

# The role of the information technology staff in the digitalization process: A comparative research with ILO data

Aysel Arslan<sup>1\*</sup> and Çetin Bektaş<sup>2</sup>

<sup>1</sup> Ondokuz Mayıs University, Health Services Vocational School, Samsun, Turkey, 55139

<sup>2</sup> Tokat Gaziosmanpaşa University, Economics and Administrative Faculty, Tokat, Turkey, 60150

**Abstract.** In the competitive environment of the 21st century, businesses, economies, and countries that attach importance to technology and use technology in the best way are prosperous. Today, businesses lead a life based on technology. Most of the activities conducted by professionals working in their information and communication technology (ICT) department are implemented online and offline via computers. This process, called digitalization, is very significant for their sustainability. In this study, the number of experts employed in ICT in Turkey between 2015-2019 will be examined and compared with Germany's employment in the same period. The study aims to evaluate whether IT specialists' employment in the businesses in Turkey, which undergoes a process of digitalization, is sufficient. It is considered that the study will contribute to the steps taken towards digitalization. The study relies on the ILO data (International Labour Organization). The study uses a case research design, one of the qualitative research methods, and analysed the data by using the content analysis method.

## 1 Introduction

In the 21st century, businesses are forced to adapt rapidly to the changing environment. Their success in a constantly changing and developing environment has a lot to do with their skill levels in using technology.

In terms of businesses, digitalization can be considered as the fulfilment of their activities with technological equipment and supplies. In this way, their activities speed up, their productivity grows, their costs go down, and they make economic gains. Digitalization is also very essential for the economy of a country, society, and administration. Regarding the economy of a country, digitalization contributes to economic growth by creating new job domains. It also leads to new values by supporting innovation. In terms of society, it increases society's quality of life and provides easier access to bureaucracy. In terms of bureaucracy, it

---

\*Corresponding author: [aysel.arslan@omu.edu.tr](mailto:aysel.arslan@omu.edu.tr)

is observed that digitalization contributes to government effectiveness, transparency, e-government practices, and education policies. Therefore, countries make investments to achieve digital transformation in science, industry, and society [1]. Emphasizing digital transformation, Industry 4.0 entered the literature for the first time as an approach introduced at the Hannover Fair hosted by Germany in 2011. Such technologies are used in many different disciplines (Cyber Systems, the Internet of Things (IoT), cloud computing, Industrial Integration, Institutional Architecture, Service Oriented Architecture (SOA), Business Process Management, Industrial Information Integration, etc.). However, there is a lack of equipment and experts in countries to take full advantage of Industry 4.0. For this reason, to realize Industry 4.0, they should give more importance to this issue in their official methods and practices [2].

## **2 Digital Transformation and Its Importance**

Digital change and transformation, emerging as a result of today's competitive environment and globalization, have become a common target for all countries. Digitization is a priority for businesses, society, and policymakers. Competitive, social, and institutional pressures force businesses to increase their impact on society and the environment and participate in digital transformation [3]. Digitalization is "a global megatrend that fundamentally changes existing value chains across industries and public sectors". This phenomenon includes such terms as "mobile applications, big data, machine to machine, internet of things, Industrial Internet and Industry 4.0" [4]. There is no single and precise definition of digitalization. "We can call digitalization the way many areas of social life are restructured around digital communication and media infrastructures" [5]. Digitization, briefly, is digital technology use in the production and use of products and services. The workings are done through virtual channels. Digital technologies have been playing a transformational role in the world economy, thanks to the internet, smartphones, and other technologies that collect, store, analyse and share information [6].

