



INDUSTRY 4.0 COMPETENCIES
FOR CAREER MANAGEMENT -
RESEARCH IN
TURKEY, ROMANIA, SPAIN, HUNGARY AND POLAND

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Rooted in the Past, Forging the Future

CAREER GUIDE AND MOBILE APPICATION FOR EMPLOYEES



The aim of the Project


- ▶ Our project aims to produce innovative educational materials by which employees are able to plan their careers in the age of Industry 4.0

to develop applications by which employees will be able to measure their skills and competences.



Target group

- ▶ 1- beginners (students, graduates)
 - ▶ 2- intermediate (employees)
 - ▶ 3- advance (managers, directors)
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- ▶ The target group of the project consists of three groups; newly employed people or the ones who are going to start working in the near future (level 1), the employees who are currently working at the level of expertise (level 2) and the people who are currently working as managers (level 3).

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- ▶ Within the scope of our project, named Career Guide and Mobile Application for Employees,
 - ▶ 3 Intellectual Outputs have been developed:
 - ▶ Need analysis,
 - ▶ Career planning guide and
 - ▶ Mobile application

- ▶ First of all, a literature review and survey have been conducted on the subject of career planning in terms of Industry 4.0. This research book presents both the literature review and the results of the research phase in each partner countries.
- ▶ Then, based on the results of the needs analysis, a career planning guide at three levels has been prepared.
- ▶ And then, the mobile application has been developed on the basis of the career guide.



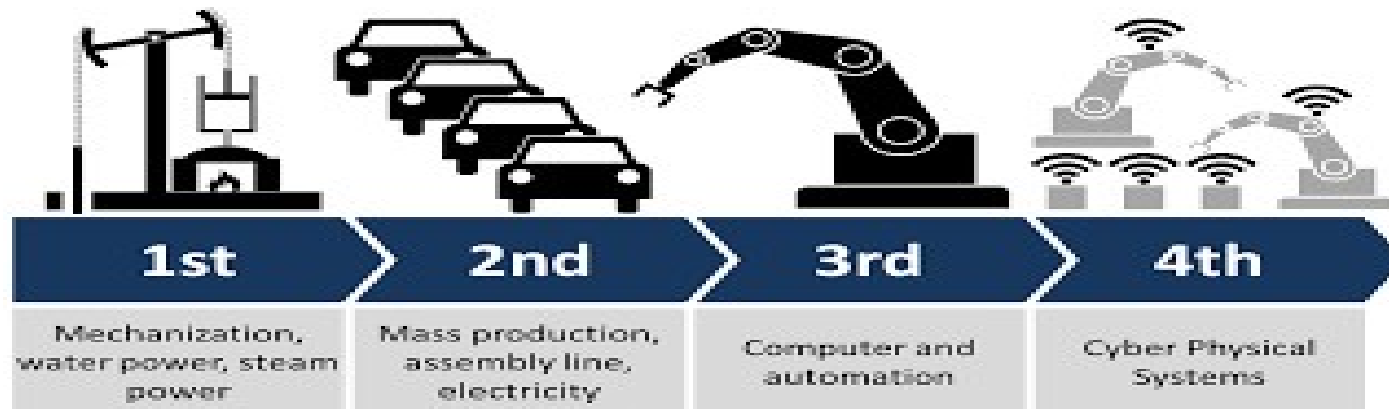
Intellectual Output 1 - NEED ANALYSIS



What is Industry 4.0?

- First industrial revolution is the use of steam power,
- second industrial revolution of electric motors, and
- the third is the programmable logic controllers or CNCs in manufacturing.

The fourth industrial revolution adheres to the connecting computers and allowing machines communicate with each other to make decisions without human involvement, also known as internet of things, allowing smart factories.



Industry 4.0

- 'Industry 4.0' was first introduced at the Hannover Fair in 2011 in Germany
- Since then, the term of Industry 4.0 is one of the most popular manufacturing topics among industry and academia in the world and has also been considered as the fourth industrial revolution with extreme impact on manufacturing in future.
- It has been widely adopted by other industrial nations within the European Union, and further a field in labor intense markets like China, India, and other Asian countries

Industry 4.0

- Industry 4.0 is the reflection of digital transformation in the industry and refers to smart factories which decide with so-called intelligent systems.



- It is closely related with the Internet of Things (IoT), Cyber Physical System (CPS), information and communications technology (ICT), Enterprise Architecture (EA), and Enterprise Integration (EI).
- The aim is to increase productivity in which production technologies and information technologies are combined

Industry 4.0

- The inevitable effects of I4.0 is the need for human factor is minimized; configuring smart factories.
- Robots as a form of complex machines are used in manufacturing to support and relieve the human operator, improve productivity, increase flexibility, reduce cost, and increase security.



