program for welders. – Vocational education adapted to market needs and the needs of employers, according to an agreed common strategy. – Better cooperation with state institutions. – Develop a sense of personal responsibility and involvement.	– The basic problem is a disconnection between education and practice. – It is necessary to have more practical training and less theory.
Latvia		– Gaps in soft skills: - Responsibility; - Self-dependence; - Precision; - Purposefulness.
Slovenia	– Curricula in line with the needs of industry. – Implementation of the practise over an extended period (also as part of the curriculum). – Specify more concrete and practical examples, not just theory. – A higher level of understanding of 4 and 5 axis processing. – Basic plans reading and using CAD viewer data. – Knowledge of cutting parameters and other regulations in the processing of metallic and non-metallic materials. – Developing of sense for cost aspect of individual treatments and other activities.	– More self-initiative and self-confidence regarding the use of instrumentation and computer software. – Knowledge of measurements of protection against electrical lightning, lightning conductor, grounding. – It would be necessary to find a link between theory, real engineering work and economy.
Slovakia	– Soft skills (conflict solving and negotiation, communication skills and ability to learn, motivation and other required for masters). – Mathematical competence –	– Establishment of specialised study branches: Electrotechnology and Electroenergetics.

Country	Metal industry	Electro industry
	applying mathematical knowledge for problem solving.	

Pointing to all of the above mentioned, it should be stressed that the current project is aimed at addressing specific skills gaps existing in the industry, therefore wider industry and overall labour market issues are deliberately separated therein. At the same time we accept *a priori* the hypothesis that solving the specific problems of the labour market is not effective without identifying and addressing the common challenges. Consequently, within the project working on solving specific skills gaps by developing joint curriculums, we hope that authorities responsible for the industry and the labour market in general will also effectively solve common labour market problems/issues.

Within successive activities of desk research, focus groups and interviews, significance of a large amount of different skills, competencies and knowledge were identified in industries, as well as existing gaps in the current educational offering therein. By arranging these various skills by their significance in all partner countries, a list of about 10 skills whose gaps were identified by respondents of focus groups and interviews as the most significant were obtained (see table below).

Table 11: Identified the most significant skill gaps

Project activity	Skill gaps in metal industry	Skill gaps in electro industry
Focus groups	– Development and maintenance of technical documentation. – Use of CAM systems in production. – Knowledge of metallic and non-metallic materials in the metal industry.	
Interviews	– Reading technical documentation. – Use of CAD technology. – Application of CAM system in production. – Adjusting parameters of CNC machines. – Use of CNC technologies for material processing.	– Read electrical schematics and make changes. – Apply workplace safety regulations. – Prepare and update technical and technological documentation. – Assemble, adjust and maintain electronic circuits and/or devices. – Control robots.

In order to make the final selection of skills for developing joint curriculums, from above mentioned skills, those skills were selected that were identified as the most significant in different data and information sources – in this case, focus groups and interviews (see table below). Consequently, four skills mentioned within WP2 are identified as whose joint curriculum development and implementation would be potentially the most effective in all project partner countries.

Table 12: Selection of skills for developing joint curriculum

(1) Use of CAM systems in production.
(2) Reading, development and maintenance of technical documentation.

(3) Use of CNC technologies in production, adjusting parameters of CNC machines.
(4) Knowledge of metallic and non-metallic materials.

6. ANNEXES

6.1. Researches and Scientific Articles Used

Arie Gelderblom. *Industrial Technologies And Skills: Gaps And Shortages*. SEOR (Erasmus University Rotterdam). Industrial Technologies 2012, Aarhus. Available: http://www.industrialtechnologies2012.eu/sites/default/files/presentations_session/Arie_Gelderblom.pdf

CCIS in cooperation with LINPRA, MASOC and ZEP. *KnowME. Skills and Knowledge Management in Metal and Electro Industry*. Survey report. 2013.

Chang C.C. *An IPA-Embedded Model for Evaluating Creativity Curricula*. Innovations in Education and Teaching International, Vol. 51, no. 1, pp. 59–71, 2014.

Chin-Guo Kuo and Chi-Cheng Chang. *Building Professional Competencies Indices in the Solar Energy Industry for the Engineering Education Curriculum*. International Journal of Photoenergy, Volume 2014 (2014). Available: http://www.hindawi.com/journals/ijp/2014/963291/

Chin-Guo Kuo et al. *Constructing Employability Indicators for Enhancing the Effectiveness of Engineering Education for the Solar Industry*. International Journal of Photoenergy, Volume 2014 (2014). Available: http://dx.doi.org/10.1155/2014/491353

Connor H. et al. *An Assessment of Skill Needs in Engineering*. *A Comprehensive Summary From Employers Of Skills Requirements In Engineering*. The Institute For Employment Studies, 2000. Available: http://dera.ioe.ac.uk/4449/3/UKEnginSkillsNeeds.pdf

Detlef Buschfeld et al. *Identification of future skills needs in micro and craft (-type) enterprises up to 2020. Final Report*. 2011. Available: http://ec.europa.eu/enterprise/policies/sme/promoting-entrepreneurship/files/skillsneeds_final_report_final_180211_en.pdf

Fitch-Roy, O. Workers wanted: The EU wind energy sector skills gap. 2013. Available: http://www.windplatform.eu/fileadmin/ewetp_docs/Bibliography/Training_report.pdf

Gazman O. *Industry-Based Skills Standards for Building Operators-a Business Case*. Strategic Planning for Energy and the Environment, Vol. 32, no. 3, pp. 25–38, 2013.

Graham Coates et al. *A Study Of Capturing The Skill Competencies Of The Workforce Within A Small Manufacturing Engineering Company*. International Conference On Engineering Design, ICED'07 (2007).