Digitalization represents a comprehensive socio-technical process. It allows the application of multiple technologies (smart homes, e-health, online services, etc.) in different areas of daily life [7]. In the business world, digitalization comes in two forms: destructive and transformative. Disruptive digitization refers to business automation through new computer-controlled equipment. In destructive digitalization, digital machines do the work of some occupational groups, which can lead to job loss in some professions. In transformative digitization, work is performed with complementary new digital technologies that lead to more effective interaction between humans and machines [8]. Businesses that choose digital transformation as an initial step must be ready to adapt their strategies and capabilities towards new perceptions and value creation [9]. Technological progress and the complexity of emerging systems can cause traditional development approaches to fail. In the digitalization process, new skills are required, especially, for the early development stages. Qualified people are needed for this domain. IT professionals who have knowledge and skills in digitalization need to have the ability to see the big picture, regardless of all the details. Experts decide how to combine their potential with extensive knowledge of technical details [10].

Sometimes, using remote and online services in unprecedented situations such as the Covid-19 pandemic can accelerate the digitization process for producers and consumers. During the pandemic, many industries accelerated their digital innovation to integrate with customers. Digital applications have helped break the barriers. It is an advantage that it is accessible and usable by anyone, anytime and anywhere. In this way, what is done in an established business can be implemented remotely [11]. Digital technologies have been employed in many areas to cope with the crisis emerging in the Covid-19 pandemic. The importance of digital

technologies has been well-understood once again. Digital technologies are indispensable for the development of societies and countries and should be improved continuously. In the epoch of the digital transformation of society, technological change and increased knowledge are the drivers of the economic growth and wealth. Therefore, it affects the sustainable development of society [12]. Developing technology, creating innovation, and producing breakthrough solutions are critical to achieving many sustainable development goals, from eradicating poverty to improving food security and reversing climate change [13].

### **3 Digital Transformation in Businesses**

Businesses need to transform their working strategies, routines, processes, and structures to succeed in a rapidly changing competitive environment. Therefore, digitalization has increased the importance of information technology and changed the demands of organizations for information technology functions. Business departments have to cooperate proactively to realize and implement information technology innovations in businesses [14]. Through digitalization, while the cognitive load increases, the physical load decreases in businesses [15]. Three chief sources are essential in digitalization of businesses. These are business information technology, employee skills, and digital strategies [16]. Digitization can enhance the value of small and medium businesses by helping to manage customer relations. Especially, thanks to social media, as customer relations develop, marketing costs decrease [17]. In addition, digital technologies offer entrepreneurs new opportunities to start businesses and sell their products worldwide [18]. In addition, digital transformation causes many businesses to make changes in their business models. A detailed plan is determined to achieve the goal. In this step, the gap between the current situation and the target is determined, necessary operations are organized to bridge the gap, feasibility studies are carried out, priorities are analysed and a roadmap is created. If the goal is about disruptive change, a gap analysis also includes identifying existing problems likely to be used in the new situation. Once the gap is defined, actions are determined to bridge the gap. In the case of an internal efficiency-related goal, operations may be composed of acquiring new technologies (for example, IT equipment) or optimizing an existing process. In the case of external opportunities and disruptive change objectives, actions may include acquiring new competencies, analysing potential new markets, and reorganizing internal resources. The feasibility analysis includes cost-benefit analysis, and impact analysis on current practices, offerings and resources, and risk analysis. The joint costs of digitalization comprise the technology that is required for digitalization and the training and support of the personnel involved in the work. In addition, since digitalization includes change along with the protection of digital data, changing the way of working is also among the joint costs of digitalization. Operations are prioritized by taking into account the actions and opinions of stakeholders in digitalization. The ability of businesses to change should be considered in terms of the pace of change [19]. In this transformation, IT specialists in businesses will have a more strategic role in the future. These experts are supposed to fulfil seven critical management tasks. These are (1) investment and portfolio management, (2) institutional architecture management, (3) security and business continuity management, (4) dealer/supplier management, (5) consulting and development support, (6) digital strategy development, and (7) governance via information and communication technology. These management tasks configure and enable the coordinated development of a secure, reliable, compliant, cost-effective, and flexible enterprise information technology. Given its strategic importance, the future information and communication department will not be located at the third or fourth level of organizational hierarchy charts, but close to the board of directors [14].

