University 5.0 is a Fact or Dream?

Ali Eskinat and Suat Teker

Abstract— Over the Covid-19 crises, most universities keep increasing the use of hybrid model at various levels in all disciplines in their education system forced by the market demand. This paper reviews the evolution of university generations from university 1.0 to university 4.0 using a historical point of view. This paper advocates that a large number of completely digital universities may breakout and reach everywhere in the world with no barriers of language, time and locations, and competing with local and traditional universities in all sense after year 2030. The analysis foresees that the dynamics of digital transformation era will force the emergence of digital universities what is called University 5.0 and it may become an inevitable fact of higher education after 2030.

Keywords— Digital Universities, Hybrid Education, University 5.0, Virtual Education**.**

I. Introduction

Higher education institutions have been recently forced to deliver education services in new ways and operate in a global marketplace. Therefore, universities must rethink and redesign how they provide access to their courses anywhere and at any time.

Indeed, higher education institutions have not only to fulfill the increasing digitalized expectations of the Generation Z students but also be ready for the forthcoming storm of the Generation Alpha.

Since the Medieval age, higher education concept and the evaluation of its main actors' universities are highly discussed. The first-generation University 1.0 initiated as information transfer centers in the 11th Century. Later, the second-generation University 2.0 appeared as information transfer and research centers in the 19th Century. 1970s brought the third-generation University 3.0 as information transfer, research and application (university-industry) centers. Then, the fourth-generation University 4.0 flourished as a digitalized university depending on the technological and social innovations under the storm of digital transformation age of the 2000s. The aim of this study is to provide a sight forward to the upcoming fifth-generation University 5.0 with its foreseen rise by the 2030s named as digital university targeting all world as a single market and providing all-education services in a translocal and transtemporal form globally.

With some pioneer universities such as State University of New York (SUNY), University of Phoenix and University of London, a number of higher education institutions entered into global online higher education sector. Moreover, companies such as Coursera, Udacity and EdX have been offering degrees in all levels as well as certificate programs.

Recently, many prestigious innovations also appeared in the global news. For instance, Stanford University in the US opened its digital classroom to facilitate the current distance education system [13]. Facebook, rebranded as Meta, has announced that it will open 10 digital university campuses across the United States [11] as the model of a digital university. Therefore, University 5.0 is to be implemented I the near future with the support of leading digital companies [12]. Furthermore, China Communication University has opened its digital campus by partnering with search engine Baidu's metaverse platform XiRang [27]. University of Miami also announced its entry into the field of metaverse [33].

Specifically, all these developments happened in a very short period of time expressing the new rules of the game. However, this is not just a technological issue. This new era requires composite approach of political, economic, socio-cultural and legal infrastructure as well. On the other side, educational technologies, financial aspects, management and organization, marketing, strategic planning and other related internal components are also vital within the perspective of universities towards this new digital era.

Today, it may be strongly argued that universities are forced to provide hybrid education over the following years. This is also in line with the perception and demand of generation Z. This transitional period may be identified as the period for University 4.0. Then, the successors such as generation Alpha and Beta and their irresistible digital transformation may reshape the higher education, that is a university fully digital.

There is no doubt that Covid-19 Pandemic period became a facilitator for all the universities to provide online or preferably digital education worldwide. However, digital transformation era can only change education methodology as the factors of academic content and staff will continue to be the "sine qua non" rulers of the higher education as happened during the periods of university 1.0, University 2.0, University 3.0, University 4.0 and of course in the coming University 5.0 and so on throughout of the history of humanity. In the 2020s, universities must investigate more about the expectations of their students and their values.

Institutions of higher education are actively developing new strategies to rethink how they fulfill their mission. Economic and political pressures have heightened scrutiny of the merit of

a postsecondary education, especially considering cost, access, and workforce readiness [2]. Indeed, imagining the future of higher education must significantly consider the unbearable innovations of the digital age.

This paper is organized as follows. The next section provides a short review of evolution of universities. The following section covers the analysis of digital advancements and higher education. The final section includes the concluding remarks.

II. Evolution Of Universities

Higher education concept and the evolution of its main actors' universities are generally discussed arguably covering a period starting from the ancient times. The notion of higher education, its background, its first appearance, its growth over time and its high influence over the humanity with the acquired prestigious status are all the parts of an historical evolution process.

First generation of Classical Period (University1.0) was the era, whereby universities were arisen as the center of information. Historically, the University of Bologna, founded in 1088, is considered as the mother of European universities with its corporate body. In fact, University of Paris, founded in 1208 is also considered as the first university to be consisted of students and professors from different disciplines. At this point, the origin of the medieval universities is considered as the schools of Roman Catholic Church. Their aim mainly designed on training of professionals, scientific studies, improvement of society, and teaching critical thinking and doing research.