Janez Renko, CCIS – EEIA Slovenia. *KnowME. Skills and Knowledge Management in the Metal and Electrical Industry. Industrial Relations And Social Dialogue. Overall Interview Report*. 2013. Available: http://know-me.gzs.si/pripone/p_EN_KnowME_overall_IR%20.pdf

Kurt Schmid. *Future Skills Needs In Micro And Craft(-Type) Enterprises Up To 2020. Highlights Of An International Comparative Research Project With Austrian Participation*. ibw – Institut für Bildungsforschung der Wirtschaft. ibw Research Brief, Issue No. 67, April 2011. Available: http://files.adulteducation.at/bifodok/rb_67_en.pdf

New Skills For New Jobs: Action Now. A Report By The Expert Group On New Skills For New Jobs Prepared For The European Commission. February 2010. Available: http://ec.europa.eu/social/BlobServlet?docId=4505&langId=en

OECD (2013). *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*. OECD Publishing. Available: http://dx.doi.org/10.1787/9789264204256-en

Oxford Research for DG Employment, *Social Affairs and Equal Opportunities. Final Report - Transversal Analysis on the Evolution of Skills Needs in 19 Economic Sectors*. 2010. Available: http://ec.europa.eu/social/BlobServlet?docId=4687&langId=en

Robert L. Mott et al. *Future Directions For Mechanical, Manufacturing, And Industrial Engineering Technology Programs*. University of Dayton, 2002. Available: http://www.meteconline.org/resources/papers/JET%20Final%20Paper-Future%20of%20Mfg%20ET-2002.pdf

SEMTA. Future skills Wales 2005. Sector skills survey. Available: http://www.learningobservatory.com/uploads/publications/445.pdf

UK Commission For Employment And Skills. *Sector Skills Assessment: Manufacturing*. The Sector Skills Council Manufacturing Consortium (UK). 2012. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/306443/briefing-paper-ssa12-manufacturing.pdf

Vivarelli, M. Innovation, Employment and Skills in Advanced and Developing Countries: A Survey of the Literature. Discussion Paper No. 6291. Bonn, Germany. 2012. Available: http://ftp.iza.org/dp6291.pdf

Winterbotham M., Vivian D., Shury J. and Davies B. UK Commission's Employer Skills Survey 2013: UK Results. Evidence Report 81. 2014. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/327492/evidence-report-81-ukces-employer-skills-survey-13-full-report-final.pdf

6.2. Overview of the most relevant researches and data summaries in skill gaps

Connor H. et al. *An Assessment of Skill Needs in Engineering*. *A Comprehensive Summary From Employers Of Skills Requirements In Engineering*. The Institute For Employment Studies, 2000. Available: http://dera.ioe.ac.uk/4449/3/UKEnginSkillsNeeds.pdf
„Skill shortages are apparent at all levels but especially at the higher end of the occupational spectrum, among professional engineers, and also in skilled (craft) trades, including electronics and IT skills. The main skill gaps are in specific technical and practical skills areas but personal and generic skills are also in short supply."
„There are noticeable differences between different engineering occupations and different engineering sectors, for example between electronics and mechanical engineering, which mean that specific supply and demand issues have more significance to some parts of the engineering industry than to others."
„The shape and structure of the industry has changed in many ways which have implications for skills. There has been a shift in the occupational balance towards the more highly-skilled and educated. Jobs have become more demanding at all levels, and there is an increased use of cell and team working. There are now fewer large firms because of downsizing and more out-sourcing."
„At a regional level, there are also considerable contrasts due to the varying composition of engineering, in terms of sectors, size breakdowns and occupation patterns, though all regions have some representation of all sectors of engineering. Key issues of strategic importance for engineering at a regional level, and priorities for regional organisations, will therefore vary accordingly."
„A number of drivers of change are acting in unison to change skill requirements in a range of jobs. These include the increased use of technology, new materials and new processes throughout industry, an increasing emphasis on customers and meeting their requirements, new working practices, and the globalisation of many aspects of business. These demand higher-level skills and education, and also greater breadth of skill and greater flexibility in the applications of skills."
„A range of new and specific technical skills is required to meet the demands of technology and of the business, but also of importance is the greater emphasis employers put on personal and generic skills in all work areas. The key role of managers and supervisors, and the importance of their generic skills, are increasingly being recognised, though perhaps not sufficiently within many small firms. The role of line manager/team leader has become increasingly critical, and requires a different mix of skills (both technical