In the 21st century, the world is witnessing the fourth industrial revolution and the digital transformation of the business world commonly referred to as Industry 4.0. The sustainability impacts of Industry 4.0 are attracting more and more attention to businesses [20]. Since the beginning of industrialization, technological leaps have led to paradigm shifts currently called "industrial revolutions" [21]. The concept of Industry 4.0 refers to the fourth industrial revolution associated with the first three industrial revolutions, mechanical power (industry 1.0), mass production (industry 2.0), and the digital revolution (industry 3.0) [22]. Industry 4.0 has been widely acclaimed by the world since its introduction at the Hannover Industrial Expo in 2011 [23]. The first three industrial revolutions emerged as a result of mechanization, electricity, and information technology. The fourth industrial revolution shows itself with the internet of things [24]. In essence, innovation in the internet of things is characterized by the blend of physical and digital components to create new products and new business models. In this way, it has become possible to digitize the functions and basic capabilities of their products [25].

## **4 The Research of ICT Expert Staff Working in Businesses**

### **4.1 Purpose**

In this study, the professional ICT employees of the businesses in Turkey and Germany in the period of 2015-2019 are compared and examined. This study has tried to establish a connection between the importance that countries attach to the digitalization process and the number of ICT professionals employed by businesses. The ILO data are used to compare the ICT professionals employed by the countries. The study is based on the total employment of countries. In this way, the importance of information technologies in businesses will be evaluated by comparing the number of professionals employed by Turkey and the leading country in digitalization, Germany, where the 4th Industrial Revolution emerged in 2011.

### **4.2 Scope**

Within the scope of the study, the number of ICT professionals employed in Germany and Turkey in the digitalization process is compared. The number of information technology professionals in the total employment of the countries between 2015-2019 is examined in contrast. The first reason for choosing these two countries for the comparison is that both countries have similar population densities. The other reason is that the 4th Industrial Revolution first appeared in Germany in 2011. In Turkey, it officially emerged in 2016 through the work of the Supreme Council of Science and Technology (BTYK), and its importance has increased in recent years. Digital transformation is an ongoing process for countries and is affected by the digitization efforts of businesses. In this study, the importance that is attached to the subject will be evaluated by examining the ratio of ICT professionals employed in the businesses of these countries.

### **4.3 Method**

The case research design, one of the qualitative research methods, was used as the study method. The employment data of ICT professionals according to the International Occupational Standards Classification (ISCO) of the ILO (International Labour Organization) were used in the study. The data were analysed using the content analysis method. Content analysis is a method that provides the opportunity to examine events that cannot be directly observed and presents information objectively, systematically,

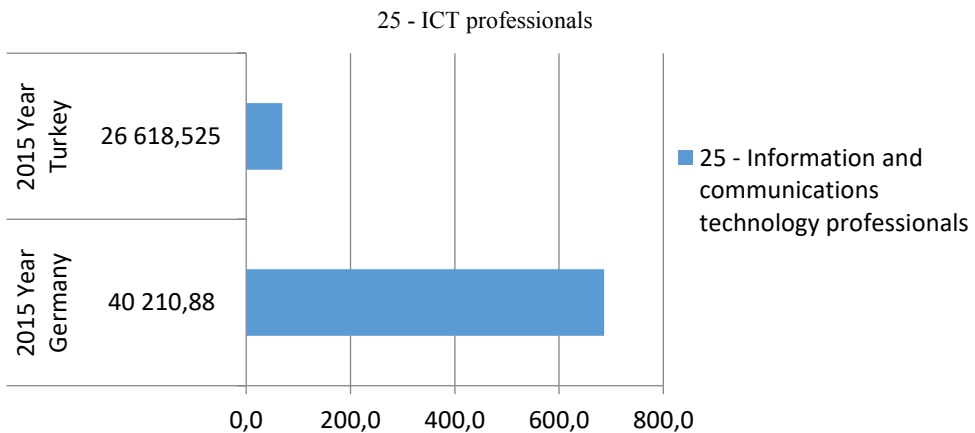
quantitatively, and reliably [26]. The data collected within the scope of the study were analysed in detail and reported.

