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The Development of Competencies for Employability Digital Competencies

Influence of the Industry 4.0 concept on digital competencies

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Abstract

The term called Industry 4.0 (I4.0) is an umbrella-concept, which encompasses several elements from the latest technological trends influencing the human workforce and education. But the questions arise: Does the industry 4.0 concept itself change workforce competencies? What is the impact on education? Thus far, only the technological aspects have been investigated thoroughly, despite their well-known, and strong, influence on the economy and society. This study addresses the interactions, dependencies, and correlations between certain areas of social existence, as expectations change regarding human competencies and their continued role in economic sectors and technological innovation. The role of the human factor within society is unquestionable as we start to understand why industrial revolutions have appeared. Fundamentally, it is always human concerns that stimulate change and it is human/social aspects that are heavily influenced by the same changes. As the I4.0 concept has an influence not just on how products are manufactured but also on the practices of consuming "products", governments, research institutes, education systems, and organisations all have a crucial role to play in managing the massive wave of change. We believe that the concept should be more

deeply analysed and understood, as it might give rise to a new complex terminology for techno-social change, which eventually would feed into achieving economic goals more efficiently.

Keywords: industry 4.0, digital competency, education and economic development

1. Introduction

An increasingly globalised world and the use of advanced technologies (e.g. Artificial Intelligence, Machine Learning, Robotic Process Automation, Industrial Internet of Things, Additive manufacturing methods like 3D printing etc.) in manufacturing and processing industries together draw attention to the question of whether the necessary human skills and competencies to be competitive are well identified and education systems have already adopted the right approach. In this study we analyse the current trends, which we refer to as the I4.0 concept, and investigate the relevance of new digital competencies our area of focus, which encompasses the small and middle-sized (SME) companies in the Hungarian manufacturing and processing sector. The perspective of the research is based on similar European studies and research and Hungarian high-level education strategies. The examined studies and literature which are the reference of this cooperative research have led us to draw our own conclusions. Our goal is not just to evaluate our hypothesis that I4.0 is making new competence demands, but also to investigate the potential impact of the validated hypothesis on the education systems, and indirectly to employability in the future (Lorenz et al., 2015). It is a fact that the I4.0 concept has not developed in the same way worldwide, in Europe, or even among different industry sectors. In this study, the differences in maturity that are highlighted may be used as an opportunity to check the leading countries' situation and conduct a comparative analysis with the Hungarian reality. Enhanced skills and competencies are required to remain at the forefront of the new technological revolution and one of the biggest concerns in terms of technological, social, and cultural advancement in the workplace is the pressure to decrease operation costs and the increased prospect of unemployment faced by people who are less prepared for the changes that are coming (Demirkan, 2016). The potential of using advanced technology including the I4.0 elements like machine learning, intelligent process automation, collaborative robotics, decentralised manufacturing management, horizontal and vertical system integration etc. (Tan et al., 2017), will redefine most jobs and at the same time eliminate some of them and generate new ones. As the competitiveness of an enterprise is highly dependent on the way work is done, the technology employed, and the know-how of the employees, the competence of the individual is a crucial characteristic (Jensen, 2019). Competence is generally viewed as the main term that encompasses more specific concepts such as knowledge, skills, abilities etc. As one of the main roles of the high schools, universities, as well as adult post-graduation education is to improve these elements, it is axiomatic that identifying what areas to focus on and the practical orientation of education are both of crucial importance. Considering the complexity and multidisciplinary of the topic in the study we conducted a systematic literature review, which offers an overview of recent research and follows a concept-centric approach.
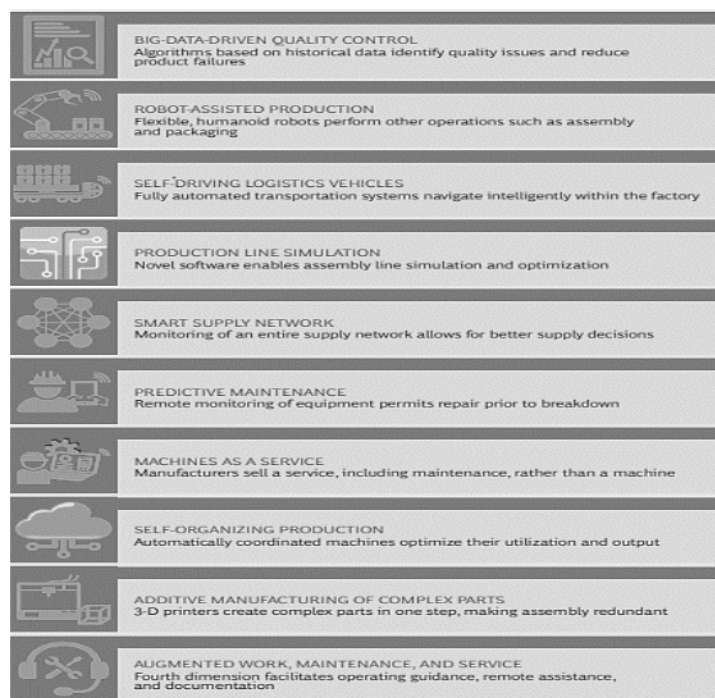
2. Digital transformation

