Fourth Industrial Revolution: knowledge and skills needed for employees

Tomsk Polytechnic University

Ekaterina Emelyanenko[a]

[c]School of Core Engineering Education, Tomsk Polytechnic University

Abstract

This paper analyzes the impact of the new industrial revolution on employees, as well as presents skills needed for adapting to the digital business transformation. It has been concluded that among general skills there is a growing need for uniquely human abilities, such as emotional intelligence, creativity, communication skills, etc. The importance of technical knowledge (the ability to work effectively with software, programming, general digital literacy) is growing. In general, to create a successful and competitive workforce, companies need to act in two directions - to form training and monitoring systems for skills and knowledge in accordance with the needs of the market, as well as to promote the ideas of life-time learning, that is, continuous independent education.

Keywords: Fourth industrial revolution, digital business, skills, knowledge, training

1. Introduction

The fourth industrial revolution has a significant impact on the transformation of the labor market – professions and approaches to work are being changed. Today, the success of a company largely depends on the ability of its employees to use technology; moreover, they should do it creatively and innovatively.

In 2018, the World Economic Forum considered the fourth industrial revolution and its impact on business and society as one of the most important. This revolution represents the development of technological progress where the widespread digitalization takes place and a variety of new technologies are introduced that cause changes in production, business processes and society as a whole.

Industry 4.0 implies a fundamental transformation of the business that causes many difficulties, there are many obstacles to its spread. Experts and practitioners ranked the main difficulties in descending order of importance: the absence and lack of digital skills, resistance to changes; the need for costs of change and long-term investments; the change of business model and business culture from the view point of internal changes (for example, marginalization of hierarchical structures that dominated for many years), greater openness to the outside and consistency of relations (for example, development of supplier-buyer relations) [1].

Today, digital technologies are still at the approbation stage, although there are many successfully solved cases. For many companies, new technologies seem to be an interesting and promising topic, but it is considered to be the matter of the future.

Digitalization affects not only industrial production. In recent years, the number of devices connected to the Internet has increased significantly. Thanks to online services, many residents pay

bills, spend their leisure time, shop online. Accordingly, their preferences and requirements are changing; there is a demand for a completely new approach – in-depth personalization. In the future, the one who can predict the client's desires and create trends will become the leader in business.

In general, to create a successful and competitive workforce, companies need to act in two directions – to form training and monitoring systems for skills and knowledge in accordance with the needs of the market, as well as to promote the ideas of life-time learning, that is, continuous independent education.

2. Discussion

Since the first industrial revolution, every wave of technological change has led to the literal disappearance of a significant number of jobs. The loom turned out to be more competitive than home weaving, but it created jobs in factories. Many professions that are in demand today did not exist five years ago. From this point of view, experts believe that the labor market will not be narrowed, but it will change its structure, compensating for the employment losses by increasing demand for engineering and computer professions. The new industrial revolution will not replace people with machines, on the contrary, people's competences and abilities will become the key resource that can determine the competitive strengths of companies.

New technologies define new requirements for employees and create demand for new skills. A new digital reality will require a different set of skills [2]. Thus, there is a gap between the skills needed for the job and the actual skills that the employees possess. Studies show a striking degree of influence of the latest technologies on the nature of work.

Technological changes are promoted by workers in engineering, computer, and mathematical professions, since they are the ones who make the changes. Based on their competencies, they are responsible for the creation and implementation of technology from the viewpoint of technology. However, how will the technological revolution affect other occupational categories, in particular, office workers?

Competences should be considered in relation to each particular profession, but we can talk about a certain layer of skills and knowledge common to workers in all professions. In studies on the impact of the fourth industrial revolution, emphasis is placed on the impact of technological, demographic and socio-economic changes on business models, the transformation of employment conditions and needs for professional skills, all of which will lead to serious problems with recruitment, training and personnel management [3]. Today, there is a growing need for a wide variety of skills in various workplaces in various industries.

Even those professions that may be reduced will require different skills to work. On average, by 2020 more than a third of the basic skills demanded in most professions are not considered to be a key one for work today. In all industries, about two thirds of respondents intend to invest in retraining employees as a part of a change management strategy and planning future labor resources. In general, contrary to expectations, social skills (persuasion, emotional intelligence and training of others) will be more in demand in all industries than narrow technical skills, such as programming or operating equipment and control. Indeed, technical skills will need to be complemented by strong social skills [4].

There is a wide range of skills needed in the future. General IT skills and use of software and general programming skills are gaining importance. For employees of various professions, it will be important to be able to handle complex information, communicate with employees and customers with the help of new digital technologies, solve problems, and be able to plan. Achieving a good level of basic knowledge of digital technology is a prerequisite for professional development. The new environment, formed by technology, requires the improvement of some existing and additional skills. For example, according to the G20 analytical report, there is a

growing demand for non-standard analytical skills related to creativity, problem solving, communication, teamwork and entrepreneurship – all the skills that help employees remain effective in the face of change [5].