#### 4.4 Findings

The study resulted from the data of ILO's International Classification of Occupational Standards (ISCO). The purpose of the ISCO classification made by the ILO can be listed as follows [27];

- to provide a basis for international reporting, comparison, and exchange of statistical and administrative data on occupations.
- to present a model for the development of national and regional occupational classifications.
- to establish a system that can be used directly in countries that have not developed their national classifications.

In the ISCO classification, occupations are divided into ten subgroups. Professionals (specialists in their field), one of these subgroups, are also classified within themselves. Within this classification, ICT specialists fall into number 25. ICT specialists are divided into two sub-sections: software and application developers and analysts, and database and network specialists. These constitute the experts working in information technology. In the study, the employment status of ICT specialists ranked 25th in the ISCO classification between the years of 2015-2019 was assessed in terms of Germany and Turkey. The information technology specialists employed in the businesses of both countries were compared. When the two countries are examined by the years, the results are as follows [27]. While the total number of the labour force employed in Germany in 2015 was 40,210,880, the number of employment of experts in informatics was 686,687. This rate was approximately 1.7% in the entire labour force. The total number of personnel employed by Turkey in 2015 was 26,618,525. The number of informatics specialists in total employment was 69,364. This rate was approximately 0.3% in total employment (Fig. 1).

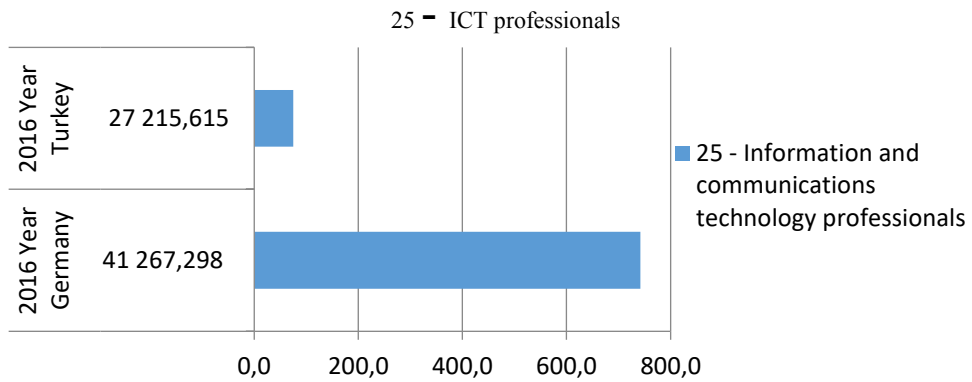


**Fig. 1.** The number of IT specialists in total employment in Turkey and Germany in 2015.

Source: Compiled by the authors on the ILO 2015 data.

While the total labour force employed in Germany in 2016 was 41,267,298, the number of specialists employed in informatics was 741,684. This rate was approximately 1.8% in the total labour force. The total number of personnel employed by Turkey in 2016 was