Different countries have different standards, and it is also the case that the "digital transformation in higher education and society" cannot work with the same method in each case (Jensen, 2019, p. 5). However, it should be kept in mind that "graduates from universities aim

for important positions in the public or private sector and they are the future knowledge workers" (Toarniczkya et al., 2019, p. 2). "Digital transformation at the global level" aims to define high-level and comparable standards, to "determine the key values and principles that are pivotal to shaping a meaningful, human-centred digital future for the common global good, regardless of where in the world we are physically based" (Jensen, 2019, p. 5). On the other hand, technology is a barrier, and "unequal access to the internet implies unequal access to information, knowledge and international networks" (Jensen, 2019, p. 17). "Communication and technology have an important role in life especially in education" (Kiss, & Gastelú, 2015), therefore digitalisation requires a common solution that shapes the future positively.

"Global connectivity has created not only borderless classrooms, but also virtual workplaces" (Tan et al., 2017, p. 13) to which the entire world needs to adapt. One of its essential elements is to re-create the higher education system as well as to develop skills like "sense making, novel and adaptive thinking, virtual collaboration, transdisciplinary, cross-cultural competency, social intelligence, cognitive load management, new media literacy, a design mind-set and computational thinking" to prepare for a successful future (Tan et al., 2017, p. 13). Taking everything into consideration, the task is clearly far from simple. There are several stakeholders, affecting many areas through society, economy, and fundamental human rights. The process has begun, and COVID-19 has accelerated it. Scientists and decision-makers of the present age have an opportunity to shape the processes advantageously. As a recent BCG report (Lorenz et al., 2015) identified the technologies driving the world of work towards the industry 4.0 concept, (Figure 1) the study could declare that these are "quantitative effects on the industrial workforce, we studied how the ten most influential use cases for these foundational technologies will affect the evolution…" (Lorenz et al., 2015, p. 4).

FIGURE 1. EFFECTS OF INDUSTRY 4.0 ON THE WORKFORCE

BIG-DATA-DRIVEN QUALITY CONTROL
Algorithms based on historical data identify quality issues and reduce product failures

ROBOT-ASSISTED PRODUCTION
Flexible, humanoid robots perform other operations such as assembly and packaging

SELF-DRIVING LOGISTICS VEHICLES
Fully automated transportation systems navigate intelligently within the factory

PRODUCTION LINE SIMULATION
Novel software enables assembly line simulation and optimization

SMART SUPPLY NETWORK
Monitoring of an entire supply network allows for better supply decisions

PREDICTIVE MAINTENANCE
Remote monitoring of equipment permits repair prior to breakdown

MACHINES AS A SERVICE
Manufacturers sell a service, including maintenance, rather than a machine

SELF-ORGANIZING PRODUCTION
Automatically coordinated machines optimize their utilization and output

ADDITIVE MANUFACTURING OF COMPLEX PARTS
3-D printers create complex parts in one step, making assembly redundant

AUGMENTED WORK, MAINTENANCE, AND SERVICE
Fourth dimension facilitates operating guidance, remote assistance, and documentation

Source: Lorenz et al., 2015, p. 5.

