DIGITAL TRANSFORMATIONS AND THE CHALLENGES OF HIGHER EDUCATION INSTITUTIONS

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Abstract This work aims to identify the challenges of Higher Education Institutions against the increasing digitalization. The first part of the work reviews Industry 4.0, analyses recent scientific works to demonstrate how the technological changes and especially the development of Information and Communication Technologies causes the future of jobs. Fourth Industrial Revolution creates the general foundation for the activities of nowadays; the platform economy is gaining strength; digital transformation with the advent of big data, digital literacy, and data literacy is becoming increasingly essential. To prepare students for their future work is the direct responsibility of Higher Education Institutions. The second part of this work is devoted to the challenges of the education system, focusing on the Higher Education Institutions. Desk research is conducted to analyze what changes will bring the ongoing process and how these institutions should respond to the challenges of digitalization. The contribution of this paper is to develop the conceptual design of responding measures to the digitalization taken by Higher Education Institutions.

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1   Introduction

In the era of technological changes, the accumulation of knowledge and the development of skills that will be adapted and in-demand to the conditions of such changes have acquired special importance. Technological advances have made significant progress in information and communication technologies (ICTs).

Digital technologies that have computer hardware, software, and networks at their core are not new, but in a break with the third industrial revolution, they are becoming more sophisticated and integrated and are, as a result, transforming societies and the global economy (Schwab, 2016).

The creation of a global information space, access to resources and financial resources needed to make use of this space has become a prerequisite for a long-term competitive advantage at both macro and micro levels.

Based on the analysis of the demand for new skills over the last two decades, it is clear that the most in-demand focus is on digital skills. The analysis of various aspects of a new reality driven by the formation of platform economics has revealed the particular challenges facing the education system. Digital transformation and with the advent of big data, digital literacy and data literacy are becoming increasingly essential; it is evident that global networks are becoming the platforms for new jobs and the acquisition and development of new skills should be accelerated (Papachashvili, 2020).

The pandemic has generated additional disruptive changes in the labor markets. Fig 1 clearly shows the rapid growth in digital skills or digital jobs. ILO revealed an increasing trend in the interest in digital jobs and digital skills in the last decade, and a gap between digital jobs and digital skills as labor and educational markets evolve at different speeds. The latter is usually slower (ILO, 2020).
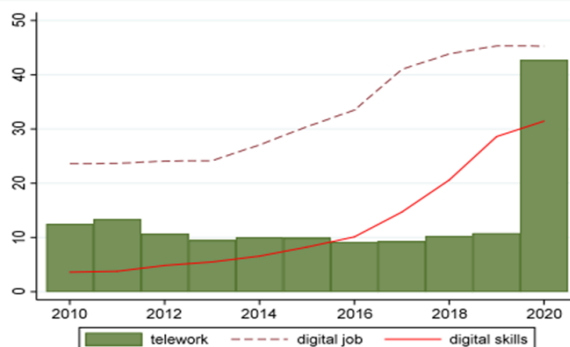
Figure 1: Google trends search for "digital jobs", "digital skills" and "telework"
Source: ILO, 2020.

Researchers rightly point out that the study of the impact of digital transformations on the institutions of higher education needs to be further deepened in conceptual and methodological terms (Benavides et al., 2020). Although a number of articles have been published before the pandemic and in the pandemic almost all countries were forced to switch to distance learning, which is one of the challenges, and later to hybrid learning in some countries, this only indicates the need to accelerate digitalization and does not change the overall picture. It should be mentioned that these issues were already highly accented at the beginning of the 21st century.

The aim of this given work is to identify the challenges of Higher Education Institutions (HEIs) against the increasing digitalization.

This study sets out to answer the following research question: What do the above-mentioned changes imply for Higher Education and how the main agencies (such as HEIs) should respond to the challenges of digitalization?

The given work is based on desk research methods. The examination-analysis of the focused issues have been implemented on the basis of the review of scientific articles.

Relevant conclusions are drawn and recommendations are developed. Findings will be useful to develop the conceptual design of responding measures to the digitalization taken by higher education institutions.

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2   Industry 4.0 and future of jobs

Many definitions are common in referring to "Industry 4.0" (I4.0) and most of them indicate the process fundamentally related to the digital revolution. "The fourth industrial revolution creates a world in which virtual and physical systems of manufacturing globally cooperate with each other in a flexible way" (Schwab, 2016).