From the historical point of view, the first university in the United States was founded 548 years after its European counterparts. Harvard University, founded in 1636, was the first university in the United States. After this, the Collegiate School of Connecticut was founded in 1701 and became Yale University. Then, in 1740, the University of Pennsylvania was founded via impressive efforts of Benjamin Franklin [9].

As a result, the improvement of higher education in Europe was directed by a bilateral relation with the knowledge and ancient past practices. The scholastic system with its curriculum of the trivium (grammar, logic and rhetoric) and quadrivium (arithmetic, geometry, music and astronomy) drew heavily on the ancient Greek and Arab learning which came to dominate the universities of medieval Europe [8].

As the second generation (University 2.0), European universities focused on research and science during period of the 19th and 20th Centuries, thus their philosophies and structures designed the concept of contemporary university.

The start of modern university is generally accepted as the establishment of University of Berlin in 1810 with the help of Wilhelm von Humboldt, however major parts of a research university were already at the stage before 1789 in Prussia and Hanover [3].

Academic education concept appeared in the beginning of the 19th Century with a core idea of holistic unification of research and studies. Thereafter, this model also unified fields of arts and sciences together with research to acquire not only universal general learning, but also cultural knowledge. In fact, a number of components of the Humboldtian model greatly affected and eventually formed a part of the notion of the research university, beside effected the American model. American universities, beginning with the University of Virginia and followed by Johns Hopkins University, were among the first to adopt a number of the German educational and scientific doctrines that were worldwide regarded as effective in the 20th century [5].

Higher education system was highly affected by the concept of Humboldtian University along central, northern, and eastern Europe competing with the grandes écoles of post-Revolutionary France. Universities based on the Humboldtian model have enabled students to tackle intractable issues, resulting in great scientific breakthroughs with significant economic benefits [10].

Meanwhile research university idea appeared in the US as well, it is considered as a public asset to achieve economic growth and national targets. Specifically, research universities are institutions that stress the superiority of research concerning their missions with statements such as research-based or research-intensive. At the beginning of the 21st century, research universities in the knowledge-based economy appeared as the key institution of the global information society [18].

As the third generation (University 3.0), with university-trained scientists proving their worth in the First and Second World Wars, governments around the world came to recognize universities as the primary sites of research in science and technology as well as in the social sciences and humanities [26]. Meanwhile, universities were widely viewed as the main training sphere concerning future leaders by the countries all around the world. In fact, the post-war era has shown the development and rise of strong North American and European university sectors as well as impressive growth in China, Australasia, Russia, Latin America, and some parts of Africa.

During the 1970s, inventions in biotechnology and patent legislation favored market-oriented research like the Bayh-Dole Act in1980 in the US and provided the start of research partnerships between industry and higher education institutions with the aim of creating fast and significant innovations to market. Based on OECD recommendations, a similar trend has emerged in all industrialized nations. This innovation of the market university as an economic engine, first emerged in the US, diverges from Humboldt's principles [4].

Indeed, since the passage of the Bayh–Dole Act in 1980 in the United States, technology transfer activities at universities have taken center stage [17]. The literature has concentrated on patenting activities as a general trend and as a university specific response to the Act [23]-[14]-[21], and on the establishment and operations of university technology transfer offices [31]. At this point university research parks significantly contribute to the U.S. national innovation system, necessitating a special focus on these areas. Parks increase the transfer of information between universities and tenant

companies and boost regional economic development while also making markets more competitive [16].

The medieval or first generation universities are solely science-oriented institutions with the objective of generating critical professions. Whereas Humboldt or second generation universities continue to educate people for certain professions, they also train research scientists. On the other side, Third generation universities offer an atmosphere that is convenient to entrepreneurial university objectives.

As the fourth generation (University 4.0), universities are higher education institutions whereby human capital is typically enhanced through the processes of instruction, learning, research, and innovation. In the digital transformation age, creating the digital university mainly addressing a digitalized one is advantageous for the entire economy. Moreover, investment in the development of human capital is a sensible and sustainable tool to promote economic progress [20].

The purpose of the contemporary university has been redefined across the world in terms of success in global competition [24]. Indeed, modern universities have approached the task of transition to the University 4.0 model or to the digitalized university model [1]. In favor to this, Industry 4.0 affects the necessary knowledge and skills demanded of human capital. Universities must undergo a transformation to university 4.0 in order to comply with this action and continue to graduate qualified human resources [6].

Referring to the trends and possibilities for the growth of universities aiming to hold leading positions in national and world rankings, this issue is seen as related to digitalization, which has the most significant event in the field of higher education since the year 2020. In this regard, the recognition of the key factors by which universities are evaluated by top international and national rankings, evolutionary and relevant models of building a top-tier university, carriers for the progress of digital transformation in connection with higher education, as well as an analysis of existing vectors, and internships at top-tier universities in digitalization are considered as the most immediate issues [25].