The study was focusing on German industry, which is representative from an Industry 4.0 concept adaptation aspect. The adoption of I4.0 is a process; to define it more precisely, it is a change implementation where the identified and chosen technologies will be adopted. As these technologies may require a different method or way of working to operate them, the operational structure and operative processes may need to be also changed. This change is usually called digital transformation. As Demirkan (2016) observes, "Digital transformation is the profound and accelerating transformation of business activities, processes, competencies, and models to fully leverage the changes and opportunities brought by digital technologies and their impact across society in a strategic and prioritised way" (Demirkan, 2016, p. 14). Moreover, "technology will not improve business digital transformation and will not add competitive advantage on its own, it will need a structural change and development agenda to link and align digital strategy principles to specific business domain and definite business strategy, both in the short-term and long-term" (McKinsey, 2017, p. 2).

The literature and studies reviewed thus far lead us to our first conclusion: if I4.0 elements are planned to be adopted by an enterprise, it will initiate the digital transformation process, which goes beyond simply the technology. As a recent McKinsey study estimated (2017), the whole business model and its support functions will need to be redesigned strategically, which should be combined with the new technologies. Obviously, this will require a different competency set-up.

3. New competency demand

There seems to be wide agreement that the advance of automation and digitalisation will continue to transform the competency requirements for employees over the upcoming years. However, it is difficult to predict exactly how the importance of each specific individual competency will change, or which competencies have a low capacity for automation and will therefore be in demand in the labour market. Technological change cannot be accurately predicted, so any attempt to imagine the future is inevitably subject to uncertainty (Vogels, Rainie & Anderson, 2020). So far as the technology-related megatrends are concerned, their influence on the labour market is obvious. Every area of the labour market, whether blue collar or white collar, will be affected. "Intelligent algorithms" could very rapidly replace those jobs whose steps could be documented. "One-third of current jobs requiring bachelor's degree, can be performed by machines or intelligent software in the future" (Vogels, Rainie & Anderson, 2020, p. 17). Due to the changes, a new category of jobs will appear. However, it is necessary to note that, "a gradual transition will take place, which has already commenced and differs from industry to industry and from company to company" (Blundell, 2020, p. 647). If we adopt the hypothesis that the education system needs to reflect the needs of the industry and labour, it is important to investigate the interdependencies and interactions between all concerned parties (Irving, 2020). The authors of the current paper, in broadly examining the topic observe that as a preparatory step, all concerned parties must be identified (this is not as obvious as one might assume). Several questions shall be asked before planning the research, such as: What is the purpose of technology? For what do we use technology? Who wins from developing and using the most advanced technology? What are the goals and roles of the government, different research institutes, and different education systems? Is there a network or hierarchy between the actors? All of these questions should be investigated in order to reach a deep understanding of the current research problem.

Technology megatrends are often approached from the perspective of Moore's law (Gordon E. Moore, 1965; Intel.com, 2021), whose exponential curve describes the increase in the number of network devices, or the computing performance of CPUs. As Némethy and Poór put it, "new technologies are increasingly becoming part of everyday life, not just pulling industries, they shape the world of work as a privilege" (Némethy & Poór, 2018, p. 222). In the current study, the authors also draw the conclusion that technology is improving faster than profit-oriented enterprises can adapt to it to achieve economic goals, as well as much faster than society can understand and adopt it. If we accept this statement, on might infer that the gap is steadily increasing between the capability of technology and the (average) human competency. The side effect of this would be that even advanced technology is theoretically available and human competency imposes a limit on maximising the achievable benefit. The education system, and especially the universities, which are closest to the labour market in the case of white-collar positions, is coming under huge pressure to fill this gap. If we wish precisely to understand what digital transformation means, and what its impact on existing business models is, production systems must be seen as crucial elements.

Digitalisation is a complex phenomenon, and it does not "just mean 'remote'!" (Engler, 2020). It is an "unavoidable rung on the ladder" (Nugent, 2020). Digitalisation is "using digital technologies in combination to blur the boundary between the physical and the virtual worlds" (Moore, 2015). It is necessary to recognise the "digital impacts of the business", the way systems work in detail and to "deploy critical skills which are essentially needed to fuel the re-imagined business model" (Engler, 2020). From this perspective, it is important to investigate the relevance of knowledge which is depicted thus by Schüppel:

