Overcoming the Challenges of Digitalisation in Hungarian Manufacturing Companies

Nóra Obermayer, Viktória Nagy, Viktória Erika Tóth and Dénes Kiss
University of Pannonia, Faculty of Business and Economics, Institute of Management, Department of Management, Veszprém, Hungary
obermayer.nora@gtk.uni-pannon.hu
nagy.viktoria@gtk.uni-pannon.hu
toth.viktoria@gtk.uni-pannon.hu
kiss.denes@gtk.uni-pannon.hu

Abstract: The digitalisation has become an imperative for most organisations and their workforces in our world of emergent and continuous changes. Digital technologies are evolving at the speed of light, such as big data analytics, social media, artificial intelligence, internet of things, etc., and the platform built with these technologies. In this context, digitalisation refers to the adoption of these technologies for communications and business activities into digital ones connecting people, products, services and systems. Recently, studies began to emphasise the significant role of integrating human factors into digitalised workplaces and investigate deeply how well prepared they are — workforces and organisations — for the digitalisation challenges in the era of Industry 4.0. The aim of our research is to provide a survey-based result on digital skills of the workforce influenced by digitalisation and to support organisations to fulfil digitalisation challenges. The data used for the analysis come from a primary online questionnaire survey conducted in the spring of 2021. The questionnaire was completed by managers and white collar workers of Hungarian manufacturing companies (n=621). The analysis is based on quantitative methodology, descriptive statistics and relationship analyses were used. The results showed the identified level of experience of workforces related to digital technologies and the level of development of the organisations.

Keywords: digital technologies, digitalisation, digital competences, manufacturing companies

1. Introduction

In the Industry 4.0 era, the more and more widespread use of digital technologies requires a more complex, comprehensive approach focused on managing human-machine knowledge. The most significant challenge lies in exploiting the true potential of digitalisation that uses knowledge and information sharing and data analysis to promote data-driven decision-making (Natarajan, 2018). The increasing volume of data from multiple business sectors and sources proves that the proper management of data, information and knowledge is critical to corporate life (Abonyi and Miszlivetz, 2016). Digital technologies are not meant to replace human work, but to create collaboration between people and technologies. They are not taking over work done by people, but rather facilitate, accelerate problem solving. No jobs were lost to the emergence of the computer, the product of the third industrial revolution. It only created new ones, and the same future is expected from the fourth industrial revolution. People are able to carry out tasks that machines are simply unable to learn or automate. Due to this fact, it has become necessary to develop and reinforce skills that cannot be relegated to machinery through machine learning or artificial intelligence (Mortensen, 2017).

A workforce in the digital age must have technological, methodological, social and personal competencies and is required to continually develop these (Agolla, 2018). The evolution of manufacturing, aimed at maximising efficiency, has progressed from manual processes to automation on the widest possible scale, which will result in the elimination of unskilled jobs; at the same time, the demand for digitally literate labour will increase (Tabarés et al., 2018). This age will bring new challenges for both enterprises and employees (Kaasinen et al., 2020; Demeter et al., 2019). Controlling new technologies requires new skills and competencies (Obermayer and Tóth, 2020) and a more flexible business environment, as corporate performance is still hugely impacted by the capability and dedication of managers and workforces (Stachová et al., 2019). The human factor must be an integral part of the fourth industrial revolution. The future must be shaped so as to emphasise people, as the most dehumanised form of the fourth industrial revolution does “robotize” human beings (Schwab, 2020).

2. Theoretical background

2.1 Digitalisation

The term “digital transformation” has its roots in the word digitalization, which can be described as a change in the business models of organisations to integrate digital technologies (e.g. the Internet of Things (IoT), Artificial Intelligence (AI), machine learning, Augmented Reality (AR)) for the purposes of innovation in products, services and processes (Machado et al., 2021; Birkner and Máhr, 2016). These technologies are known as SMACIT technologies, which is an abbreviation of Social, Mobile, Analytics, Cloud and the Internet of Things (Shahi and Sinha, 2020). Digital transformation is “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies'' (Vial, 2019:121). Digital transformation consists of three primary stages (Verhoef et al., 2019).