- Industry 4.0 creates many new opportunities for companies, but at the same time several challenges arising from the ongoing automation and digitization (Hecklau, Galeitzke, Flachs, & Kohl, 2016).
- All the industrial revolutions did not influence not only the production itself, but also the labor market and the educational system as well.

- As a result of industrial revolutions, some professions and jobs disappeared.
- Same is expected in Industry 4.0, it is expected that some professions will be replaced (Benešová & Tupa, 2017).
- Historically, the rural population has been a major source of low-cost labor. Today, replacing the shortage of low-cost labor is automation (Li, 2018; Qin et al., 2016).
- Routine activities which also include monitoring tasks are entirely or partly taken over by machines (Erol et al., 2016).
- Industry 4.0 propagates the idea of workers should focus on creative, innovative and communicative activities

- Processes are becoming more complex, which leads to an increase of jobs with higher qualifications and a loss in jobs requiring lower qualifications.
- To cope with knowledge and competence challenges related to new technologies and processes of Industry 4.0 new strategic approaches for holistic human resource management are needed in companies (Hecklau et al., 2016) opening up a range of new business potentials and opportunities.
- Industry 4.0 will dictate new competencies from the employees.

- Enterprises have a responsibility and obligation to train their employees.
- It is necessary to establish lifelong learning and continuing professional development programs to help workers cope with new demands from the jobs and skills (Zhou et al., 2015).

- As we are in a transformation phase in digitization of manufacturing processes, the study takes training needs of the new industrial revolution also known as industry 4.0.
- The new paradigm shift in manufacturing processes requires new skills, as current education system is designed for previous production, the research proposes that employees and students may need training to adopt themselves for new production pattern.

The research Phase

The research aims to find out the training needs of the new industrial revolution also known as industry 4.0 of these 3 target group.

We carried out a field study for the first two level by conducting questionnaires and interviews for the managers.

- The study took place in Spain, Poland, Hungary, Romania and Turkey.
- Data is collected from;
- 90 students and 61 employees in Spain,
- 89 students and 73 employees in Romania,
- 100 students and 58 employees in Hungary,
- 138 students and 94 employees in Poland and
- 109 students and 60 employees in Turkey, with purposive sampling.

- Based on Prifti et. al (2017) Industry 4.0 Competency Model a questionnaire form is used as the data collection tool.
- The questionnaire form was adopted from Prifti et al. (2017)'s "A Competency Model for Industry 4.0 Employees" which is based on Great 8 competency dimensions.

- Frequency analysis is conducted in order to determine the training need analysis of students and employees in all partner countries.
- Thus it is aimed to reveal the skill kit required by Industry 4.0 for all the 3 levels from 3 sectors (education, manufacture and service)
- In other words, are the graduates, employees and managers ready for Industry 4.0 with the skills?

Industry 4.0 Competency Model

- **1- Leading and Deciding**
- **2- Supporting and Cooperating**
- **3- Interacting and Presenting**
- **4- Analyzing and Interpreting**
- **5- Creating and Conceptualizing**
- **6- Organizing and Executing**
- **7- Adapting and Coping**
- **8- Enterprising and Performing**

1- Leading and Deciding

- This dimension captures participant's taking control and exercise leadership, initiates action, gives direction, and takes responsibility skills

2. Supporting and Cooperating

- This dimension captures participant's supports others and shows respect and positive regard for them in social situations.
- Puts people first,
- working effectively with individuals and teams, clients, and staff.
- Behaves consistently with clear personal values that complement those of the organization

3. Interacting and Presenting

- This dimension captures communicates and networks effectively.
- Successfully persuades and influences others.
- Relates to others in a confident, relaxed manner

4. Analyzing and Interpreting

- This dimension is related to Applying Expertise and Technology
- Shows evidence of clear analytical thinking. Gets to the heart of complex problems and issues. Applies own expertise effectively. Quickly takes on new technology.
- Big data, network security, machine learning, system development, mobile Technologies, IT

5. Creating and Conceptualizing

- Works well in situations requiring openness to new ideas and experiences.
- Seeks out learning opportunities.
- Handles situations and problems with innovation and creativity.
- Thinks broadly and strategically.
- Supports and drives organizational change.

6. Organizing and Executing

- Plans ahead and works in a systematic and organized way.
- Follows directions and procedures.
- Focuses on customer satisfaction and delivers a quality service or product to the agreed standards.

7. Adapting and Coping

- Adapts and responds well to change.
- Manages pressure effectively and copes well with setbacks.

8. Enterprising and Performing

- Focuses on results and achieving personal work objectives.
- Works best when work is related closely to results and the impact of personal efforts is obvious.
- Shows an understanding of business, commerce, and finance.
- Seeks opportunities for self-development and career advancement.