FIGURE 2.
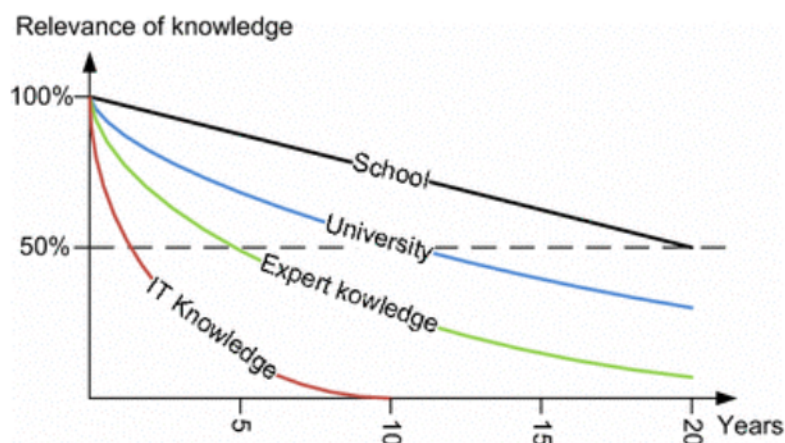
Source: Saracco, 2018

As Saracco (2018) has mentioned, "new knowledge become available, while previous knowledge becomes obsolete. The speed of obsolescence varies for different types of knowledge and in different areas". Indeed: should a student still learn to do the square root of a number or instead be required just look at the answer given by a calculator on a screen?

In the meantime, the knowledge half-life (the time it takes for 50% of what you know to lose its value, become useless, superseded) is shrinking, it is now below 5 years in technology areas

(as shown in the graphic, IT knowledge's half-life is less than 2 years!). More than ever in the past, knowing how to ask the right question as well as "whom" to ask have become crucial skills (Saracco, 2018).

Each education system has a certain latent capacity to react to the new demands. One of the main tasks in these organisations to manage this latent potential, as it is not necessarily an obvious goal to minimise it, given that the primary role of a university is to provide a robust knowledge base which is supposed to be future proof. Different knowledge areas have different knowledge obsolescence, and this results in different optimum levels of latent capacity. It shall be admitted that knowledge has future-proof elements as well as a bigger or smaller package of dynamically improving competencies and skills. In addition to companies, employees, and societies, education systems, and legislators also face the task of meeting the new challenges resulting from constantly advancing technology. As Gehrke et al. (2015) puts it, "the demand for technical talent will drive the shift of job creation within manufacturing industry, requiring more qualified personnel on the shop floor. Companies will need a skilled workforce to develop and run advanced manufacturing tools and systems and to analyse the data received from machines, consumers, and global resources. This results in a rising need for skilled workers trained in cross-functional areas and with capabilities to manage new processes and information systems" (Gehrke et al., 2015, p. 4). In a society that seeks to innovate at multiple levels, it is essential that both the professional and policy-making levels recognise both change and the need for change. The VDI study cited above portrays the competency pyramid described in Figure 3.

FIGURE 3. QUALIFICATIONS AND SKILSS FOR THE FACTORY WORKER

Source: Gehrke et al., 2015

As indicated in the pyramid, the 3rd tier constitutes the basis for the 2nd tier, which in turn constitutes the basis for the 1st tier. The study focuses on the potential new demands and the architecture of competency but does not estimate the extent of existing individual or organisational know-how and knowledge obsolescence. Nevertheless, the value of the study resides in its portrayal of the levels (or tiers) which may help an organisation to evaluate and establish an accurate picture of the demand for a strategic competency or skill. From the authors' perspective, the process of change can be caused by external or internal factors, or by an internal imbalance that can be derived from economic factors in addition to social

inequalities. The obsolescence of the structure of higher education and the need for a service and market-oriented approach expected by industry together have the power to induce change. This change is still taking place. Following such a recognition, the transformation of higher education in Hungary has started, which is outlined in detail and comprehensively in the medium-term policy strategy document titled "graduation in higher education.