and communication skills)."
„While a lot of change is happening there is also continuity, and though declining, craft skills continue to be needed (in large numbers), along with the underpinning knowledge that goes with them."
„It is estimated that around one in six engineering employers have hard-to-fill vacancies and these are found more commonly in the engineering areas: craft, technician, professional and managerial occupations. Two-thirds of all vacancies at craft and skilled operative level are hard-to-fill ones, as are over half of all vacancies at engineering professional level. Particular areas of difficulty identified include: design engineers, CNC programmers, electrical engineers, fitters, pattern makers and CNC setters and operators."
„Engineering employers find it more difficult to recruit people with technical and practical skills than other skills. These technical skills cover a wide range and often fairly generic terms are used, eg electrical, design. Limited evidence is available which explores the nature of these difficulties in detail. It would be beneficial in helping to understand more about skill gaps and their causes if they could be unpacked more, at a sectoral or local level."
„Skill deficiencies in the existing engineering workforce are also evident, in particular in the engineering occupations cited above as causing recruitment difficulties. One in four engineering employers considers there is a gap between the skills of their current workforce and those needed to meet their business objectives. The nature of these skill gaps also mirrors those experienced in recruitment difficulties, with an emphasis on practical and technical skills, but the personal and generic skills are also mentioned."
Fitch-Roy, O. *Workers wanted: The EU wind energy sector skills gap*. 2013. Available: http://www.windplatform.eu/fileadmin/ewetp_docs/Bibliography/Training_report.pdf
"This study has found economy wide concern about the low number of graduates from schools and universities opting for science, technology, engineering and mathematics (STEM) courses."
"Our study has also revealed industry concerns about an information schism. The education and training on offer lags behind technical developments in the wind energy sector. The current focus on academic rather than practical and problem solving skills means that there is strong industry support for an EU wide standardisation of curricula."
Graham Coates et al. *A Study Of Capturing The Skill Competencies Of The Workforce Within A Small Manufacturing Engineering Company*. International Conference On Engineering Design, ICED'07 (2007).
„With regard to the skills of an individual, research literature distinguishes between soft and hard skills. Hard skills are viewed as those primarily related to a technical domain. Further, with a particular focus on engineers, hard skills are referred to as defining skills, which are said to be unique to the engineer and encompass a sound knowledge of the engineering fundamentals within their discipline. In contrast, soft skills are seen as interpersonal skills that enable effective performance in a commercial working environment. Collectively, soft skills have been defined as including communication skills, teamwork skills, problem-solving skills, and conflict resolution skills. In the research reported, it has been widely recognised that companies desire individuals with both hard and soft skills."
„Establishing a way to quantify a person's skills is recognised as a fundamental problem and a significant challenge."
„However, it has been reported that there is no natural scale on which to measure skills, which is seen as placing a burden on researchers to provide a scale that is uniformly understood. Also, it has been noted that existing research suggests there is no universal formula to measure the value of employee skills and competencies. Regardless of the scale used to represent an individual's skills, it has been recommended that it should be based on a combination of professional training, practical experience, and academic qualifications."
Chin-Guo Kuo and Chi-Cheng Chang. *Building Professional Competencies Indices in the Solar Energy Industry for the Engineering Education Curriculum*. International Journal of Photoenergy, Volume 2014 (2014). Available: http://www.hindawi.com/journals/ijp/2014/963291/
„In competence-based theory, I-O psychologists generally take the competency model formed by KSAOs (Knowledge, Skill, Ability, Others) as a suitable way to describe the critical capabilities required for performing a particular job. Therefore, "Competency'' can also be regarded as the set of capabilities that you should have when engaging in a particular task. This competency can be further subdivided into general competency, management competency, professional competency, and core competency. With the professional competency expected by the employer establishing a baseline, the techniques and skills exhibited by technical personnel allow prediction of their job performance."
„This study found that solar industry professional competency is composed of 11 professional dimensions, with each professional competency composed of several subdimensions."

SEMTA. *Future skills Wales 2005. Sector skills survey*. Available: http://www.learningobservatory.com/uploads/publications/445.pdf
"Anecdotal data provided some indication of the types of other technical and practical skills lacking amongst applicants for skill shortage vacancies, and in which occupation types these occurred. For example, some employers felt that applicants for vacancies in Skilled Metal and Electrical trades lacked skills relating to reading and understanding engineering drawings and qualifications to do electrical work."
"Apart from other technical and practical skills, the skills most commonly reported as lacking amongst employees were mainly generic skills, for example, team working skills, problem solving skills and communication skills."
"Over three quarters (77 per cent) of establishments in SEMTA said that their employees lacked other technical and practical skills. The non-generic skills most commonly cited included Trade Skills/Building/Electrical/Construction (Time Served), Equipment Handling/Training, Product Knowledge and Engineering/Mechanical Engineering."
Vivarelli, M. *Innovation, Employment and Skills in Advanced and Developing Countries: A Survey of the Literature*. *Discussion Paper No. 6291*. Bonn, Germany. 2012. Available: http://ftp.iza.org/dp6291.pdf
"Beyond the quantitative effect of new technologies on the number of employees, it is also important to investigate the qualitative effect of technological change in terms of its possible skill bias. Nowadays, the evidence in favor of the skill-biased nature of new technologies is large, robust, and proven across different OECD countries, different economic sectors and different types of innovation."
"In general, the microeconometric literature, and particularly the most recent panel data analyses, tend to support a positive link between technology and employment, especially when R&D and/or product innovation are adopted as proxies of technological change and when high-tech sectors are the focus."
"Turning the attention to the DCs, technological change is mainly imported and innovation is more determined by trade, FDI, and consequent technology transfer, rather than by domestic private and public R&D expenditures."
Chin-Guo Kuo et al. *Constructing Employability Indicators for Enhancing the Effectiveness of Engineering Education for the Solar Industry*. International Journal of Photoenergy, Volume 2014 (2014). Available: http://dx.doi.org/10.1155/2014/491353
„When the employee commands the competence required by the enterprise then it can be expected that the employee will demonstrate the performance anticipated by the enterprise. Such competence can be broken down into four types: core competence, professional competency, management competence, and general competence."
„From the results of field interviews, it was seen that "working attitude" establishes a basis upon which an employee can fully express his or her competence and demonstrate the "job performance" expected by the company. Employability demonstrates consistency between the level of an individual's "competence" and "job performance;" these two also contribute to high employability, in the form of the individual's long-term value for the company."
„Working attitude determines the level of competence and job performance. The possession of an aggressive working attitude and active learning competence can help increase job performance. When an individual's job performance is not as expected, good working attitude could enable the individual to pursue a higher job performance and to improve his/her value for long-term employment by the enterprise."
Robert L. Mott et al. *Future Directions For Mechanical, Manufacturing, And Industrial Engineering Technology Programs*. University of Dayton, 2002. Available: http://www.meteconline.org/resources/papers/JET%20Final%20Paper-Future%20of%20Mfg%20ET-2002.pdf
„A major issue facing engineers and technologists has to do with the global economy. Basic, labor intensive manufacturing has largely moved to the lowest bidder, often China. To maintain a high standard of living, the United States (as well as Western Europe) will have to keep doing research and finding more complicated products to manufacture."
„Cultural issues and intercultural communication are becoming more important in industry because of globalization."
„Mechanical engineering technology education is expensive to deliver due largely to expensive laboratory equipment, limited laboratory class sizes, and lack of available graduate student teaching assistants. The trend to declining enrollment in engineering and MET tends to decrease class sizes, thereby raising the cost per student. The opportunity or convenience of distance learning appears to substantially increase enrollment in classes where it has been employed."
CCIS in cooperation with LINPRA, MASOC and ZEP. *KnowME*.