During the first stage, organisations undergo digitalisation, which involves transferring processes (e.g. paper-based processes) and systems to digital platforms. The next stage involves further integration and optimization of digital technologies and IT capabilities for the purposes of developing processes and services. Digital transformation is actually implemented only during the last stage of the process, and involves systematic and comprehensive application of digital technologies. The effects of digital transformation, the scope and speed of current changes, and the emergence of digital technologies have led to a radical transformation of workplaces, resulting in a reduction of demand for workforces carrying out routine, manual tasks (Bertani et al., 2020), which means a reduction of demand for essential workforces (Szabó- Szentgróti et al. 2021). Industry 4.0 and digital transformation are focused mainly on technology, and often ignore the role of digital competencies in the labour force (Kozanoglu and Abedin, 2020). However, the currently developing concept of Industry 5.0 emphasises the creativity of people cooperating with efficient smart technologies (Maddikunta et al., 2021). Questions therefore arise concerning the need to develop the competencies of existing workforces, and the competencies of future workforces who will make up the digital workforce. Digital technologies enhance the autonomy of the workforce, and the demand for workforces with digital competencies is continuously growing (Kozanoglu and Abedin, 2020).

2.2 Human perspective

International (Li et al., 2019) and domestic studies have examined the human-centric aspect of Industry 4.0 (Horváth and Szabó, 2019). This latter study summarises the drives and limitations of adopting Industry 4.0. Drives identified include market competition, expectations from corporate management, productivity, and certain elements of efficiency. One the other hand, there are also limitations such as organisational factors, the current capabilities of enterprises, technological and process integration and the lack of collaboration. Certain human resources and financial sources act as drives, others as limitations. Additionally, SMEs with a capacity to respond to challenges flexibly may gain a competitive advantage, although certain drives and limitations may have different levels of relevance for enterprises of different sizes (Horváth and Szabó, 2019). The necessity for new digital technologies came with increasing requirements for collaboration between human beings and technologies (Manimuthu et al., 2021). Companies have attempted to introduce digital technologies, but their workforces often refuse to cooperate (Nagy et al., 2018). Resistance is apparent mostly among unskilled or semi-skilled workforces carrying out routine tasks, and is generated by their fear of losing their jobs (Sciutti et al., 2018). In many cases, workforces clearly lack knowledge on digital technologies and fear the unknown, do not trust as they worry that the intensification of digitalisation will lead to them losing their jobs because they lack the competencies necessary for handling new technologies (Horváth and Szabó, 2019).

Although some believe that Industry 4.0 will replace the human workforce, manufacturing companies are more likely to use robotics to support workforces. The technology will increase productivity, but will not replace human labour. The number of routine tasks will drop, while the number of tasks involving flexibility, problem solving and custom solutions will increase. A survey by the Massachusetts Institute of Technology (MIT) has found that groups of collaborating humans and robots are potentially more efficient than groups consisting of only humans or only robots (Koleva, 2019). According to a study by PwC Strategy&16 involving 26 countries, 10% of global manufacturing companies can be considered digital champion. This means, among other things, that the way they implement digitalisation is innovative and goes beyond automation. In Asia 19%, in America 11% and in the EMEA region only 5% of manufacturers have reached the level of digital champion.

3. Research method

One of the important findings of earlier studies was that the main obstacles hindering digitalisation from a human resources standpoint were lack of trust and the lack of digital competencies among workforces. In 2021, our research group decided to conduct a quantitative research and the aim was to explore the impact of digitalisation on digital competence of the workforces and the challenges raised by implementing digital technologies. In the course of our research, we aimed to find answers to the following questions:

RQ1. What level of digital competence do workforces possess?
RQ2. How has digitalisation intensified various challenges (like lack of digital competence of the workforce)?

3.1 Data collection

The data used in the analysis are from primary sources, from an online questionnaire survey (Limesurvey) conducted in the spring of 2021. The anonymous questionnaire contained questions in five different categories that could be completed in approximately 15-20 minutes. One of them was Digital technologies, which we have chosen as the main topic of this paper. Questionnaires have been completed by managers and white-collar workers of Hungarian manufacturing enterprises. We have invited more than 50 000 companies to complete our questionnaire; we have queried their e-mail addresses from the database of Bureau van Dijk Orbis. We have selected the target group based on two criteria: firstly they must be Hungarian enterprises, secondly they must be manufacturers.