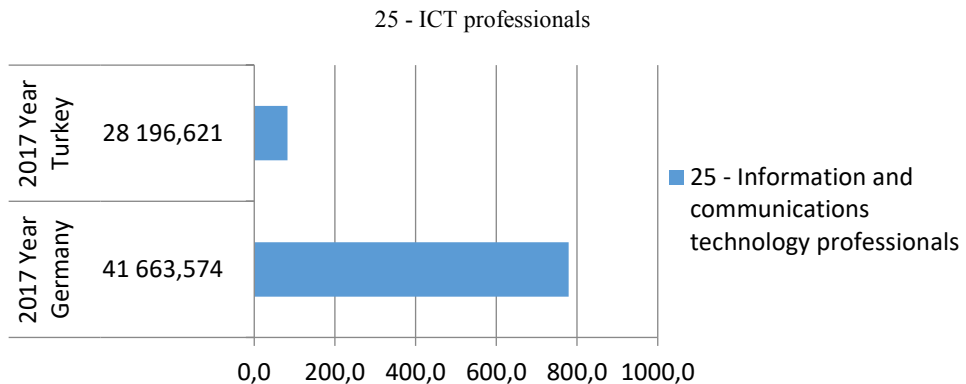
27,215,615. The number of informatics specialists in the total employment rate was 74,948. This rate was approximately 0.3% in total employment (Fig. 2.).



**Fig. 2.** The number of IT specialists in the total employment in Turkey and Germany in 2016.

Source: Compiled by the authors on the ILO 2016 data.

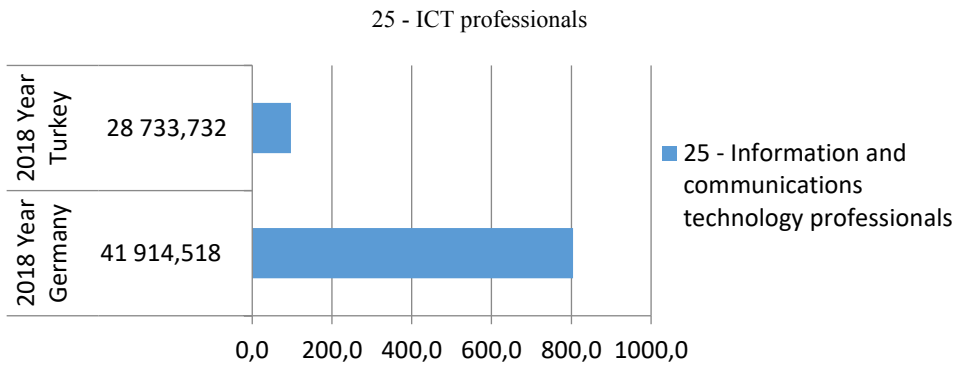
While the total number of employments in Germany in 2017 was 41,663,574, the number of IT specialists employed in their businesses was 779,216. This rate shows that the employment rate of ICT specialists in 2017 was approximately 1.9%. While the total number of employees in Turkey was 28,196,621 in 2017, the number of IT specialists employed in their enterprises was 82,457. This rate shows that the employment rate of IT specialists in 2017 was approximately 0.3% (Fig. 3.).



**Fig. 3.** The number of ICT specialists in total employment in Turkey and Germany in 2017.

Source: Compiled by the authors on the ILO 2017 data.

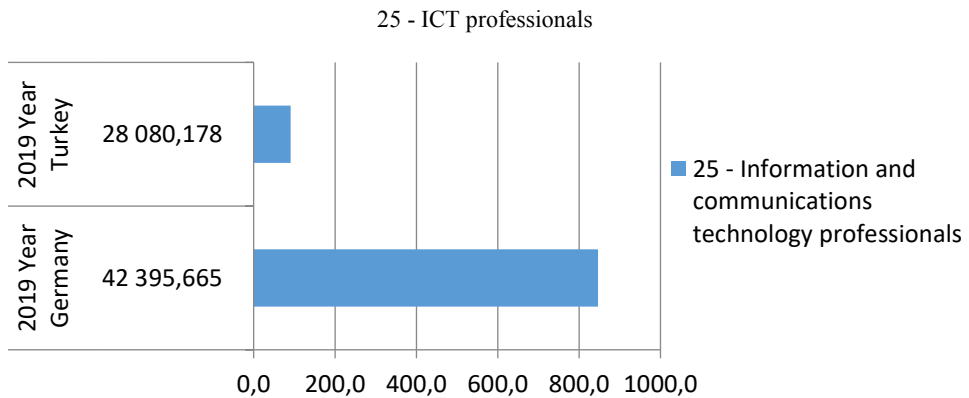
While the total number of employments in Germany in 2018 was 41,914,518, the number of IT specialists employed in their businesses was 804,449. This rate shows that the employment rate of IT specialists in 2018 was approximately 1.9%. While the total number of employees in Turkey in 2018 amounted to 28,733,732, the number of IT specialists employed in their businesses was 97,154. This rate shows that the employment rate of IT specialists is approximately 0.3% in 2017 (Fig. 4.).