Skills and Knowledge Management in Metal and Electro Industry. Survey report. 2013.
„In general, companies are satisfied with the level of skills in their own company, but a worrying share of 25% is not satisfied with their current skills level, in SMEs even 30%. Stated as the main problems related to skills were the facts that there are not enough highly skilled workers available on the labour market and that there are not enough VET apprentices available. The lack of skilled workers is especially evident in Latvia and in medium-sized companies. Despite this lack of highly skilled workers, the share of companies that think demographic change does not concern them and that do not prepare for it, is the highest in Latvia with 26%. Also about one quarter of small companies believe that demographic change does not concern them. It is not surprising that the large companies are best prepared for demographic change with the highest share of companies already having measures in place to adapt to demographic change. About 80% of large companies provide regularly or quite often learning opportunities, training and education to their employees while this share is only 43% among the small and 67% among the medium-sized companies."
„All companies have expectations about cooperation of their social partner organisations, especially in the areas of preparing for future skills and labour need and in anticipating and preparing for industrial and demographic change. This result clearly underlines the importance of projects such as KnowME and show the need for further action."
Janez Renko, CCIS – EEIA Slovenia. *KnowME. Skills and Knowledge Management in the Metal and Electrical Industry. Industrial Relations And Social Dialogue. Overall Interview Report*. 2013. Available: http://know-me.gzs.si/pripone/p_EN_KnowME_overall_IR%20.pdf
„The actual skills needs in companies are covered by skilled employees; additional VET training of the employees is performed when needed. VET graduates coming from schools have a good knowledge, but no practical skills. The majority of companies do not report/communicate the deficiencies in the VET education to the VET schools/authorities. Some companies collaborate very well with VET schools and universities. Skills/skilled workers on the market are available, but almost all need adaptation to the work tasks, sometimes they also go through a specialization process."
„Future skills and knowledge planning is performed in the metal industry in some cases as long-term planning technology related – Lithuania. In the electrical and electronics industry mostly short/medium term planning is used because of the rapid changes in the market and customer requirements."
UK Commission For Employment And Skills. *Sector Skills Assessment: Manufacturing*. The Sector Skills Council Manufacturing Consortium (UK). 2012. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/306443/briefing-paper-ssa12-manufacturing.pdf
„The pattern of skill demand reflects the heterogeneous nature of the sector with there being a range of sectors which have a strong demand for high level skills typically with a STEM* element, and those which are still relatively labour intensive and dependent upon machine operatives." ** Science, technology, engineering, and mathematics.*
„The qualifications profile of the sector reflects the relatively aged workforce with many people not possessing qualifications or possessing relatively low qualifications given their occupation and seniority."
Detlef Buschfeld et al. *Identification Of Future Skills Needs In Micro And Craft (-Type) Enterprises Up To 2020. Final Report*. Cologne, Hamburg, Vienna, 2011. Available: http://ec.europa.eu/enterprise/policies/sme/promoting-entrepreneurship/files/skillsneeds_final_report_final_180211_en.pdf
„Overall, the following skill needs are seen as increasing in the future: customer and market orientation, working in cooperative and collaborative international work structures, and management skills. Different top-10 lists were compiled. One is showing the skill needs set to increase most already in the past but ongoing in the future (Top 1: Customer service communication – 79.4 % (frequency of increase), Top 2: Developing new services, broaden range of offered products – 78.5 %, Top 3: Analyzing known tasks 77.2 %). The other lists the largest difference in ranking between past and future needs. It shows the present emerging skills needs, which are seen as more important in the future (Top 1: Developing knowledge about foreign markets – 35.3 % (Difference between past and future increases), Top 2: Communicating with customers and employees in foreign language – 27,7 %, Top 3: Securing own innovations and patents – 25.4 %)."
„Future skill needs are important and need planning. Companies are aware of this requirement and its relevance, and there is general consensus that more systematic approaches would be useful. However this is not reflected in practice. The driving forces for company activities in this field are mainly spontaneous, in reaction to customer or employee demands as well as being guided by personal assumptions. Companies

