

INDUSTRY – UNIVERSITY COOPERATION – A PREREQUISITE FOR DEVELOPING COMPETENCIES 4.0

Valentina Haralanova¹, Göran Fafner², & Samir Khoshaba¹

¹Mechanical Engineering Department, Linnaeus University (Sweden)

²Design Department, Linnaeus University (Sweden)

Abstract

The term Industry 4.0 represents the radical transformation that has resulted from the integration of emerging technologies and the industry. The proximity of the Fourth Industrial Revolution is observable and brings challenges arising from the ongoing automation and digitization. All companies, willing to remain competitive on the market need to go through this transformation overcoming such barriers, as the lack of qualified, skilled and talented employees to develop and manage various high-tech systems. This deficiency means that Industry 4.0 demands a change in the labour market, explicitly requiring trained professionals who have the needed competencies and skills. In this new environment, driven by new technologies and innovations the cooperation between academia and business is a prerequisite to sustainable economic growth, readiness for employment and preparedness for satisfying the new demands of the industries.

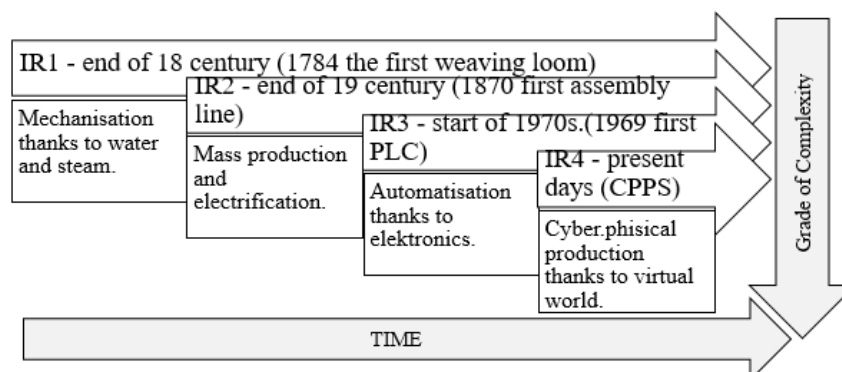
The authors are university teachers, working in Mechanical engineering department and Design department. The purpose of the presented paper is to observe the competencies and skills of mechanical engineers demanded by Industry 4.0 and to systemize the links between the industry in the region and the University aiming developing the needed competencies. Example with a project “Smart Industries”, running at the Mechanical Engineering department and Department for Computer sciences, focuses on development of expert competence within research and education areas related to the digitalization of the industry will be presented.

Keywords: Industry 4.0, Industry-University cooperation, Competencies 4.0.

1. Introduction

The history of humanity is above all a history of developing the technology and technique, because it affects the daily lives of people, their life in peacetime and in wartime. People would always use the technology they had available to help make their lives easier and at the same time try to make it better and bring it to the next level. Every era has its specific and distinctive level of developed technology and technique and this is how the concept of the industrial revolution began. Nowadays we are facing the beginning of the fourth-industrial revolution (IR4), called as well Industry4.0. A short overview of the three previous industrial revolutions will mark the path gone to the industry of today. (see Fig. 1)

Figure 1. The four IR in time and grade of complexity.



Industry 4.0, which started at the dawn of the third millennium, conceptualizes rapid change to technology, industries, and societal patterns and processes in the 21st century due to increasing interconnectivity and smart automation. In essence, the fourth industrial revolution is the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems (CPS), IoT, industrial internet of things, cloud computing, cognitive computing, and artificial intelligence.

The differences and specifics of the technologies and techniques used in different eras demand different competencies from the labour forces in generally and from the engineers specifically.

2. Objectives of the research

The 4th industrial revolution, defined by full automation of production processes alongside with a rapid development of big data, artificial intelligence, Internet of things and increasing computing power on an unprecedented scale, will cause substantial changes in all aspects of social life worldwide and consequently will require redefinition of our approaches to education. According to the World Economic Forum (WEF) 2017 in the future, up to 47% of jobs may be withdrawn. These developments will transform the way we live, and the way we work. Some jobs will disappear, others will grow and jobs that do not even exist today will become commonplace. What is certain is that the future workforce will need to align its skillset to keep pace. According to the WEF in 2020 the main ten competences needed for the future jobs were listed and rated as follows in Table 1.

Table 1. Competences 4.0 from 2020 divided by types according [Lamri, 2019].