**Fig. 4.** The number of ICT specialists in total employment in Turkey and Germany in 2018.

Source: Compiled by the authors on the ILO 2018 data.

While the total number of employments in Germany in 2019 was 42,395,665, the number of IT specialists employed in their businesses was 846,524. This rate shows that the employment rate of IT specialists in 2017 is approximately 2%. While the total number of employees in Turkey in 2019 was 28,080,178, the number of IT specialists employed in their businesses was 90,577. This rate shows that the employment rate of IT specialists in 2017 was approximately 0.3% (Fig. 5.).



**Fig. 5.** The number of ICT specialists in total employment in Turkey and Germany in 2019.

Source: Compiled by the authors on the ILO 2018 data.

## 5 Conclusions and Recommendations

In today's technology age, many activities in both businesses and daily life are done through ICT equipment and supplies. Societies have now realized the importance of digitalization and have turned to digitalization. This transformation often emerges as a need. It has been inevitable to benefit from technology in daily life and business life, especially in the COVID-19 pandemic encountered in 2019. Digitalization in businesses makes it possible to operate quickly and easily, with less effort and cost, both inside and outside. This is also reflected in the communication and interaction with customers. The opportunities provided to customers

increase their preferability. While digitalization adds value to businesses, it changes the way they work. For this reason, there is a need for trained personnel to realize their digital transformation.

This study intended to evaluate the employment of ICT specialists in contributing to digital transformation, so the employment of informatics specialists in the general employment of Turkey and Germany between the years of 2015-2019 was compared and examined. The reason for choosing Germany to compare with Turkey in the study is that they have similar population densities. The employment data of ICT professionals according to the International Classification of Occupational Standards (ISCO) of the ILO were used. In line with the results, the number of ICT specialists employed by Turkey between the years of 2015-2019 remained constant at a rate of about 0.3% by the years, whereas the number of ICT specialists employed by Germany increased by the years. Germany employed approximately 1.7% of its total employment in 2015, 1.8% in 2016, 1.9% in 2017, 1.9% in 2018 and 2% in 2019. In 2019, the employment rate of informatics specialists in Germany was approximately 1.7% higher than in Turkey. The employment of informatics specialists in Turkey is quite low in terms of the total employment rate. It is the ICT specialists who will provide digital transformation in businesses. For Turkey's digital transformation to accelerate, more ICT specialized personnel should be involved in businesses. In this regard, states must support the training of ICT specialists and give importance to their employment. The knowledge, skills, and talent power of informatics specialists are the key factor in the success of the digitalization efforts of public and private sector businesses. Businesses should employ experts in their information and communication departments. In addition, some measures must be taken to prevent the brain drain of ICT specialists. With the digitization of businesses, countries will digitalize and develop.

The study aimed to draw attention to the employment of experts in ensuring digital transformation. The study was carried out according to the number of ICT specialists' employment in the total employment. Future studies could be expanded and include the employment of information and communications technicians. In addition, employment in different countries could be evaluated by comparing them from various perspectives. It is thought that the study will be beneficial to businesses and scientists researching digitalization.