3.2 Sample

There were 621 evaluable responses in the sample (n = 621). All participating organisations were companies operating in Hungary. The sample is categorised by sector (primary activity), industry (ISIC/International Standard Industrial Classification of All Economic Activities) and size (number of employees).

The questionnaire was completed mostly by manufacturing companies (69%). Based on the ISIC, most of the companies were from the following industries: manufacturing (22.4%), construction (16.6%), wholesale and retail trade (15.6%), Agriculture; forestry and fishing (8.5%), other service activities (10.6%) and professional, scientific and technical activities (6.9%). 11% of respondents were white-collar workers, 89% were managers (71% top management). We have determined the size of the companies based on the number of their employees (Figures 1.).

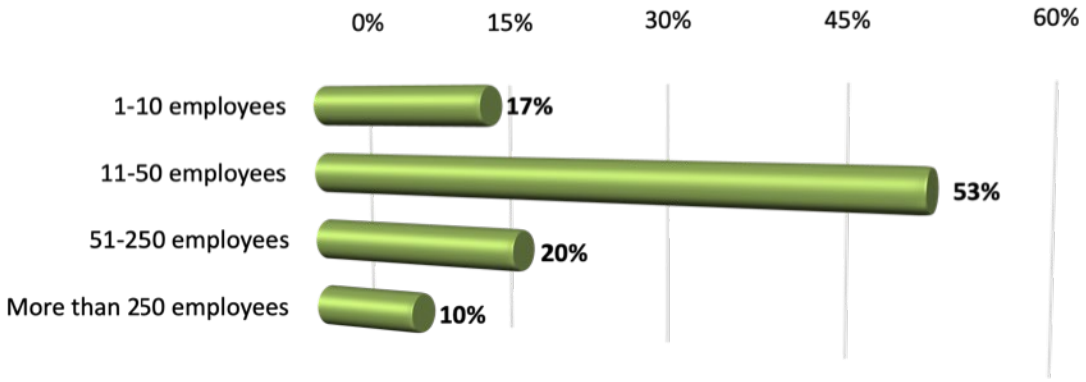

Figure 1: Distribution of employee numbers (%)

More than half (53%) of respondents were small enterprises with 11-50 employees, 20% were medium-sized enterprises with 51-250 employees, 17% were micro-enterprises with no more than 10 employees, and 10% were large enterprises with more than 250 employees. Due to the predominance of SMEs, the sample was representative of the Hungarian corporate sector as a whole.

3.3 Analysis

The analysis is based on quantitative methods, including descriptive statistics and relationship analysis, with Kendall's Tau coefficient (τ). It assumes values in the interval [-1, 1] interval. Results are provided at the 5% significance level. If the p value of V or τ is less than 0.05, the correlation between the two variables shall be considered significant. The absolute value of significant results describes the strength of the correlation (Sajtos

- Mitev 2007): 0: no correlation; [0, 0.2]: weak correlation; [0.2, 0.7]: medium correlation; [0.7, 1]: strong correlation; 1: deterministic correlation. Since τ can be both positive and negative, the associated sign is also relevant, as it determines the type of the relationship. A negative (positive) τ value means that the higher the level of one variable, the lower (higher) the level of the other.

4. Findings

Figure 2 illustrates the level of digital competence of the horizontally fragmented workforce of the company. 75% of companies have employees with basic digital competencies in one (37%) or several (38%) areas, and only 25% of companies have employees with advanced digital competencies in one (23%) or several areas (2%).

