Interdisciplinarity as a key competence on industry 4.0 labor market

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ABSTRACT[1]

The discussions on the concept of competencies 4.0 in the context of 4th industrial revolution, or industry 4.0, have been being growing recently and extensive analyses and researches have been being carried out by experts within various scientific disciplines such as management, economy, psychology, education, human resource, informatics and systemics. Due to the relevance of industry 4.0 concept in relation to current socio-economic challenges worldwide, the growing interest on the part of researchers and the proliferation of the above-mentioned terms in literature has formed a complicated network of patterns and relations constituting a scientific landscape of the discussions in questions. Accordingly, the aim of this article is to explain the contextual terminology of these discussions, namely: industry 4.0 and competencies 4.0 and discuss the nature of interdisciplinarity as one of the key factors defining future skills in the context of the new labor market needs.

Keywords: Interdisciplinarity, Competences 4.0, Labor Market, Industry 4.0

1. INTRODUCTION

Different terminology has been coined to describe new, fully digitalized era of economy which we are entering due to unprecedently fast technological developments. Industry 4.0, known also as the fourth industrial revolution, or I4.0 in short, is a German concept that describes and defines this new fully-automated realm of current and future world of work and production. It is one of the elements of the High-Tech Strategy 2020 action plan announced in 2011 by the German Government during Hannover Fairs. The aim of this strategy was a more competitive, efficient, flexible, and digitalised production and economy [1, 2]. The very term "fourth industrial revolution" was introduced on a wider scale by Klaus Martin Schwab, an executive chairman of the World Economic Forum in 2016 to describe the same phenomenon [3]. A detailed definition of the fourth industrial revolution concept in reference to all previous industrial revolutions is provided by Rojko [4] and Tay, Lee, Hamid and Ahmad [5]. Rojko [4] also presents the concept of industry 4.0 in the broader context of similar governmental initiatives worldwide. Similar initiative, called Industrial Internet, was introduced in the USA by General Electric in 2012. France has its own 'Industrie du futur' characterized by additive manufacturing, Internet of things and augmented reality (see: descrpitions below) and in 2015 China introduced the concept of 'Made in China

2025' inspired by German Industry 4.0. However, the most comprehensive overview of the concept is provided by Górka, Thier and Łuszczyk [6]. The authors depict all four industrial revolutions in reference to their main features, dates and duration, implementation of new technologies, as well as major economic and social consequences. Additionally, Poszytek and Jeżowski [7] present the fourth industrial revolution in the broader socio-economic context of the so-called three mega-trends, namely: demographic change, globalisation, and technological progress. In most cases the concept of industry 4.0 is defined by the following features [3, 5, 6, 8, 9, 10]:

- Smart factory: intelligent factory that is based on Internet of things and cyber-physical systems
- Internet of things (IoT): advanced connectivity of systems, services and physical objects enabling object-to-object communication and data sharing;
- Cyber-physical systems: systems that integrate humans with machines;
- Big data: huge amount of data obtained from devices connected to the Internet;
- Cloud computing: system logic that provides a huge space for data storage;
- Autonomous robots: robots which interact with each other and collaborate with humans;
- Simulation; modelling real or virtual processes by using real-time data to represent the real world in a simulation model;
- Augmented reality: reality enhanced by virtual elements;
- Additive manufacturing/3D printing: implementation of new manufacturing skills for the purpose of integrating information technologies;
- Block chain: decentralized and dispersed database.

2. INDUSTRY 4.0 AND THE NEED FOR NEW COMPETENCIES

Consequently, industry 4.0 calls for new competencies, the so-called competencies 4.0. In mostly common competence models refer to three main areas, namely: digital, cognitive and social one [11, 12, 13, 14, 15, 16, 17]. Although some of them slightly differ in terminology and the way they are categorized, the most prevailing matrix, or framework, of competencies 4.0 can be presented as follows:

- Digital and technical competencies;

- Social competencies: cooperation with others, communication abilities, managing others, leadership, entrepreneurship, interdisciplinarity;
- Cognitive competencies: adaptability, critical thinking, creativity, solving complex problems.

Although in most cases interdisciplinarity is categorized as an element of social competence, its nature and various characteristic features go much further beyond the social aspect of the phenomenon. Traditionally, interdisciplinarity is defined as collaboration between scientific disciplines [18] but for the further discussions in this article it would be more appropriate to simply state that it is an effective use of knowledge, skills and practices from two, or more subject areas. In the context of industry 4.0 which in general terms can be characterized as a cooperative ecosystem of humans and machines, one must consider the idea of interdisciplinarity on a few different levels. Firstly, interdisciplinarity is an ability to combine digital and the so-called soft skills represented mainly by social competencies in the above model. The best engineers are those who not only write algorithms but can also communicate and manage people in a very effective way. Secondly, the link between interdisciplinarity and cognitive competencies is obvious if interdisciplinarity is understood as an ability to produce new knowledge and practical solutions to complex problems [18]. Accordingly, interdisciplinarity encompasses practically all elements included in the above competencies 4.0 model and must be treated here as an overarching, transversal competence, or skill. Therefore, higher education institutions perceive interdisciplinarity as a crucial competence that students need to acquire and develop in order to function effectively on a labor market. For example, higher education systems response takes the form of new curricula which 'stimulate interdisciplinary cooperation is a complex interaction between content, methods and organisation' [19]. Additionally, a common mode of project work employed by students also calls for interdisciplinary approach [20]. Thus, 'the ability to work and to communicate in an interdisciplinary context does not arise all by itself but may be promoted during the academic education' [21]. And finally, Priffti, Knigge, Kienegger and Kremar [1], who carried out a bibliometric analysis on how often competencies 4.0 appear in the specialist literature in the context of the fourth industrial revolution, claim that interdisciplinarity is one of the most common competencies required by industry 4.0. This leads, in turn, our discussion towards the issue of the so-called 'big interdisciplinarity' which is defined as knowledge, practices, and behaviors that intersect with differences of status, culture, disciplines, and adeptness [22]. Such an approach can constitute a full response to the complexities of industry 4.0 realm described above.

3. CONCLUSIONS

Interdisciplinarity is a multifaceted phenomenon which deserves separate studies on its multitudinal representations in reference to competencies 4.0. Although treated as a separate skill, or competence, its nature can be observed in all other elements constituting the model of competencies 4.0. And since current research [12] shows a sudden shift from traditionally understood competencies towards 4.0 ones as a requirement of the labor market, then interdisciplinarity becomes a crucial and fundamental element of the new competence model.

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