The Findings of 5 Countries

Descriptives for Students

DIMENSION	COUNTRY	MEAN	
1. Leading and Decision	SPAIN	3,5956	
	ROMANIA	3,7333	
	HUNGARY	3,7739	
	POLAND	3,8019	
	TURKEY	3,7262	
	TOTAL	3,7425	

Descriptives for Employees

DIMENSION	COUNTRY	MEAN	
1. Leading and Decision	SPAIN	3,6525	
	ROMANIA	4,2667	
	HUNGARY	3,4422	
	POLAND	3,9468	
	TURKEY	3,9063	
	TOTAL	3,8735	

Descriptives for Students

DIMENSION	COUNTRY	MEAN		
2. Supporting and Cooperation	SPAIN	3,9590		
	ROMANIA	4,3641		
	HUNGARY	3,9157		
	POLAND	3,9251		
	TURKEY	3,7599		
	TOTAL	3,9617		

Descriptives for Employees

DIMENSION	COUNTRY	MEAN		
2. Supporting and Cooperation	SPAIN	4,1028		
	ROMANIA	4,6250		
	HUNGARY	3,6224		
	POLAND	4,0745		
	TURKEY	4,0365		
	TOTAL	4,1135		

Descriptives for Students

DIMENSION	COUNTRY	MEAN	
3. Interacting and Presenting	SPAIN	3,7022	
	ROMANIA	3,3256	
	HUNGARY	3,9521	
	POLAND	3,5495	
	TURKEY	3,6131	
	TOTAL	3,6303	

Descriptives for Employees

DIMENSION	COUNTRY	MEAN	
3. Interacting and Presenting	SPAIN	3,6738	
	ROMANIA	3,8167	
	HUNGARY	3,6088	
	POLAND	3,6791	
	TURKEY	3,8073	
	TOTAL	3,7098	

Descriptives for Students			
DIMENSION	COUNTRY	MEAN	
4. Analyzing and Interpreting	SPAIN	2,9384	
	ROMANIA	2,6488	
	HUNGARY	2,9473	
	POLAND	2,9425	
	TURKEY	3,1248	
	TOTAL	2,9342	

Descriptives for Employees			
DIMENSION	COUNTRY	MEAN	
4. Analyzing and Interpreting	SPAIN	2,8995	
	ROMANIA	2,9707	
	HUNGARY	2,7319	
	POLAND	2,8206	
	TURKEY	3,0259	
	TOTAL	2,8736	

Descriptives for Students

DIMENSION	COUNTRY	MEAN
5. Creating and Conceptualization	SPAIN	3,4772
	ROMANIA	3,2650
	HUNGARY	3,6564
	POLAND	3,4936
	TURKEY	3,5979
	TOTAL	3,5098

Descriptives for Employees

DIMENSION	COUNTRY	MEAN
1. Creating and Conceptualization	SPAIN	3,5887
	ROMANIA	3,8093
	HUNGARY	3,4308
	POLAND	3,6939
	TURKEY	3,6285
	TOTAL	3,6478

Descriptives for Students

DIMENSION	COUNTRY	MEAN
6. Organizing and Executing	SPAIN	3,4160
	ROMANIA	3,2673
	HUNGARY	3,5302
	POLAND	3,5507
	TURKEY	3,5134
	TOTAL	3,4782

Descriptives for Employees

DIMENSION	COUNTRY	MEAN
6. Organizing and Executing	SPAIN	3,5372
	ROMANIA	3,8188
	HUNGARY	3,3393
	POLAND	3,7340
	TURKEY	3,7422
	TOTAL	3,6516

Descriptives for Students

DIMENSION	COUNTRY	MEAN
7. Adapting and Coping	SPAIN	3,6361
	ROMANIA	3,5015
	HUNGARY	3,6345
	POLAND	3,6058
	TURKEY	3,5810
	TOTAL	3,5954

Descriptives for Employees

DIMENSION	COUNTRY	MEAN
7. Adapting and Coping	SPAIN	3,6681
	ROMANIA	4,0400
	HUNGARY	3,3265
	POLAND	3,6830
	TURKEY	3,7563
	TOTAL	3,7028

Descriptives for Students

DIMENSION	COUNTRY	MEAN	
8. Enterprising and Performing	SPAIN	3,5301	
	ROMANIA	2,7744	
	HUNGARY	3,5977	
	POLAND	3,4493	
	TURKEY	3,7143	
	TOTAL	3,4406	

Descriptives for Employees

DIMENSION	COUNTRY	MEAN	
8. Enterprising and Performing	SPAIN	3,4610	
	ROMANIA	3,4611	
	HUNGARY	3,4354	
	POLAND	3,3936	
	TURKEY	3,7604	
	TOTAL	3,4681	

- Findings suggest that in each country studied, both the students and the employees lack “analyzing and interpreting skills” which involves mostly IT and machine learning skills.
- This dimension is found as the weakest dimension of all 8 dimensions.
- In each partner countries participants are not skilled for Applying Expertise and Technology dimension,
- the lowest reported skills are Robotics/Artificial intelligence, Predictive maintenance and Big data/Data analysis and interpretation.
- It can be concluded that both the students and the employees lack these skills regardless of the country.