4. Driver of the change; what makes a difference

First and foremost, Europe is facing significant societal challenges due to globalisation and digitalisation, in which collaborative behaviour is needed to promote economic growth and prosperity. Universities have a significant role to play in "rethinking problems and finding solutions" and they represent one, extremely essential, side of Kálmán's "Knowledge Triangle" model (Kálmán, 2019). The universities' capacity to create knowledge is a great source of solutions to problems. When it comes to evaluating the extent of knowledge production, Csath has mentioned that the GDP is not the most appropriate tool: "only expenditures on knowledge creation – education expenditures, R&D expenditures – can be taken into account with the help of GDP, and certain results, such as acquired knowledge, can be measured with it" (Csath, 2020. p. 30). In presenting quantitative growth, both the authors of the current paper and Csath agree that knowledge creation has a direct impact on economic and social sustainability. According to the authors, the current education system is not fully aligned with market needs, a situation which does not necessarily depend on the professions. Networking and interconnectedness are focal components of the I4.0 (Gehrke et al., 2015). Workers will collaborate and communicate without borders as they will utilise smart devices which connect them in real-time to their co-workers and workplace tools or even education systems or training service providers as needed. For example, collaborations with research institutes, universities, and parties that are not classical suppliers will increase due to the interdisciplinary character of digital production or I4.0 (Gehrke et al., 2015). All of the literature points in the direction of industry or its economic goals setting the target to adapt I4.0. From a technology perspective, different and customisable elements are available, so competency characteristics could be defined by an organisation that is prepared to think strategically. Our base hypothesis can therefore be accepted: the I4.0 concept is playing the role of a change agent in respect of the competency characteristic set-up for the factories of the future.

5. Impact to the education systems

The role of education has changed a lot over the decades. The requirement to offer a simple educating ability of the higher education institutions is not a driving force any more, but must appear as the third mission in the appropriate ecosystem context in order for a university to be attractive on the market (Compagnucci & Spigarelli, 2020). A transformation took place in the education market, in which the knowledge economy became a central issue, due to globalisation, digitalisation, the global crisis and its associated challenges. Universities have huge potential to be the agents of change and contribute to regional innovation (Kálmán, 2019); however, they should first find an appropriate balance between the scope of their research, the needs of the market, and the delivery of education. In the Triple Helix model the collaboration of academia, industry and state-sponsored science makes an innovative atmosphere possible (Makai & Rámháp, 2020). The extent of the missions may differ from university to university, however by acting together these collaborators can create a path towards regional innovation and societal change, in which the higher education institutions have immense potential

(Kálmán, 2019). The I4.0 concept strengthens the relationship between university and industry, supports the strengthening of the technology and knowledge transfer processes, and forces the university to transform itself (Makai & Rámháp, 2020) and be the engine of economic and societal growth (Cai, Ma & Cheng, 2020). The needs of the labour market and society require higher education institutions which actively support technology change, international cooperation, and continuous change in skilled labour requirements, as well as providing the basis for innovation and lifelong learning (Fejlődésgazdaságtani szakosztály, 2020). That is why the situation of the universities has become a key question.

Education systems will certainly investigate the potential impacts of I4.0, and, based on a gap analysis, actions will be taken. Hungarian higher (university or higher) education systems have the right to make autonomous decisions, and design and implement their own career structure or even education methods, but next to it government provides a countrywide approach, with an education policy which may also reflect the megatrends or challenges. Our research and sample based exclusively on a Europe-wide literature review painted a clear picture that many universities – albeit mainly the directly concerned technical universities – have put digital competencies and digital education methods in the spotlight. The Covid-19 pandemic has obviously accelerated this at least from a training or pedagogical point of view, but education in digital competencies represents more than digitalising the education. Digital competencies mean that both method and content shall comply to the new expectations. As M. Lorenz (Lorenz et al. 2015) and his fellows described in their studies there are more elements universities need to work out, and as these education systems get prepared, industry will the chance to obtain the proper competency set directly from them. From the three pillars (university – industry – government) of the Triple Helix model, the first requirement is a need for broader skill sets. However, even this is not specific enough as the nature of the I4.0 is that it is not only widens the technical competency needs but also requires real interdisciplinarity, as for example a mechanic engineer shall have IT coding competency as good as business process or knowledge of economics and even sociology. As the authors of the Boston Consulting Group report observe, "many current educational programmes at all levels provide highly siloed training and offer limited interaction among fields" (Lorenz et al. 2015, p. 14). The requirement relating to the second pillar is "close the IT skills gap". This element is an obviously important but complex topic. As our study has investigated knowledge obsolescence, IT knowledge was found to be the most critical aspect. IT development platforms are improving and changing as fast as the computers on which the development shall be performed and later the application or algorithm is operated. At this point universities, education systems could find themselves facing a huge challenge to their business model. "If you want to study psychology, master computer coding, or complete an MBA, why would you pay big fees to a large university to support its infrastructure costs and hear someone lecture in a huge hall, when you could watch the world's best experts from the comfort of your apartment or on your phone, wherever you are? The old university model is becoming obsolete" (Fischetti, 2019). Fischetti puts a critical issue to the table, which is that thanks to the technology, the infrastructure and so on, the financing of universities' infrastructure cost may lose its importance. This is an additional pressure why education systems need to find new ways to reach students. This leads us to the requirement relating to the third pillar, which is to offer new formats for continuing education. As the Boston Consulting Group report puts it: "Academic leaders should prepare the education system to support the ongoing requalification of the industrial workforce, recognising the need for training to take place in more settings than only the traditional off-site locations. This support