	Competences 2020	Behavioural and motivational	Cognitive and thinking	Social and psychosocial	Digital and technical (Specialized skills)
1	Complex problem solving		☞		Product design and development, System design and engineering, Machine design, Design and manufacturing engineering, Ergonomics and human factors, Design for sustainability etc.
2	Critical thinking		☞		
3	Creativity		☞		
4	People Management	☞			
5	Coordinating with others	☞			
6	Emotional intelligence			☞	
7	Judgment and decision making		☞		
8	Service orientation	☞			
9	Negotiation			☞	
10	Cognitive flexibility			☞	

According to [Lamri, 2019], the competences are defined and divided in four types, shown in Table 1. Behavioural and motivational, they determine how individuals react in different situations; Cognitive; Social, they determine how an individual perceives society and how he/she relates to the society; Technical (specialized skills), they are acquired through learning and experience (competences in ranking order in Table 1).

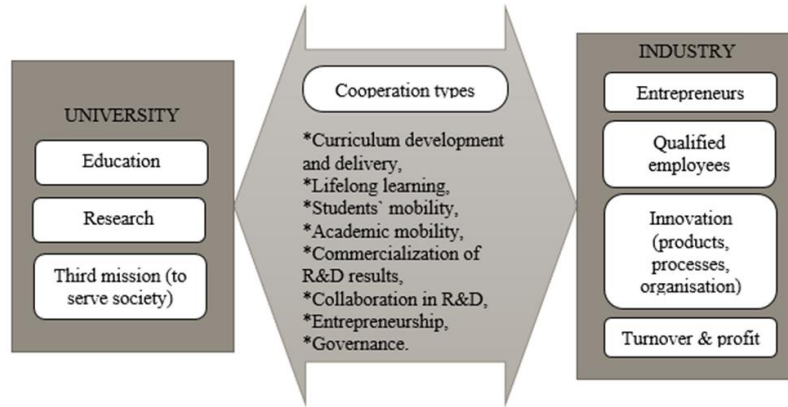
3. Methods

Competencies 4.0 are emerging from Industry 4.0. The classical role of the Universities as centres of knowledge, know-how and learning could be redefined so that universities around the world need to respond to the new economy and associated trends such as digital disruption and radically changing labour markets. Such vision of the Universities can be called University 4.0. In (Dewar, 2017) such universities are defined as “university for others' outward looking, deeply connected to industry and the communities around it, and committed to serving the needs of its students”. The intensified collaboration with the society as such and the cooperation with business and industry in particular finds its reasoning in the Swedish higher education act from year 1977. According it, Universities have three main tasks. Two of the tasks are teaching and research, and the third one is formulated as “The universities' task must include cooperating with the surrounding society and informing about their activities, as well as working to ensure that research results obtained at the university are useful”. [Act 2009:45]. The ‘third mission ‘of universities refers to the commercial application of universities’ knowledge to serve socioeconomic development by fostering links with knowledge users and facilitating technology transfer.

3.1. Industry – University cooperation

The cooperation between industry and university is related to the missions of the University and the needs of the industry and has change over time. According to research, there are eight types of university-industry cooperation. (see Fig.2)

Figure 2. Industry-university cooperation related to the missions of university and needs of industry.



3.2. Examples from Mechanical engineering department at LNU

Curriculum development and delivery is one type of university-industry cooperation, which aim is to develop human resources with competencies relevant to modern society and Industry 4.0. The companies are participating both in the development of curriculum according the needed competencies. They are taking also part in the delivery of it by being guest lecturers in different courses and programs. Another way companies are involved in is delivering their companies' catalogues for using them in projects and design work. It has become a tradition in Sweden that the projects for project-based courses are provided by the companies. Working on such projects students learn what is to work in real company and are building the needed competencies.

Lifelong learning is also one way of developing human resources, but here the students are adults, who acquire additional skills, knowledge or attitudes. At mechanical engineering department we work on a project called "Smart Industry". In the motivation of the project is said: "As a nation of knowledge, Sweden has for many years been a leading country with access to high expert competence, both in industry and from the higher education sector. However, the industry's need for competence must also be ensured in the future, and the focus on continuing and further education for professionals must increase." There is a broad competence regarding different parts of Industry 4.0 and smart industry, which spans both mechanical engineering and computer science. Based on that within "Smart industry", five focus areas are identified: Material and structure characterization, Modelling and simulation, Production and production control, Smart maintenance, Data management.

Another result of an Industry-university cooperation is EPIC a lab-hall with the newest manufacturing technology and test and experimental equipment was built. It is used not only by the students and personals from companies but also by the pupils from the technicum.

For universities and industry, there is a growing need for collaboration in order to survive in a highly competitive marketplace. The traditional culture of universities is evolving, not only with the development of universities but also because of the big diversity of the linkages between universities and industry.

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