Mostly participants are found to be weak in these areas:

- Legislation awareness,
- Creating business networks,
- Economics,
- Extract business value from social media,
- Service orientation/product service offerings,
- Business process management,
- Business change management,
- Network security,
- IT architectures,
- System development,
- Integrating heterogeneous Technologies,
- Sensors/embedded systems,
- Network technology/M2M communication,
- Robotics/Artificial intelligence, Predictive maintenance, Modelling and programming,
- Big data/Data analysis and interpretation, Cloud computing/architectures, In-memory DBs, Statistics, Data security, Business strategy.

- To sum up the findings, it can be inferred that while analyzing and interpreting dimension is found to be the weakest dimension both for students and employees, *supporting and cooperation* dimension is found to be the strongest dimension both for students and employees in five countries.
- Employees have more scores than students in all dimensions except analyzing and interpreting dimension which is related to technology.
- In general Romanian employees are better than other countries' employees except two dimensions; analyzing and interpreting dimension and enterprising and performing dimension. In these two dimensions both Turkish students and employees are found to have highest scores.

In the light of this research, it can be suggested that employees need additional training in these areas:

- Analyzing and interpreting
- Applying expertise and technology
- Creating and Conceptualizing
- Formulating strategies
- Enterprising and Performing
- Entrepreneurial and commercial thinking

In the light of this research, it can be suggested that students need additional training in these areas:

- Analyzing and interpreting
- Applying expertise and technology
- Creating and Conceptualizing
- Formulating strategies
- **Organizing and Executing**
- **Planning and organization**
- **Delivering results and meeting customer expectations**
- Enterprising and Performing
- Entrepreneurial and commercial thinking

Research for Managers

- Each five country have conducted semi-structured interview with the managers from the sectors of education, service and manufacture.
- Before starting the interviews with the managers, the aim of the project was told and asked whether the interviewee is already aware of Industry 4.0.
- If the interviewee does not know Industry 4.0, then the concept of I4.0 is explained with examples.

- 6 managers have been interviewed in Turkey
- 10 managers have been interviewed in Hungary
- 14 managers have been interviewed in Romania
- 26 managers have been interviewed in Spain
- 5 managers have been interviewed in Poland

Findings for The Skill Kit in Order to Continue Working as a Manager:

- **For service sector:**
- in order to keep the customer satisfaction to keep up to date himself/herself on the sector,
- in order to capture the requirements of the digital age knowledge on digital media and internet, digitalization and IT, ICT,
- time management,
- having a good mentoring programme,
- life long learning and
- development of skills like leadership

Findings for The Skill Kit in Order to Continue Working as a Manager:

- **For manufacturing sector:**
- knowledge on human resources,
- good command of subject on law,
- digital integration,
- system design,
- environmental management,
- presentation skills,
- anger management,
- communication skills,
- digitalization and IT,
- work-life balance,
- ICT,
- having a good mentoring programme,
- life long learning and development of skills like leadership

Findings for The Skill Kit in Order to Continue Working as a Manager:

- **For education sector: ,**
- interpersonal communication,
- knowledge on technology,
- foreign language, ,
- digitalization and IT,
- having a good mentoring programme,
- life long learning and
- development of skills like leadership

Findings for The Effects of Industry 4.0 for Lower Positions:

- Turkish managers have different opinion about the effects of Industry 4.0 for lower positions. The managers in tourism sector believes that the Industry 4.0 will have little effect on tourism sector even for the lower positions because service sectors rely on human interaction.
- The managers in education sector believes that automation can be a threat for administrative staff and the academics who give lectures on common courses such as Turkish language, history because of online education.
- The managers in manufacturing sector believes that automation has already a threat for lower positions.

Findings for The Effects of Industry 4.0 for Lower Positions:

- Polish managers, despite the threat of automation, are not afraid that their or their employees are going to lose their jobs.
- Hungarian managers think that Industry 4.0 is already present and for sure will be in the future too.
- They said that there will be changes, but also new challenges.

Findings for The Effects of Industry 4.0 for Lower Positions:

- According to Spanish managers, Technology is at the moment getting more importance in certain sectors.
- *Spanish* managers don't consider it as a problem in education but, on the other hand, in services sector is becoming a new reality. This problem is still not as relevant as in manufacturing.
- Related to human resources, the arrival of industry 4.0 will lead to a job loss, this problem will affect employees of all the positions and not only to the lower ones

To sum up;

- We are facing a new era which has new challenges for us.

However, human resources is always needed but, the employees are expected to be more qualified with key competencies required by Industry 4.0.

- *Thank you for listening*