Irish expert group, The Expert Group on Future Skills Needs, [6] interviewed business representatives, educators, trade-union officials and politicians in order to find out what skills would be needed in the future. This group divided the information gathered into several groups: basic or fundamental skills (literacy, numeracy, digital literacy); skills related to people (communication, teamwork); conceptual skills (information gathering and organization, problem solving, planning and organization, training, innovation and creativity).

The scale of changes in production and corporate structure will lead to the empowerment of employees in the field, which means that they will have to solve extremely diverse professional tasks [7]. In addition, employees should be able to quickly adapt to changes and constantly learn something new. In the future, employees will need critical and creative thinking, initiative and responsibility, adaptability, innovation, enterprise, emotional intelligence [8]. According to the study done by consulting company McKinsey, more professions will require social and emotional skills and high cognitive abilities, such as high-level logical thinking, which today are applicable only to relatively few job places. Nevertheless, the company honors the skills of programming and technical expertise. Even automated professions will require a certain amount of human participation. For example, machines are capable of performing basic operations for extracting and processing information, but the demand for work requiring a higher level of analysis will continue to grow [9].

Skills are grouped in the following way:
• theoretical skills: cognitive (intellectual) skills that determine the ability to learn, analyze and take initiative; metacognitive skills, i.e. the ability to purposefully combine different skills and critically evaluate their usefulness in a particular situation;
• non-cognitive skills: punctuality; reliability; responsibility; good faith; honesty; social (interpersonal) skills (ability to communicate or work in a team, the ability to direct, coordinate and motivate employees);
• digital skills: IT skills, i.e. the use of the Internet, the process and exchange of information, software usage, and programming skills, i.e. being able to autonomously use computer programs and adjust them to user requirements; digital literacy, that is a basic understanding of how digital technologies work, what opportunities they offer and what risks they entail [10].

Non-cognitive skills contribute to the accumulation of theoretical skills, improve readiness for learning. A lack of non-cognitive skills (lack of curiosity, determination, or self-confidence) is often accompanied by relatively low cognitive abilities [11].

Thus, education plays a key role in employee readiness for changes. However, to create a successful and competitive workforce, companies need to act in two directions, firstly, to build training and monitoring systems for skills and knowledge in accordance with market needs, and secondly, to improve employees' competencies by promoting the idea of continuous independent education.

3. Conclusion

Modern approaches to the organization of processes should pay special attention to the interaction of people and technology. The emergence of new technologies or technological approaches is the result of the systematic management of innovations. Today, the individual promotion of innovation is relatively difficult, since a lot of extremely diverse knowledge is needed. It should be mentioned that innovation comes from teamwork. Accordingly, it is necessary to unite people with various professional skills and personal abilities. To support successful

operations, a company must understand how its employees are able to cope or even contribute to digital and technological changes.

References

1. Avogaro, M. (2019). The highest skilled workers of Industry4.0: New Forms of Work Organization for New Professions. A Comparative Study.*Journal of international and comparative labour studies.* V. 8.№1. pp. 29-51.
2. Davies, A., Fidler, D., Gorbis, M. (2014). Future Work Skills 2020. *Science & Technology Perspectives.* № 12. pp. 1-14.
3. Dregger, J.,Niehaus, J.,Ittermann, P. (2016). The Digitization of Manufacturing and its Societal Challenges A Framework for the Future of Industrial Labor. *International Symposium on Ethics in Engineering, Science and Technology (ETHICS).* № 6. pp. 13-19.
4. Kergroach, S. (2017). Industry4.0: New Challenges and Opportunities for the Labour Market. *Foresight and STI Governance.* V. 11. № 4. pp. 6-8.
5. Kondratyuk, E.V. (2018). Fourth industrial revolution: what competences are necessary for employees? *Strategic decisions and risks.* № 3 (108). pp. 66-79.
6. Koval, M.S., Mirus, O.L., Harchuk, A.I. (2018). Perspectives of labor market formation in conditions of post-industrial society (industry4.0). *International Scientific Conference on The Impact of Industry 4.0 on Job.* № 22. pp. 114-124.
7. Pfeiffer, S.Robots, Industry 4.0 and Humans, or Why Assembly Work Is More than Routine Work. *Societies.* V. 6. № 2. pp. 10-15.
8. Rajnai, Z., Kocsis, I. (2017). Labor Market Risks of Industry4.0, Digitization, Robots and AI. *International Symposium on Intelligent Systems and Informatics (SISY).*№ 5. pp. 14-16.
9. Shackleton, E., Wellesley, A.(2018). Work and Organizational Psychology Looks at the Fourth Industrial Revolution: How to Support Workers and Organizations? *Frontiers in psychology.* V. 9. № 7. pp. 1-6.
10. Trompisch, P. (2017). The implications of Industry 4.0 on the future of work. *Informatization.* V. 134. № 7. pp. 370-373.
11. Volek, T., Novotna, M. (2017). Labour market in the context of industry4.0. *Statistics and Economics.* № 14. pp. 170-179.