prefer direct contact with and information from market players. They either try to cope with skills demand internally or through working in strategic networks with other companies."
OECD (2013). OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing. Available: http://dx.doi.org/10.1787/9789264204256-en
"With manufacturing and certain low-skill tasks increasingly becoming automated, the need for routine cognitive and craft skills is declining, while the demand for information-processing and other high-level cognitive and interpersonal skills is growing. In addition to mastering occupation-specific skills, workers in the 21st century must also have a stock of information-processing skills and various "generic" skills, including interpersonal communication, self-management, and the ability to learn, to help them weather the uncertainties of a rapidly changing labour market."
"Improving the supply of skills is only half the story: skills shortages co-exist with high unemployment; and better use can be made of existing skills. There is growing interest among policy makers not only in creating the right incentives for firms and individuals to invest in developing skills, but also in ensuring that economies fully use the skills available to them."
"Globalisation has also led to the outsourcing of production. Low-skilled jobs are increasingly seen as being "offshoreable" – i.e. being relocated from high wage or high cost locations to low wage and low cost locations in less developed countries. Offshoring is increasingly spreading from manufacturing to technology-intensive industries, including services. While offshoring accounts for only a small percentage of aggregate job losses on balance, the offshoring of jobs to countries with workforces that are moderately educated but earn comparatively lower wages has been cited as a possible reason for the decline in mid-level jobs in more advanced economies."
Oxford Research for DG Employment, *Social Affairs and Equal Opportunities. Final Report - Transversal Analysis on the Evolution of Skills Needs in 19 Economic Sectors*. 2010. Available: http://ec.europa.eu/social/BlobServlet?docId=4687&langId=en
„One of the most important findings of the transversal sectoral study seems to be the polarisation of the labour market and skills needs. This means: (1) Decline in skilled jobs (E.g. craftsmen, etc.), (2) Moderate increase in very low skilled elementary jobs (E.g. elementary occupations), (3) High increase in high skilled jobs (E.g. Professionals, managers, etc.)."
„Within production there has been a quite significant job loss during the last decade, this especially within skilled jobs. However, due to enlarged focus on specialisation and new value adding activities there seems to be a development towards European excellence within production resulting in higher added value and more high skilled jobs: European production goes towards specialisation and excellence meaning significant loss in skilled jobs but increase in high skilled jobs. Regardless of job losses and other structural developments there is a clear tendency of up-skilling: (1) Up skilling in all sectors both historically and in the future, (2) Increasing educational levels in all sectors."
„When looking at emerging skills and competencies many sectors especially experience new emerging skills need within areas, which are closely connected to the major trends in world policy and economy including climate, ICT and the continued internationalisation of markets and supply chains: New skills and competences are especially related to sustainability (environment, climate, health, etc.), ICT, and to the internationalisation of both workforce, markets and supply chains."
Winterbotham M., Vivian D., Shury J. and Davies B. *UK Commission's Employer Skills Survey 2013: UK Results. Evidence Report 81*. 2014. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/327492/evidence-report-81-ukces-employer-skills-survey-13-full-report-final.pdf
"Economic growth and recovery may be constrained by skill shortages as the labour market responds to employer requirements. While in most cases demand for skills is met through successful recruitment, almost three in ten vacancies are reported to be hard-to-fill, and shortages in suitably skilled, qualified and/or experienced workers are the main reason for this. Overall, such skill-shortage vacancies represent more than one in five of all vacancies (22 per cent), up from one in six in 2011 (16 per cent)."
"Skill shortages differ by occupation and pockets of shortages remain largely unchanged since 2011. Skilled Trades roles remain the most common occupation where skill shortages are likely to be encountered when employers recruit for these roles. In 2011, managerial roles were the next most challenged by shortages in available skills; since then, the challenge has shifted towards Professionals, Associate Professionals, Caring, Leisure and Other services staff and Machine Operatives."
"The existence of skill gaps may not necessarily indicate potential performance issues. In a relatively large proportion of cases the employees in question are new to their job role and/or are trainees, with the

suggestion that their proficiency problems are temporary. In other cases, skill gaps could be an indication of employer awareness of skills issues, or higher expectations/ambitions. It is certainly the case that employers pursuing a strategy of High Performance Working and employers recording a high Product Market Strategy "score" (indicating that they are innovators, offering premium products or services) are more likely to report skill gaps (although the proportion of the workforce employed by this kind of progressive organisation that is lacking proficiency is no greater than the proportion of the general workforce with a skills gap)."

6.3. Focus group forms

Focus group meeting 1

The aim group of the 1st focus group meeting: to identify main technical skill gaps, challenges and potential areas of development and training needs in metal and electro industry in the participants' companies, to research skill gaps, to select and define skill gaps for the joint curriculum.
Moderator: _____
Moderator's assistant: _____
Place: _____
Time: _____ _____

Questions for the 1st focus group meeting (1-4 are questions for focusing the discussion, the 5th and the 6th are the most important for the research):
Do your employees possess all the necessary skills for current production processes at your company?
What technical skills do your employees miss?
Do you monitor the development of the technologies?
Do you offer training for the employees? If yes, how often?
5. What current technical skills have to be improved (updated) for future in metal and electro industry (in 3-5 years) and new VET programmes have to be designed for them?
6. What new skill needs will be essential for future in metal and electro industry (in 3-5 years) and new VET programmes have to be designed for them?

Participants, representatives of 10 (at least) companies vary in size in the metal and electro industry):

	Name, surname	Name of the company	Number of employees
1			
2			
3			
4			
5			
6			
7			
8			
9			

Preparation of the discussion
Moderator. Introduction. The aim of the discussion.
Moderator's assistant. Filling in the agreement (if needed), turning on the dictaphone.
Participants introduce themselves (name, company).
Procedure of the discussion

1.	Do your employees possess all the necessary skills for current production processes at your company?	*[Comments]*
2.	What technical skills do your employees miss?	*[Comments]*
3.	Do you monitor the development of the technologies?	*[Comments]*

4.	Do you offer training for the employees? If yes, how often?	*[Comments]*
5.	What current technical skills have to be improved (updated) for future needs in metal and electro industry (in 3-5 years) and new VET programmes have to be designed for them?	*[Comments]*
6.	What new skill needs will be essential for future in metal and electro industry (in 3-5 years) and new VET programmes have to be designed for them?	*[Comments]*

Conclusions

Skills defined in the 1st focus group discussion	Remarks

Identified skills for the 2nd focus group discussion

1.
2.
3.
4.
5.
6.

Focus group meeting 2

The aim of the 2nd focus group meeting: to discuss the results of the 1st focus group meeting and develop the recommendation for the final selection of skill gaps for designing a common training programme in metal and electro industry

Moderator: _____

Moderator's assistant: _____

Place: _____

Time: _____

Participants (the same as in the 1st focus group)

	Name, surname	Name of the company	Number of employees
1			
2			
3			
4			
5			
6			
7			
8			
9			

Preparation of the discussion

Moderator. Introduction. The aim of the discussion.