could include providing online-learning platforms and access to free courses at "open" universities, which have no entry requirements, as well as using mobile apps to offer training and access to know-how. Universities could also offer a free, high-quality "massive open online course" in programming to all citizens. Academic leaders should work with business leaders to discuss their companies' specific training needs. This collaboration could lead to new education models for business, such as instructional programmes aimed at building capabilities rather than conferring degrees" (Lorenz et al. 2015, p. 16).

In the knowledge economy, the innovation of the education system is key (Kaloudis et al. 2019, p. 11), not just because they are the locus of knowledge transfers, and supporters of innovation through university spin-offs, start-ups, publications, and patents but also because they are the source of knowledge and source of the skilled human workforce. One of the goals of education is to bridge the gap between students and the challenges of the future by helping to find adequate responses to emerging challenges such as globalisation, digitalisation, the changing needs of the humanity, and new ways of working. An important goal, in line with the profile of universities, is the generation of a competitive workforce, as well as research that contributes to the production of knowledge and the development of the economy (Fonyó, Hausz & Kardon, 2016 pp. 47-50). This requires a synergic approach in the innovation ecosystem, a cooperative working relationship between the state, the university and industry, as well as long term strategic planning.

The education system faces many challenges due to the rigid and inflexible work conditions, however among its aims are: to find new education strategies, to introduce creativity in the education system, to provide adequate answers to the challenges of the world (Yordanova, 2019), to be in line with the I4.0 needs, and to provide useful knowledge to the industry. The universities today occupy an outstanding position. They are symbols in scientific, cultural, and moral terms as well as the facilitators and pioneers of innovations (Bejinaru, 2017). It is therefore very important that they transform themselves, to become the engine of the economy and find a way in line with their profile to be the solutions to the problems raised by I4.0.

The challenges raised by Industry 4.0 may have been felt especially keenly in higher education – Motyl et al's survey (2017) shows this is certainly true among engineers – but the effects can be felt in every area of working life. Effective performance and specific job knowledge have become necessary in the industry in order for one's employer to be successful and if one wishes to be able to contribute to the firm's value creation. This expert knowledge should be combined with a broad IT knowhow and specific skills are necessary in the transformed work environment (Nico et al. 2017, p. 12). This change demands a totally new way of thinking and working, combining many soft and hard skills. It requires creativity, innovation, critical thinking, problem solving, in-house and external collaboration, work autonomy, flexible work hours (PwC, 2018) as well as digital literacy on the part of the employees. Many studies differentiate among multiple competency levels (with these levels receiving different designations in some cases), which are:

a) Technical skills: Basic and specialist knowledge from a person's own specialty/discipline.

b) Data and IT skills: Control, use, checking of data-based systems, data analysis, data security/data protection, etc.

c) Social competence: Interdisciplinary cooperation, project management, communication skills, organisational and leadership competence, decision-making competence, etc.

d) Personal skills: Self-initiated learning skills, analytical thinking, problem solver mindset, capacity for abstract thought, openness, flexibility, etc.

These categories are non-homogeneous sub-fields of the identified competence areas, and the education system needs to be prepared to support the ongoing requalification of the industrial workforce. This means that in the name of life-long learning approach these sub-fields must be continuously in focus and must be maintained with a view to future redesign. Where digital skills are concerned, the crucial aspect is not knowledge of certain IT tools, or a development environment (programming language), but rather also the data management principles, cloud, edge and fog computing, network technology, M2M communication and the ability to support advanced technology-supported problem solving using simulation and modelling methods.