Digital transformation is defined as the changes associated with digital technology applications and integration of that to all aspects of human life. This transformation is in fact to move from a physically empowered life to a digital one (Oztemel, 2020). Each stage of industrial development brought relevant challenges for the workforce and, naturally, for education. In the historical context, industrial development included the following stages:

✓ The first industrial revolution spanned from about 1760 to around 1840. Triggered by the construction of railroads and the invention of the steam engine, it ushered in mechanical production.
✓ The second industrial revolution, which started in the late 19th century and into the early 20th century, made mass production possible, fostered by the advent of electricity and the assembly line.
✓ The third industrial revolution began in the 1960s. It is usually called the computer or digital revolution because it was catalyzed by the development of semiconductors, mainframe computing (the 1960s), personal computing (the 1970s and 80s), and the internet (the 1990s). (Schwab, 2016)

Each subsequent stage included and developed the previous stage (albeit at different sizes and speeds in different countries), and the last stage was characterized by the speed of industrial breakthroughs and the rapid changes in workforce demands in favor of the demand for highly qualified and sophisticated skills.

Researchers distinguish differences among Education 1.0, 2.0, 3.0, and 4.0 in terms of educational technology. For example, some identified peculiarities are as follows (Sharma, 2019):

✓ Education 1.0: Centuries of memorization practice;
✓ Education 2.0: Learning through Internet;

✓ Education 3.0: Consumption of knowledge and labor;
✓ Education 4.0: Enables education to create change.

It is noteworthy that in the modern world, the transition to the second, third and fourth stages take place simultaneously. The uniqueness of the last step is that the demand for jobs is focused on the so-called "Just-in-Time" delivery system of Jobs.

Digital transformation requires new sets of skills and may not be successful in utilizing only its existing competencies. It imposes a new way of doing things and leaves operational burdens mainly on machines. People are expected to utilize their intellectual capacities rather than physical powers. On this, a very important aspect in the supply and demand of the labor force addresses Oztemel (2020). Researcher arguing about emerging new technologies such as digital manufacturing, artificial intelligence, robotics and autonomy of those, integrated communication network (RFID and IoT), cyber-physical systems, smart factories (flexibility, speed, productivity), big data and analytics, business intelligence, and notes that training program should be employed on the "basis of the need"; In the digital world, training to fill skill gaps should be offered online and on a just-in-time basis due to the speed of change.

Some peculiarities of "Just-in-Time" education are discussed by Levine (2018). The researcher anticipates that regardless of the decisions an institution makes, there is likely to be fierce competition for "just in time" students from a burgeoning number of organizations engaged in postsecondary education. It is likely to come down to whether a student would rather learn the latest computer language and earn a credential from Microsoft or the local regional university. This assumes both providers make the instruction equally convenient, the service equally good, and the cost comparable. What will be necessary is a re-envisioning of college access to include convenient, affordable, and up-to-date education and credentialing tied to market needs across the lifespan. In the years ahead, colleges will be faced with a new population wanting to be retrained for life rather than seeking degrees. They will be demanding not "just in case" education but "just in time."

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In response to this challenge emerged digital labor platforms. They include both web-based platforms, where work is outsourced through an open call to a geographically dispersed crowd ("crowd work"), and location-based applications (apps) which allocate work to individuals in a specific geographical area. (ILO, 2018) Digital transformations, on the one hand, contribute to the global demand-supply of labor, but due to the deepening of the digital divide, local (national and regional within the country) incompatibility still remains a challenge in the demand-supply of labor. The imbalance between demanded and delivered professions and qualification requirements on the labor market is identified by researchers in many countries in the world, including Georgia (Tavartkiladze, 2020; Papachashvili, 2019).

With regards to reinforcing the digital divide in education during the COVID-19 crisis is noted in the report of ILO (2020) which states that wealthy schools and learning institutions are able to continue with education and the less wealthy cannot.

As for skills mismatches, it may emerge not just between the supply and demand of existing skills today, but also between today's skills base and future skills requirements. Efforts aimed at closing the skills gap will increasingly need to be grounded in a solid understanding of a country's or industry's skills base today and of changing future skills requirements due to disruptive change.

Across industries, geographies, and job families, and ability to understand the current skills base in near-real time and to accurately forecast, anticipate and prepare for future job contents and skills requirements will be increasingly critical for businesses, labor market policymakers, workers' organizations, and individuals to succeed. Drivers of change to job markets such as Big Data analytics may themselves become useful tools in managing this process (Future of Jobs, 2016).

The close collaboration of business and education is seen by many researchers as a way to overcome this incompatibility. Since new knowledge is always improving technological progress and the convergence of these fields accelerates the process of circulation of new knowledge. Reseachers Vesperi & Gagnidze (2018) reviewed this issue from the perspective of the Entrepreneurial University. Another aspect to receive a set of new knowledge for successfully respond the technological transformations is the integration into the Global Value Chains (Gogorishvili et al., 2018; Mikaberidze&Papachashvili, 2020). On the example of the UK national

policies, Munro (2018) concludes that digital technologies are often framed as tools for advancing marketization, serving utilitarian purposes, and enabling change and reform of higher education.