Moderator's assistant. Filling in the agreement (if needed), turning on the dictaphone

Procedure

	Skills identified in the focus group meeting 1	Comments on selection
1.	*[Skill]*	
2.	*[Skill]*	
3.	*[Skill]*	
4.	*[Skill]*	
5.	*[Skill]*	
6.	*[Skill]*	

Summary

Selected skills for the research	NQF/ EQF level	The level of importance (4-1)				Reason of selection
		4	3	2	1	

6.4. Interview forms

Metal industry

Dear Madam/Sir,
the main purpose of the Erasmus+ skillME project, which is being implemented in four EU Member States, is to identify skill gaps in electro and metal industry's advanced manufacturing sector and to create curriculums to fill these gaps.
Several different methods are used for gathering data, one of which is interviews. Our aim is to implement and analyse 10 interviews (5 in electro and 5 in metal sector) per project participating country with HRM staff and production line leaders so we consider your feedback on this topic very important.
Collected data will be statistically analysed and interpreted at group level and used only for the purpose of this project. Anonymity of participants as well as the confidentiality of all collected data is guaranteed.
During the interview please give your opinion relative to your company and the job descriptions within it, regardless of your knowledge of other related companies.

A) Company information

A1. Size of company: A) Small or medium-sized enterprise
(up to 250 employees)

B) Large company
(over 250 employees)

A2. Company name: _____

A3. Sector: _____

A4. Total number of employees in the company: _____

A5. Job title (position) of the interviewee: _____

B. Questions about job positions at secondary vocational education level

B1. Please indicate two priority job positions in your company for qualifications in the metal sector (eg: technician, mechanic, installer, operator, etc.) in a specific area (eg: maintenance of equipment and/or machinery, manufacturing of equipment, vehicles, distribution, etc.) at secondary vocational education level where you observed the highest number of skill gaps among new employees.

	Job position	Number of employees
1		
2		

B2. Could new VET curricula, developed through this project, overcome these gaps?
YES/NO

B3. If you answered the previous question positively please specify which skills/knowledge are lacking?

B4. Can you predict the need for new qualifications in your company in the next five years? If yes, which qualifications?

C. Employee competenices

C1. Rate the desirable competencies of employees by puting an X next to each competency in accordance with the following scale:

0 – N/A
1 – Least required
2 – Required
3 – Most required

In the YES/NO column specify if the competencies are adequatly achieved through vocational education (YES - achieved; NO - not achieved).

Nr.	Competencies/skills/learning outcomes	0	1	2	3	YES/NO
1.	Use of CAD technology					
2.	Application of CAM system in production					
3.	Knowledge of renewable energy sources systems					
4.	Use of non-conventional machining procedures					
5.	Use of CNC technologies for material processing					
6.	Adjusting parameters of CNC machines					
7.	Programming of robots and manipulators					
8.	Optimization of product and operating procedures					
9.	Reverse engineering					
10.	Use of new technology for measurement and control					
11.	Applying quality assurance procedures					
12.	Reading technical documentation					
13.	Applying prescribed legal regulations and standards					
14.	Applying workplace safety regulations					
15.	Knowledge of metallic and non-metallic materials in mechanical engineering industry					
16.	Applying new technologies for joining parts in metal industry					
17.	Knowledge of welding techniques					
18.	Use of 3D modelling programs					
19.	Knowledge of 3D printing					
20.	Mathematical competence - applying mathematical knowledge for problem solving					
21.	Natural competence – awareness of nature, importance of ecology and environment protection					

C2. Which competencies, of the one you've marked as lacking, would you say are the most important?

C3. Are there any competencies that weren't mentioned in the table in C1 that you would like to single out as being problematic for workers?

D. General comment on competencies

D1. Comments, suggestions and/or ideas regarding required competencies (both current and future needs)

If you are interested, the final interview summary can be sent to you by e-mail.
YES/NO
e-mail:_____

Thank you for participating in the interview.
Interviewer (name and organisation):
Date: _____

Electro industry

Dear Madam/Sir,
the main purpose of the Erasmus+ skillME project, which is being implemented in four EU Member States, is to identify skill gaps in electro and metal industry's advanced manufacturing sector and to create curriculums to fill these gaps.
Several different methods are used for gathering data, one of which is interviews. Our aim is to implement and analyse 10 interviews (5 in electro and 5 in metal sector) per project participating country with HRM staff and production line leaders so we consider your feedback on this topic very important.
Collected data will be statistically analysed and interpreted at group level and used only for the purpose of this project. Anonymity of participants as well as the confidentiality of all collected data is guaranteed.
During the interview please give your opinion relative to your company and the job descriptions within it, regardless of your knowledge of other related companies.

A) Company information

A1. Size of company: A) Small or medium-sized enterprise
(up to 250 employees)
B) Large company
(over 250 employees)

A2. Company name: _____

A3. Sector: _____

A4. Total number of employees in the company: _____

A5. Job title (position) of the interviewee: _____

B. Questions about job positions at secondary vocational education level

B1. Please indicate two priority job positions in your company for qualifications in the electro sector (eg: technician, mechanic, installer, operator, etc.) in a specific area (eg: maintenance of equipment and/or machinery, manufacturing of equipment, vehicles, distribution, etc.) at secondary vocational education level where you observed the highest number of skill gaps among new employees.

	Job position	Number of employees
1		
2		

B2. Could new VET curricula, developed through this project, overcome these gaps?
YES/NO

B3. If you answered the previous question positively please specify which skills/knowledge are lacking?

B4. Can you predict the need for new qualifications in your company in the next five years? If yes, which qualifications?

C. Employee competenices

C1. Rate the desirable competencies of employees by puting an X next to each competency in accordance with the following scale:

0 – N/A
1 – Least required
2 – Required
3 – Most required

In the YES/NO column specify if the competencies are adequatly achieved through vocational education (YES - achieved; NO - not achieved).