## References

1. K. Sabbagh, R. Friedrich, B. El-Darwiche, M. Singh, S. Ganediwalla & R. Katz, *The global information technology report*, 121-133 (2012)
2. L. D. Xu, E. L. Xu, and L. Li, *International Journal of Production Research*, **56(8)**, 2941-2962 (2018)
3. F. J. Forcadell, E. Aracil, & F. Úbeda, *Global Policy*, **11**, 18-27 (2020)
4. J. Collin, K. Hiekkänen, J.J. Korhonen, M. Halén, T. Itälä, M. Helenius, *IT Leadership in Transition-The Impact of Digitalization on Finnish Organizations*, Research rapport, Aalto University, Department of Computer Science, 121 (2015)
5. J. Bloomberg, *Forbes*. Retrieved on August, 28 (2019)
6. A. B. Youssef, S. Boubaker, B. Dedaj, & M. Carabregu-Vokshi, *Technological Forecasting and Social Change*, **164**, 120043 (2021)
7. J. S. Brennen, & D. Kreiss, *The International Encyclopedia of Communication Theory and Philosophy*, 1–11 (2016)
8. F. M. Fossen, & A. Sorgner, *Journal of Business Research*, 548-563 (2019)



9. T. Saarikko, U. H. Westergren, & T. Blomquist, *Business Horizons*, **63(6)**, 825-839 (2020)
10. Y. Sedelmaier, & D. Landes, How can we find out what makes a good requirements engineer in the age of digitalization? In *2017 IEEE Global Engineering Education Conference (EDUCON)*, 230-238, IEEE (2017, April)
11. A. A. Shaikh, R. Sharma, H. Karjaluo, *Digital Business*, **1(1)**, 100002 (2020)
12. R. A. Layton, *Journal of Macromarketing*, **29(4)**, 349-362 (2009)
13. M. A. Berawi, *International Journal of Technology*, **10(4)**, 644-647 (2019)
14. N. Urbach, F. Ahlemann, T. Böhm, P. Drews, W. Brenner, F. Schaudel, R. Schütte, *Business & information systems engineering*, **61(1)**, 123-131 (2019)
15. T. Jeske, M. Würfels, F. Lennings, *Procedia Computer Science*, **180**, 371-380 (2021)
16. R. Eller, P. Alford, A. Kallmünzer, & M. Peters, *Journal of Business Research*, **112**, 119-127 (2020)
17. S. Ainin, F. Parveen, S. Moghavvemi, N. I. Jaafar, & N. L. M. Shuib, *Industrial Management & Data Systems*, **115(3)**, 570-588 (2015)
18. G. Elia, A. Margherita, C. Petti, *International Journal of Innovation and Technology Management*, **13(5)**, 1640008 (2016)
19. P. Parviainen, M. Tihinen, J. Kääriäinen and S. Teppola, *International Journal of Information Systems and Project Management*, **5(1)**, 63-77 (2017)
20. M. Ghobakhloo, *Journal of Cleaner Production*, **252**, 119869 (2020)
21. H. Lasi, P. Fettke, H. G. Kemper, T. Feld, M. Hoffmann, *Business & information systems engineering*, **6(4)**, 239-242 (2014)
22. M. Massaro, S. Secinaro, F. Dal Mas, V. Brescia, D. Calandra, *Business Strategy and the Environment*, **30(2)**, 1213-1231 (2021)
23. Y. Xie, Y. Yin, W. Xue, H. Shi, D. Chong, *Systems Research and Behavioral Science*, **37(4)**, 711-718 (2020)
24. H. Kagermann, W. Wahlster, J. Helbig, *Recommendations for implementing the strategic initiative INDUSTRIE 4.0: Securing the future of German manufacturing industry; final report of the Industrie 4.0 Working Group*, Forschungsunion (2013)
25. F. Wortmann, K. Flüchter, *Business & Information Systems Engineering*, **57(3)**, 221-224 (2015)
26. K. Krippendorff, *Content Analysis: An Introduction to Its Methodology*, Sage, Newbury Park, CA, 472 (1980)
27. ILO (International Labour Organization). Access address and date: <https://www.ilo.org> (2021)