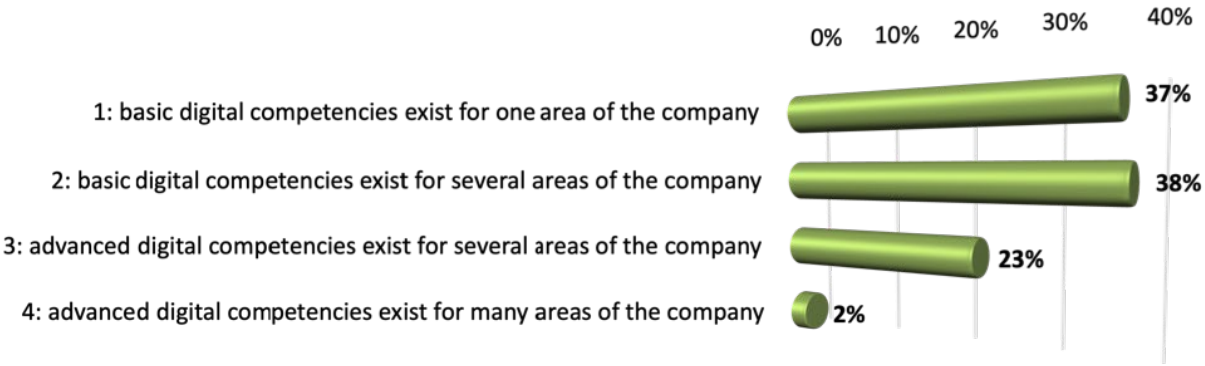

Figure 2: Digital competence in the workforce (%)

Based on the findings above, we stated that the labour force possesses basic digital competence. Analyses have shown that, in accordance with DESI statistics, the majority of respondents only have basic digital competencies, although the results were higher than both the EU (56%) and Hungarian (49%) averages. This means that employees at Hungarian manufacturing companies have above-average levels of digital competence.

The majority of respondents have considered the lack of digital competencies to be a major challenge. 95% of respondents believe that the significance of the challenge has: somewhat increased (33%), greatly increased (49%) or absolutely increased (13%) due to the lack of digital competencies in the workforce (Figure 2.).

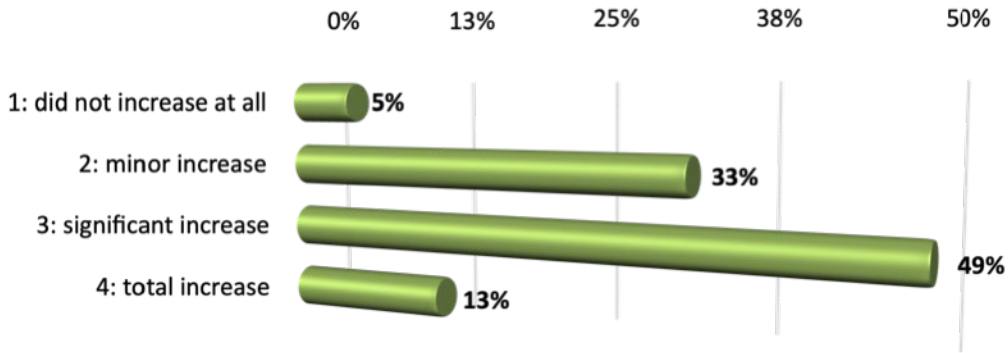

Figure 2: The challenge posed by lack of workforces' digital competencies

The results show that digitalisation has intensified the challenge posed by a lack of digital competence in the workforce.

The diagonal sections of Table 1 show the deterministic correlations with a black background, which means that each variable is in perfect correlation with itself. As for the empty cells, there we have found no significant correlation. Among significant correlations, cells with a red background indicate weak, those with yellow or light green background indicate medium correlation. Since τ can be both positive and negative, the associated sign is also relevant, as it determines the type of the relationship. A negative (positive) τ value means that the higher the level of one variable, the lower (higher) the level of the other.

We have identified many significant correlations, some of them were weak and most of them were medium correlation, but we have found no instances of strong correlations.

Table 1: Results of the correlation study with Kendall's Tau coefficients

		1	2	3.1	3.2	3.3	3.4	3.5
1	**Workforce experience of digital technologies**		**0,418**			**-0,066**		0,077
2	**Level of development of digital technologies at the company**	**0,418**		0,076	0,086			
3.1	**Challenges of 'ad hoc' digitalisation without strategy**		0,076		**0,424**	0,285	0,253	0,298
3.2	**Challenges of lack of workforces' digital competencies**		0,086	**0,424**		0,372	0,350	**0,289**
3.3	**Challenges of distrust towards digital technologies**	**-0,066**		0,285	0,372		**0,529**	0,368
3.4	**Challenges of distrust towards workforces**			0,253	0,350	**0,529**		0,382
3.5	**Challenges of data security**	0,077		0,298	**0,289**	0,368	0,382	

Colour Key: the strength of the significant results is weaker stronger

The more the level of development of digital technologies at the company are, the more the workforce experience of digital technologies (τ = 0.418). This result can be seen almost trivial, but it does not necessarily mean the existence of a digital technology, its application by the workforces.