According to the International Labor Organization (ILO, 2020) in the context of a changing world of work and education, many are challenges and opportunities. Also, ILO indicates, that challenges are emerging on both the supply and the demand side of work and education. The arrival of the COVID-19 Pandemic further exacerbated many of these trends/disruptions and unleashed a series of mega shocks to society as a whole, and to work and education in particular. The COVID-19 crisis has given an additional push to the ongoing trend of the digital transformation of the labor market. The ILO estimates that job losses could be equivalent to 495 million jobs in the last quarter of 2020.

In many industries and countries, the most in-demand occupations or specialties did not exist 10 or even five years ago, and the pace of change is set to accelerate. By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist. In such a rapidly evolving employment landscape, the ability to anticipate and prepare for future skills requirements, job content, and the aggregate effect on employment is increasingly critical for businesses, governments, and individuals in order to fully seize the opportunities presented by these trends—and to mitigate undesirable outcomes. (Future of Jobs, 2016).

3   Challenges of higher education institutions

Many researchers describe the issues generated by the technological advancement that the Industrial Revolution 4.0 brings with it, and force HEIs to deal with a digital transformation in all dimensions, and indicate complex relationships between actors in a technologically supported education domain.

Rethinking the management system in the context of ongoing process is the focus of researchers Roblek et al. (2016). They suggest considering the importance and influence of the Internet-connected technologies for the creation of value-added for organizations and society under the "Knowledge Management 4.0".

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Benavides et al. (2020) analyzed scientific papers of the period 1980–2019 and reviled emerging fields, none of the found digital transformation (DT) in HEI proposals have been developed in a holistic dimension. This situation calls for further research efforts on how HEIs can understand DT and face the current requirements that the fourth industrial revolution forced.

Gagnidze (2020) explains the role of the education system in responding to the challenges of the Fourth Industrial Revolution, discusses opinions about the ways for improving school and university education; suggests opinions for cooperation between different stakeholders to implement effective education policies.

Xiao (2019) examined the role of digitalization as it framed in the strategic development plans of 75 top universities in China. Findings show that digitalization as perceived by these universities features instrumentality (e-campus construction and application) and modernization (sustaining and efficiency innovations in teaching and learning), a situation also seen in other countries.

After examining the innovation culture at IBM Research Vey et al. (2017) suggest interesting questions to think and observe: what is the role of managers in the era of digital transformation?

In view of the rapid rate of change, will the "learn how to learn" eventually become more important than the content itself?

To cope with uncertainty in I4.0, among others, some authors suggest creating an infrastructure for promoting entrepreneurship and I4.0 competing fields embedded in education policies (i.e. programming, data analysis, etc.) (Magruk, 2016).

Fundamental shifting the role of academic library and the academic librarian discussed in the changing context of higher education. For example, based on the literature review, it has been identified innovations in academic libraries in digital learning/e-learning, partnership and co-creation, student experience, and the design of spaces for learning that are relevant to current pedagogies (Llewellyn, 2019).

Another study identifies new development strategies of the libraries; complex e-book purchase models offered to libraries; questions of copyright, licensing, and digital rights management; format considerations; and availability of hardware and software on which to read e-books in the digital age (Kahn & Underwood, 2013).

As development and operation of the massive open online courses (MOOCs) which involve multiple stakeholders can be considered as an alternative to the delivery of traditional educational services. But there are different supply-side as well as demand-side impediments. For instance, although colleges and universities in China have established certain mechanisms to develop and operate MOOCs, they faced challenges and issues such as insufficient technical support, inadequate curriculum/instructional design training, and a lack of national curriculum/instructional design and development standards as well as platform standards (Liu & He, 2019).

Online learning is an evolving subject and it requires innovative research methods and approaches to be fully explored and harnessed.

Lekashvili (2019) analysis the key problems of managing the innovation process in the field of teaching economic science and identifies factors affecting the modernization of the education process at the university as follows: human resources potential (highly qualified personnel); corporate culture; applicants, students; self-monitoring of the quality of education; modernization of infrastructure capacity; International activities; scientific commercialized innovative projects and products; financial and economic potential; lack of information resources; optimization of pricing policy; extracurricular activities, and marketing of educational services.

4 Findings for Higher Education Institutions Responding to Industry 4.0

Higher education institutions currently operate in the context of digitalization. They will have to overcome many obstacles and resistances to keep up with demand, as the tightening and acceleration of demand-supply in the labor market create alternatives to knowledge delivery in the traditional form.

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In order to maintain competitiveness, higher education institutions will have to implement a new reality response management. For the conceptualization of transition management, it is crucial to identify key pillars to influence and promote.