Nr.	Competencies/skills/learning outcomes	0	1	2	3	YES/NO
1.	Assemble, adjust and maintain electronic circuits and/or devices					
2.	Perform electric installations according to connection diagrams					
3.	Read electrical schematics and make changes					
4.	Detect and diagnose malfunctions in circuits and/or devices					
5.	Understand industrial communications					
6.	Install and maintain elements of intelligent installations					
7.	Use electrical measuring instruments for testing devices and eliminating faults					
8.	Measure electrical quantities					
9.	Measure non-electrical quantities					
10.	Install and maintain PLC (programmable logic controller)					
11.	Knowledge of renewable energy sources systems					
12.	Know the properties of electrical devices in an electric distribution system					
13.	Apply basic knowledge of electrical machines and devices as well as knowledge on the control and regulation of automation systems					
14.	Install sensors and actuators					
15.	Control non-regulated and regulated electric-motor drives					
16.	Design a simple automatic system for monitoring and controlling by a microcontroller or industrial computer					
17.	Control robots					
18.	Collect data using a computer and microcontroller and processing it					
19.	Connect computers and/or devices into a network					
20.	Prepare and update technical and technological documentation					
21.	Apply quality assurance procedures					
22.	Apply prescribed legal regulations and standards					
23.	Apply workplace safety regulations					
24.	Knowledge of measures and procedures that affect savings (cost reduction)					
25.	Mathematical competence - applying mathematical knowledge for problem solving					
26.	Natural competence – awareness of nature, importance of ecology and environment protection					

C2. Which competencies, of the one you've marked as lacking, would you say are the most important?

C3. Are there any competencies that weren't mentioned in the table in C1 that you would like to single out as being problematic for workers?

D. General comment on competencies

D1. Comments, suggestions and/or ideas regarding required competencies (both current and future needs)

If you are interested, the final interview summary can be sent to you by e-mail.
YES/NO
e-mail:_____
Thank you for participating in the interview.

6.5. List of companies represented in focus groups

Slovenia. Focus group 1

Name, surname	Name of the company	Number of employees
ANDREJ POKLIČ	GKN DRIVELINE D.O.O.	333
PETER ZALETELJ	CREINA D.D.	43
HUGO BOSIO	BOSIO D.O.O.	71
Dr. BLAŽ NARDIN	GORENJE ORODJARNA D.O.O.	224
DRAGO FRANKO	NAFTA STROJNA D.O.O.	124
ANTON MERČNIK	ARCONT D.D.	533
ROBERT RIBIČ	UNIOR D.D.	2023
IVAN RUPNIK	HIDRIA IMP KLIMA D.O.O.	281
MATJAŽ KOMPARA	GOSTOL-GOPAN D.O.O.	98
ALEN ŠINKO	KOVIS D.O.O.	173
GREGOR ŠVAJGER	SISTEMSKA TENIKA D.O.O.	241
SLAVKA MARINIČ	PRIMAT D.D.	166
MILAN KOPAČ	POCLAIN HYDRAULICS D.O.O.	270
JANJA PETKOVŠEK	GZS-ZKOVI	/
ŽELJKO JOKIĆ	GZS-ZKOVI	/

Slovenia. Focus group 2

Name, surname	Name of the company	Number of employees
ANDREJ POKLIČ	GKN DRIVELINE D.O.O.	333
PETER ZALETELJ	CREINA D.D.	43
HUGO BOSIO	BOSIO D.O.O.	71
Dr. BLAŽ NARDIN	GORENJE ORODJARNA D.O.O.	224
DRAGO FRANKO	NAFTA STROJNA D.O.O.	124
BRANKO KURBUS	ARCONT D.D.	533
ROBERT RIBIČ	UNIOR D.D.	2023
IVAN RUPNIK	HIDRIA IMP KLIMA D.O.O.	281
MATJAŽ KOMPARA	GOSTOL-GOPAN D.O.O.	98
ALEN ŠINKO	KOVIS D.O.O.	173
SLAVKA MARINIČ	PRIMAT D.D.	166
MILAN KOPAČ	POCLAIN HYDRAULICS D.O.O.	270
ANTON MLAKAR	VAR D.O.O.	66
ALEŠ BIZJAK	POCLAIN HYDRAULICS D.O.O.	270
MATEJ KOGLOT	GOSTOL TST D.O.O.	84
BOJAN GANTAR	TRIMO D.D.	394
MAG. VALTER LEBAN	KOLEKTOR ORODJARNA D.O.O.	192
MATIJA BRODNIK	RIKO RIBNICA D.O.O.	37
GREGOR ŠVAJGER	SISTEMSKA TENIKA D.O.O.	241
JANJA PETKOVŠEK	GZS-ZKOVI	/
ŽELJKO JOKIĆ	GZS-ZKOVI	/
PETRA FLERIN	GZS-ZKOVI	/

Latvia. Focus group 1

Name of the company	Participant	Size
Bureu Veritas Latvia	Normunds Ozols	S
Cutcentre Ltd	Andrejs Podurecs	S
Ltd “Instro”	Aleksejs Gutmans	M
Ltd “Inspecta Latvia”	Kaspars Staņa	S
Ltd “Intra EM”	Andrejs Šišovs	S
ISP Optics Latvia	Ēriks Bediķis	M
Stock Company “Jauda”	Ivars Eniņš	L
Ltd. LL KU Viadukts	Vladimirs Larionovs	L

Ltd “Metālmeistars”	Māris Balodis	S
Ltd “Peruza”	Arnis Petrānis	M
Ltd “Severstal Distribution”	Aļona Kerubina	L
Ltd “Polymold”	Atis Šakars	S
Ltd “Tērauds & komponenti”	Edgars Nažinskis	S