The more the workforce experience of digital technologies (1) are, the less the challenge posed by distrust towards digital technologies (3.3) (τ = -0.066). It also follows from the result that it is worth developing the digital competence of the workforce, as this will reduce the distrust towards new technologies, so they are more likely welcome changes.

The greater the challenge posed by 'ad hoc 'digitalisation without strategy (3.1) is, the greater the challenge posed by the lack of workforces' digital competencies (3.2) (τ = 0.424). Without an official digitalisation strategy, adequate communication and leadership example about the use of digital technologies, the unskilled workforce is a major challenge.

The greater the challenge posed by distrust towards digital technologies (3.3) is the greater the challenge posed by distrust towards workforces (3.4) (τ = 0.529). If the workforce is distrust towards new digital technologies, management will also be distrust towards the workforces (in an extreme case, there is also a fear that the workforce will harm the digital technology, like robotics).

The greater the challenge posed by the lack of workforces 'digital competencies (3.2) are, the greater the challenge posed by data security (3.5) (τ = 0.289). If workforces are unaware of the use of digital technologies, they are more likely to accidentally, or in the absence of knowledge, act prudently on data security issues, meaning they share data that should not be.

5. Discussion

Today, digitalisation is a priority for the world's manufacturers, particularly in European countries (Qin et al., 2016) - including Hungary. While Hungary is one of the most (5th) highly industrialised countries of Europe, and industry's share of Gross Domestic Product (GDP) was at 24.3% in 2020, the DESI 2021 index shows that Hungary is second to last in integration of digital technologies into corporate activities. Hungarian enterprises perform poorly on all technological indicators, and the uptake of key digital technologies (big data, artificial intelligence, cloud) is low (European Commission, 2021).

Based on the analysis digitalisation at the manufacturing companies strengthen and improve the workforces' experiences at a moderate level. The lack of experience of digital technologies does not give rise to new challenges with implementation, as the managers' attitude to the challenges of embracing new digital

technologies is neutral, even inversely positive to a small degree, which should sooth the bias of managers when it comes to handing new digital technologies to workforces as even if they are unfamiliar with them, they are likely to embrace and use them effectively, with minimal risk to data security. Although decision makers should be wary of deploying new digital technologies without giving enough time for their workforces, as their performance might drop due to the unknown challenges of digital technologies. Our findings, like the research conducted by Obermayer et al. 2021, Müller et al. (2018), Kiel et al. (2017a), and Horváth and Szabó (2019), show that the most difficult obstacle to digitalisation is that companies do not have a digitally competent workforce, so companies do not have or cannot find workforces with appropriate digital competences.

A key factor in the future successful implementation of digitalisation is providing digital attitude training to workforces, which prepares them to accept and trust towards digital technologies. Regular communication with workforces may dispel their doubts. Corporate management can assist workforces in overcoming their distrust when they are worried about new digital technologies and changes because of digitalisation and because they lack of the necessary digital competencies and experience. The company is responsible for providing its workforces with sufficient information and education, and therefore for alleviating resistance to adaptation.

5.1 Limitation and futures studies

The current research has certain limitations that offer opportunities for further research. First, the research's result was based on a sample from Hungarian manufacturing companies. As further study, since the topic is relevant and under-researched, other countries should be analysed. Second, because of the quantitative nature, further qualitative research may be needed to produce more deepen insights. Case study methodology, would make it possible to explore the topic.

Acknowledgements

This work was supported by the TKP2020-NKA-10 project financed under the 2020-4.1.1-TKP2020 Thematic Excellence Programme by the National Research, Development and Innovation Fund of Hungary.

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