For example, it is important the learning and development professionals in times of digital transformation to act as change agents and peer-to-peer consultants to shape a culture of organizational change (Vey et al., 2017).

In the change management process, it is necessary to be taken into account misconceptions among employees which may lead to active or passive resistance against changes in the educational organization. Accordingly, having a clear vision of the target state is essential for the adoption and integration of technology. To communicate the vision of all employees, the so-called guiding coalition should exemplify the behavior to reach the target state of the organization (Ifenthaler & Egloffstein, 2020).

The ICTs have the potential to offer lifelong learning opportunities to a wide constituency of learners. However, unless the issue of access is addressed, the ICTs will increase divisions within societies. States and education authorities at the national and local levels are acknowledging the need to adopt policies and strategies to ensure affordable access to infrastructure and equipment, as well as the development of information technology literacy skills. It is only by adopting such strategies that the full potential of the ICTs for transforming the learning process can be realized (Keogh, 2001).

If the educational world does not first assume a proactive mindset that recognizes both the reality and the implications of dynamic, large-scale, and unpredictable technological change, it may surrender any opportunity to successfully shape that change. Educators cannot afford to disregard this dynamic change process but instead must come to understand and maximize its potential for education (Amirault, 2015).

To manage the transition process of the universities there will be helpful determination the level of readiness of the organization for digital transformation, which can be helped by the Acatech Industrie 4.0 Maturity Index. It assesses them from a technological, organizational, and cultural perspective (Industrie 4.0 Maturity Index, 2017).

The index is designed for manufacturing companies, but we consider it entirely can be adapted for higher education institutions. For example, it is possible to assess the level of readiness of human resources and the digital library in the resource pillar. Also, other infrastructural elements can be added. The management of transformation based on six principles, as follows: computerization; connectivity; visibility; transparency; predictive capacity, and adaptability (Fig. 2).
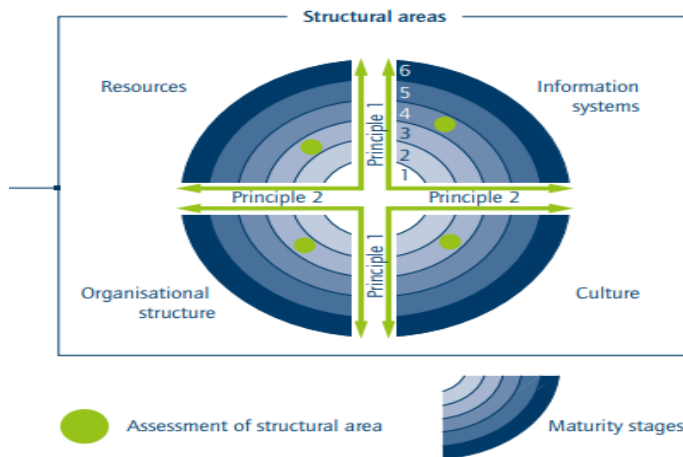
Figure 2: Structural Areas of I4.0 Maturity Index
Source: Industrie 4.0 Maturity Index, 2017.

The Acatech Industrie 4.0 Maturity Index can be used to develop a digital roadmap precisely tailored to the needs of each individual company in order to help them make the most of Industrie 4.0 and transform themselves into learning, agile organizations.

5   Conclusions and Recommendations

Almost every country in the world faces the challenges of digital transformations (I 4.0) which was exacerbated during the COVID-19. The changes brought by technological transformations have primarily challenged knowledge-transfer organizations.

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A successful response to this challenge gives an important advantage to the organization, as digitalization becoming more and more dominant in the complex environment.

With the increasing digitalization, alternative knowledge transfer channels are growing and higher education institutions will face many acute problems.

It is evident that global networks are becoming the platforms for the acquisition of the demanded knowledge and the development of new skills. It will be harder to maintain the traditional ways of studying and learning.

Because of the ambiguous future, more reasoning is needed to find the right development path taking into account the local peculiarities.

Various studies have revealed a long-term trend of slow delivery of relevant educational services. This is not surprising, as the accumulation, transformation, and creation of new knowledge, which is primarily served by higher education institutions, takes a long time. The globalization of markets is leading to a rapid increase in demand for certain skilled labor.

In order to maintain competitiveness, it is necessary to form a proper vision of what skills should be equipped the workforce.

Effective management of the digital transformation process in the HEIs refers to the readiness of human resources, library resources, infrastructure, etc.

The 4.0 maturity index will be useful for assessing the level of digitization in the organization (HEIs) and outlining the measures to be taken.

Current development issues of HEIs should be considered in the context of digitalization. Some impediments may be overcome more or less quickly and some of them require a long-term effort. These multidimensional issues will be highly disputable in the future decades.

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