Digital transformation is the sustainable reality in our time. After breakthroughs such as Virtual Reality (VR), Augmented Reality (AR), "Blockchain Technology, and Web 3.0, the phenomena of Metaverse emerged as a post-reality cosmos, a continuous and permanent multiuser ecosystem combining physical reality with digital virtuality. Metaverse offers the ability to address the basic limitations of web-based 2D e-learning technologies regarding online distance education [22].

Today, world giant technology or software companies such as Facebook and Microsoft see metaverse as the future of the internet and invest billions of dollars in this field. For example, it is widely known that Facebook, which concluded an acquisition concerning the Oculus company for 2 billion dollars in 2014 [32]-[11], and also employs thousands of engineers for its metaverse investments [28]. Although virtual and augmented reality technologies are currently mostly used

in the gaming and entertainment industries, it is predicted that an important digital transformation will be experienced especially in the field of education with metaverse [7]-[15].

After these four historical evolutions of universities, one can possibly question "What should be the underlying purpose of university education in the 21st century?" For this reason, one can argue that the future of higher education must significantly consider the unbearable innovations of the digital age.

University 5.0 paradigm is on the way to flourish depending on technological innovations and digital transformation. As digitalized traditional universities have lived an era of glory in the 2020s, the winds of change towards completely digital universities is not so far. In the new era the education process is expected to face no constraints, e.g. all course contents and 3 D lectures be translated in real time. More, group studies and more customized programs may significantly shift the engagement of students 'learning by doing.

III. DIGITAL STORM IN HIGHER EDUCATION

Today's world is a place consists of constant technological innovations. Software world has spread digital transformation age to all parts of our life. The new actors have appeared as artificial intelligence, virtual reality, augmented reality, mixed reality and so on. Change and development are irresistible as a perfect storm has already impacted higher education.

Reduced financial opportunities from traditional funding sources such as state governments, the revolutionary effects of artificial intelligence (AI) can transform higher education. To prepare students for the changes in the labor market driven by AI, machine learning, and automation, higher education must be redesigned and evolve rapidly and continuously. Moreover, ongoing organizational and curriculum modifications would be required for a university to maintain its relevance and survival [29].

Universities need to assist their students to be more open-minded to adapt themselves to the rapid and irresistible growth in technology. Today, everyone is witnessing historical evaluations caused by reformation in various industries as a result of the emergence of artificial intelligence and machine learning. Higher education cannot be concerned out of this atmosphere. Indeed, based on studies over the artificial intelligence, continuation of business as the past is unsustainable [30]-[35]. Certainly, research provides valuable insights and perspectives on higher education in the AI era.

Universities of the 21st century are not free from the current sociotechnical dilemma and disruption caused by the current digital revolution [19]. Education models have arisen to supply individual learners' new options for education surpassing conventional roads to degrees and other related credentials. Human resources can also easily be upgraded with the new opportunities provided for students to combine their formal education with modularized online tools to an affordable cost that significantly establish sustainability in learning. Due to this, universities developing partnerships with online course provider companies or creating different options for their

students to experience education contents by their own steps, will fulfill the controlling demands of learners during the studying pathways, while moving forward to a degree or certification [19].

Mixed reality (MR) is an evolving environment where digital and physical things interact at the junction of the digital and offline worlds. This hybrid area combines digital technologies into the real world and generates virtual replicas of real settings, blurring the distinction between the real and virtual worlds. The user is immersed in a simulation, such as flying or being on Mars, through virtual reality. Augmented reality superimposes data over physical locations and things, such as labels and additional information over museum exhibits. As television displays project 3D pictures into physical space, holograms are also being used to create mixed environments. Key to MR is its interactivity, which offers enormous learning and evaluation potential; learners can develop new understanding based on interactions with virtual objects that bring underlying data to life [19].

Mixed reality (MR) is an umbrella term that includes a variety of technologies. The person uses a headgear and interacts with a fully computer-generated scene in virtual reality (VR). Augmented reality (AR) employs a head-mounted display or a mobile device to superimpose images or other content onto the real world. MR delivers overlays derived from AR, but, similar to VR, these are interactive and can be controlled [19].

At this point, global MR market is predicted to reach $100-$200 billion by 2022, representing a rapid expansion. In this period, the global market for MR in education is expected to exceed $7 billion. However, a key restriction of MR in education is that the majority of present educational applications let just a small number of users [19].