The world has become "globalised, automatised, virtualised, networked and flexible" (Motyl et al., 2017) and higher education institutions should make the students ready for these needs. For the future universities it is essential to take into consideration the necessity of their role. Universities are the creators of "tomorrow's technology leaders" and they can contribute to industry's competitiveness by promoting "dual-track education" in which students learn the theoretical background at the classrooms and practical skills at the workplace (PwC, 2018). Within education, excellent teaching, experts from the branch, high quality trainings, lifelong learning are necessary for the successful industrial performance and industry should be actively involved in designing the higher education of tomorrow's technology innovators. One particularly vital element is an ability to adapt to the changes that are to come on the part of the institutions and employees (Nico et al., 2017). Transformation of one's work conditions requires complex skills from the employees; the universities should make the future employees ready for the needs of a job world undergoing transformation by making them ready for the high tech skills and for the "complementary skills" such as management, communication, leadership, emotional intelligence and so on (PwC, 2018).

It is an eternal question how to measure, evaluate the digital skills, competencies. All organisations make an effort to define measurable KPIs (key performance indicators) regarding the skills competencies of the human resources. If these skills or competencies are crucial to achieving the strategic goals of the organisation, its evaluation system must be objective and relevant. It has always been a proven method to measure technical and IT knowledge via theoretical tests and exercises. Even without previous training, the competence level of an experienced employee can be measured and evaluated. Education systems are widely using this to fine-tune and customise the training they offer. Other elements are mostly soft skills, for which impressive task-based assessments and integrated role-playing training workshops have been developed in recent decades. Based on the literature review, it is commonly stated that more traditional education systems and universities ought to operate with this approach, as it may increase the effectiveness of the evaluation and the involvement of the trainee/student in the development process.

6. Conclusion

As a result of this study, the authors have realised that the I4.0 concept significantly changes the competencies expected from the workforce, and demands adequate answers from the universities, who represent knowledge generators and the source of much of the professional workforce. The impact of the I4.0. concept challenges the higher education system. Their transformation is essential not only due to their social and environmental responsibility, but also because it is part of their mission to educate the future workforce appropriately to meet the world's demand, as well as to minimise the gap between what is learned and useful knowledge. Overall, the authors have found that lifelong learning plays a key role, especially in the transformation of the university structure. For employees, the issue is not simply having or acquiring future-proof competencies. They also need to receive training on a continuous basis in order to have up-to-date knowhow and to be able to respond rapidly to the changes in occupations where rapid digitalisation and automation have appeared, as well as to demonstrate flexibility, an attribute that is becoming more and more essential on the labour market. Lifelong learning is essential for universities and other education providers. Learning is a double-edged sword. Taken broadly, it means making students ready for the needs of the industry and society; on the other hand, it also means learning how to cope with the teaching in the present system. Lifelong learning goes hand-in-hand with the transformation of the economic structures' needs which allows the creation of quality jobs that require more knowledge and creativity, with the potential to be implemented at different levels. In accordance with Csath (2020), much more attention should be paid to human and social factors; for example, investments should be better divided between physical, mechanical, and other technical areas and investments in people, knowledge and social development (Csath, 2020). Researchers examining the role of small and medium-sized universities in the Central and Eastern European region have concluded that the role of universities far from cities is crucial to the regional innovation system; however, the economic impact of these universities is still smaller than in more developed countries (Birkner & Mahr, 2016). In fact, the real contribution of universities is essential for the future and makes it possible to create increasingly complex networks of relationships, building new local and regional innovation ecosystems. Training systems require more space and time to be re-designed, and both dual and postgraduate training should be given more space to implement practice-oriented training imparting stable basic knowledge. Companies should also be involved actively in the education, who should on the one hand have their own training department with up-to-date knowledge, and on the other hand seek opportunities to supply to new types of professional training in a much more flexible and accessible way. Despite the fact that the authors have individual research interests, the existence of certain points of connection clearly indicates that further cooperative research opportunities are possible. It has been agreed to continue the research and analyse the interconnection of the I4.0 technology megatrends and their influence on the digital competences demanded by the labour market.

As can clearly be seen, innovation is a vital part of business, part of education and part of private life. As humans, we cannot ignore it, but we should grow hand-in-hand with it. Our long-term goal as researchers is to identify the importance of the "Industry 4.0" in our contemporary world as well as to make possible the integration of the "Industry 4.0" concept into higher education and inform businesspeople. This paper represents an introductory stage, providing a broad overview of "Industry 4.0" and its connection with the needs of, and changes happening in, education.

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