Latvia. Focus group 2

Name of the company	Participant	Size
Ltd “SILMOR”	Jānis Siliņš	S
Ltd “Granīts”	Artūrs Puļķis	S
Ltd “Valpro”	Aivars Flemings	S
Ltd “Polymold”	Signe Strausa	S
Ltd “Tērauds & komponenti”	Edgars Nažinskis	S
Ltd “NOOK”	Aivars Kļaviņš	M
Stock Company “Jauda”	Ivars Eniņš	L
Ltd “Intra EM”	Andrejs Šišovs	S
Ltd “Instro”	Aleksejs Gutmans	M
MASOC	Andis Lejiņš	L

Slovakia. Focus groups 1 & 2

Ing. Ján Badžgoň, PhD., Castro & Pollux, a.s.
Ing. Rastislav Kanas, SAT Systémy automatizačnej techniky, spol. s. r. o.
Ing. Miroslav Holčík, MURAT, s. r. o.
Ing. Otto Verbich, PhD., viceprezident pre vedu a výskum
Ing. Roman Palaj, TESLA Liptovský Hrádok, a. s.
prof. Ing. František Janíček, PhD., Fakulta elektrotechniky a informatiky STU v Bratislave
Danica Fleischerová, VUKI a. s.
Ing. Štefan Kuric, Eltek, s. r. o.
Ing. Michal Rafaj, RMC, s. r. o.
Ing. Slavomír Seman, ABB, s. r. o.
Ing. Roman Slobodník, OSRAM, a. s.
Ing. Dušan Synak, PhD., Sylex, s. r. o.

Croatia. Focus group 1

Name, surname	Name of the company	Number of employees
Anton Rosančić	Metus d.o.o.	200
Milan Petrović	Končar generatori i motori d.d.	518
Sanja Damjanović	Končar elektronika i informatika d.d.	254
Zoran Gligorić	Elektro- kontakt d.d.	835
	KONČAR – Mjerni Transformatori	244
Marina Jerković	ĐĐ INŽENJERING Slavonski Brod	39
Stjepan Hittner	HITTNER d.o.o. Bjelovar	98
Robert Vidas Iva Prša	KONČAR-Metalne konstrukcije d.d. Zagreb	286
Snježana Šimunec	MIV Varaždin	650
Radislav Drljević	TTO Thermotechnik Rijeka	63
Anton Rosančić	Metus d.o.o.	220
Milan Petrović	Končar generatori i motori d.d.	518
Sanja Damjanović	Končar elektronika i informatika d.d.	254
Zoran Gligorić	Elektro- kontakt d.d.	828
	KONČAR – Mjerni Transformatori	244
Sanja Foder	HF Belišće	651
Heidi Eterović	Centre for metal industry kompetencis	1

Croatia. Focus group 2

Name, surname	Name of the company	Number of employees
Marina Jerković	ĐĐ INŽENJERING Slavonski Brod	39
Stjepan Hittner	HITTNER d.o.o. Bjelovar	98
Robert Vidas Iva Prša	KONČAR-Metalne konstrukcije d.d. Zagreb	286
Snježana Šimunec	MIV Varaždin	650
Radislav Drljević	TTO Thermotechnik Rijeka	63
Anton Rosančić	Metus d.o.o.	220
Milan Petrović	Končar generatori i motori d.d.	518
Sanja Damjanović	Končar elektronika i informatika d.d.	254
Zoran Gligorić	Elektro- kontakt d.d.	828
	KONČAR – Mjerni Transformatori	244
Marina Jerković	ĐĐ INŽENJERING Slavonski Brod	39
Stjepan Hittner	HITTNER d.o.o. Bjelovar	98
Robert Vidas Iva Prša	KONČAR-Metalne konstrukcije d.d. Zagreb	286
Snježana Šimunec	MIV Varaždin	650
Radislav Drljević	TTO Thermotechnik Rijeka	63
Anton Rosančić	Metus d.o.o.	220
Milan Petrović	Končar generatori i motori d.d.	518
Sanja Damjanović	Končar elektronika i informatika d.d.	254
Zoran Gligorić	Elektro- kontakt d.d.	828
	KONČAR – Mjerni Transformatori	244
Sanja Foder	HF Belišće	651
Heidi Eterović	Centre for metal industry kompetencis	1

6.6. List of companies interviewed

Country	Metal Industry	Electro Industry
Croatia	ĐĐ INŽENJERING Slavonski Brod HITTNER d.o.o. Bjelovar KONČAR-Metalne konstrukcije d.d. Zagreb MIV Varaždin TTO Thermotechnik Rijeka	Metus d.o.o. Končar generatori i motori d.d. Končar elektronika i informatika d.d. Elektro- kontakt d.d. KONČAR – Mjerni Transformatori
Latvia	Ltd „Talsu tehnika” Ventspils Welding Factory Bucher Municipal MASOC Skonto Plan Ltd. „Tiger” Ltd. Grandeg Ltd. LEAX Peruza	Ltd. „Komforts” FESTO
Slovenia	Aljaž Rogelj Mahle Letrika d.o.o. Hidria IMP Klima d.o.o. Lovran d.o.o. Revoz d.d. Novo mesto BSH Hišni aparati d.o.o. EMO Orodjarna Cinkarna Celje d.d. BSH Hišni aparati d.o.o.	Lovran d.o.o. Hidria rotomatika d.o.o. Revoz d.d. Novo mesto Cinkarna Celje d.d. BSH Hišni aparati d.o.o
Slovakia	ELSTER, a. s. JUSTUR, spol. s. r. o. CEP Scherdel pružiny, PREMATLAK, a. s. Secondary School Stará Turá, SENSUS Slovakia Chirana Medical, a. s.	Viragoparts + Medley, CH pritnt, Chirana Medical, a. s. Lantestel, s. r. o., SOS Stara Tura.