MR typically begins on campuses as an initiative. Concerning some examples in the higher education side one can consider The PennImmersive initiative of the University of Pennsylvania Libraries and the Blended Reality: Applied Research Project at Yale University as significant examples of campus departments and academic researchers collaborating to investigate the uses of MR for research, teaching, and learning. Once an institution decides to put MR technology on campus, the greatest number of users will have access to it if it is given through the library or other student-accessible campus area. Frequently, the technology is provided at a makerspace or media lab. The North Carolina State University Libraries provide spaces for borrowing and using equipment. The Miami Beach Urban Studios at Florida International University and The Wilbur Powerhouse at Lehigh University are building-sized makerspaces that offer a variety of technologies, including MR, to the campus and surrounding communities [19]. Another interesting example is The XReality Center at The New School and the School of Fashion at Parsons School of Design collaborated in the spring of 2018 to develop a virtual reality-based immersive learning experience incorporating a 1920s evening coat [34].

The use of MR technology in experiential teaching is optimal. VR can enable viewers to visit normally inaccessible locations, such as art museums, archaeology sites, refugee camps, and Mount Everest, as well as completely inaccessible locations, such as the Titanic, the Mesozoic Era, and Mars, using simulations and 360° video. VR enables users to perform actions that are physically impossible, such as manipulating entire environments or navigating inside veins, or risky, such as training for firefighters. AR can enable users to interact with objects that are unseen in the physical environment, such as electromagnetic fields, through the use of overlays. By vastly expanding the spectrum of tasks and activities through which a learner can gain experience, MR technology enables experiential learning in situations where it may not have been conceivable in the past. Reflection and self-assessment are also essential components of experiential learning, although MR technology does not necessarily facilitate them. In general, MR is most effective for achieving learning objectives that benefit from repetition (such as building clinical skills) or simple exposure (such as fear extinction) [19].

On the other hand, artificial intelligence (AI) use computer systems to perform tasks and actions that have traditionally required human understanding. Computer science advancements are producing intelligent computers that more closely resemble human reasoning than ever before. AI employs the foundations of algorithmic machine learning to develop predictions that enable human-like task accomplishment and decision making. As the programming, data, and networks underlying AI advance, so does the application potential for areas like education.

AI is recommended for educational applications due to its capacity to tailor experiences, minimize workloads, and assist with the analysis of huge and complicated data sets. Concerns around fairness, inclusivity, and privacy decrease excitement for adoption. Despite these worries, the market value of AI in the American education sector is predicted to surpass $85 million by 2022, with a compound annual growth rate of about 48%, a trend that is replicated globally. Institutions of higher education are cooperating with business to develop AI-driven solutions for the objectives of reducing college expenses and helping students to tailor their learning experiences to better match their needs, as a result of this rapid adoption growth [19].

Another one is Blockchain technology. It operates as a decentralized digital ledger and is mostly used to underpin cryptocurrencies at present. The technique utilizes a distributed data structure in which ledger records are copied in multiple locations. Blockchain eliminates the function of a central authority over the ledger, so providing a highly secure model whose integrity is based on the mutual confidence of all participants. The potential for the blockchain to disrupt and replace centralized systems has attracted interest from a variety of industries, including education, despite the fact that widespread blockchain implementation in higher education is at least several years away. In the meanwhile, schools and universities are researching the potential applications of the technology in areas such as transcripts, smart contracts, and

identity management. Proponents say that blockchain has the ability to radically alter a wide range of businesses that rely on intermediaries, such as banks, providing a comprehensive ecosystem solution with decentralized verification and storage in its place. In higher education, rather than the widespread adoption of blockchain technology itself, the heritage of blockchain may be what the technology inspires.

As education has become increasingly lifelong, actually occurring not only in formal academic contexts but also in workplace training, lessons from professional associations, workshops, and various other formal and informal models, blockchain could enable students to maintain accurate data of their knowledge and skills [19].

IV. CONCLUSION

Over time, students will be attracted to those universities that are embracing the digital age on their terms and anticipating evolution. They may even prefer these universities because of time and place flexibilities in terms of their future need for complementary career improvements or new professions after their graduations.

It may be argued that the trend towards digital transformation in higher education in the last 20 years has gained a serious momentum especially during the Covid-19 period. In this sense, it should be expected that the traditional university system will be forced to evolve into a digital university system in a not-too-distant future. In other words, traditional prestigious universities are expected to continue whereas digital universities appear as destructive competitors. On the other side, digital technologies such as virtual reality, augmented reality, blockchain, web 3.0 and finally preliminary steps of metaverse have been running fast and higher education system needs to assimilate this storm in the near following years of the 21st Century. Indeed, digitalization is the reality of Industry 4.0 era and universities have been digitalized increasingly in the light of University 4.0 concept.

As a result of this study, it may be argued that universities will increase to provide hybrid model education depending on the market demand until 2030, whereby it will be applied at different rates in education disciplines, such as of medicine, engineering, social sciences and many others. After 2030 traditional universities will continue to use blended learning whereas digital higher education institutions will start their inevitable growth. Finally, this paper advocates completely digital universities named as University 5.0 and it may become an inevitable fact of higher education after 2030.

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