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THE ERA OF DIGITALIZATION IN EDUCATION WHERE DO UNIVERSITIES 4.0 GO?

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Abstract:
Digitalization has revolutionized one of the most significant industries in the modern world, which is education. It has proven to be a successful and renowned strategy throughout the entire spectrum of the education industry. It has dissolved the distinction between physical and virtual distance and integrated more scientific methods for instructors to teach pupils. In order to select the most relevant studies in the digitalization field, bibliometric analysis was used, with the principal source of scientific articles selected being the academic platform Scopus. The content of 3836 research articles has been taken into consideration since 2019 and 2023. The search documents related to the "digitalization" issue are in title, abstract, and keywords. In order to highlight the structure of the scientific field, we used a content analysis, inspecting the most common words and the relationships between words. Additionally, a network of co-occurrences was taken into account. The analysis was performed using the WOSviever program. In the next part of the research, the term "digitalization" was examined in more detail. The Scopus search engine uses filters, including the terms "digitalization," "higher," and "education," but is limited to key words. The content of 104 research articles has been taken into consideration since 2019 and 2023. The research results showed that the fields of technology, education, and management provide the theoretical basis for research on the digitalization of higher education. The findings also demonstrate the topic's interdisciplinary character (as seen by publications published in several fields) and its strong relationship to concepts like online learning, digital transformation, and sustainable development. Based on the literature analysis, it can be concluded that University 4.0 will go to the smart fully digital University (University 5.0), will take care of aspects of sustainable development, and will develop teachers' soft skills, especially emotional intelligence.

Key words: *COVID-19, digitalization, society 5.0, University 4.0, Web 5.0, WOSviewer*

"Students just expect digitalization…
digitalization is not the future, it's the present."
Nigel Smith, Head of Content from Future Learn

"Technology can become the "wings"
that will allow the educational world to fly
farther and faster than ever before – if we allow it."
Jenny Arledge

INTRODUCTION

The current world is seeing an increasing influence of digital technology in professional and educational processes. The rapid advancement of information and communication technology has altered the nature of many facets of public life, much as the industrial revolution did in the 19th century [1]. The training of a contemporary expert includes the digitalization of education as a fundamental component. The significance and amount of information have been increasing steadily, and there are more multidisciplinary studies and initiatives as a result of these developments. Empirical research indicates that students nowadays are cognizant of the need to enhance their proficiency in artificial intelligence, big data processing and analysis, and information and communication technologies [2]. According to Chekanov and Neizvestny [3], the shift to a digital society places significant demands on the development of new specialized competences as well as the process of acquiring these competencies. According to Buryak [4], a specialist's "market value" in the job market is increased by education grounded on cutting-edge, future breakthrough technologies. In this context, the need of introducing and analyzing novel ideas in the educational system as well as the modification of current forms, techniques, and training technology is becoming more pertinent [5].

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Digitalization of education has long been a process in the making. Nonetheless, there was a notable spike in interest during the COVID-19-related temporary communication constraints and the general shift to an entirely remote structure of interaction amongst all participants in the educational process [6, 7, 8]. All educational levels and the actions of students, instructors, administrators, and other stakeholders have been directly impacted by digitalization [9, 10]. Not only is digitalization a current trend [11, 12], but it also presents a promising path for advancement in a number of areas, including education [13]. While it may develop in a variety of ways, technological advancement will undoubtedly have an impact on this pathway. Not only must higher education institutions meet the increasingly technological demands of Generation Z students, but they also need to prepare for the impending Generation Alpha storm. Because of these factors, and in particular because of the COVID-19 crisis, most institutions continue to adopt hybrid models at different levels throughout all subject areas in their curricula [14, 15].

In order to select the most relevant studies in the digitalization field, bibliometric analysis was used, with the principal source of scientific articles selected being the academic platform Scopus. The content of 3836 research articles has been taken into consideration from 2019 and 2023 years. The search documents related to “digitalization” issue in title, abstract and keywords. In order to highlight the structure of the scientific field, we used a content analysis, inspecting the most common words and the relationships between words. Additionally, a network of co-occurrences was taken into account. The analysis was performed using the WOSviever program. To respond to the following main research question by exploring the valuable information the world's clouds provided:

1. What does network visualization look like between co-authorships and countries?
2. Which are the most common words found in the full scientific articles on digitalization in higher education?
3. What are main key words used by authors?
4. What are co-citations and cited sources?

In the next part of the research, the term digitalization was examined in more detail. The Scopus search engine uses filters, including the terms “digitalization” and “higher” and “education”, but is limited to key words. The content of 104 research articles has been taken into consideration since 2019 and 2023. To respond to the following main research question by exploring the valuable information the world's clouds provided: What are co-occurrence all key words in network visualisation? Based on the literature analysis, the author answers the question in the manuscript: Where do Universities 4.0 go?

There are many studies on digitalization [16, 17, 18], but they usually concern the challenges or opportunities that existed before this term [19] or from the students of teachers’ perspective [13, 20, 21, 22, 23]. The manuscript fills the gap because it analyzes the issue from the perspective of University 4.0 and its future. Therefore, the study is novel.

LITERATURE REVIEW

Digitalization of education is a key area of reform for this industry [24]. It is said that "changes associated with the application of digital technology in all aspects of human society" are referred to as "digitalization" or "digital transformation." "The ability to transform existing products or services into digital variants, thus offering advantages over the tangible product" [25, 26] is another definition of digitalization that is widely acknowledged. Specifically, organizational change and transformational leadership are impacted by the digitization process [27, 28, 29]. Due to the fact that the majority of higher educations (HEIs') clientele are younger generations who complement modern technology and are inherently linked, it is imperative that these institutions adjust to the widespread digitization that is occurring. The demands of these generations are reflected in the necessity for the educational system to change as a result of the pervasive integration of digital technology into people's lives from an early age. Though now a service or benefit provided by HEIs, digitalization is anticipated to become a requirement for these institutions' survival in the future [26, 30]. Achieving the educational goals of the Europe 2020 Strategy is seen to depend more than ever on the effective use of digital technology and learning materials in training and education. Enhancing and adding more value to the teaching and learning processes is the function of digital technology and resources. With the aim of enhancing teaching and learning methods, educators and learners have the ability to use a growing array of digital tools and materials, as well as collaborate via platforms. Nevertheless, political obstacles still exist in spite of the clear advantages of integrating digital resources and technology into formal schooling. For the purpose of incorporating digital resources and technology into education, many national policy initiatives have been put into place in the member states of the European Union. The World Economic Forum, the European Commission, have all performed surveys and research that highlight the fact that digital resources and technology are still not fully integrated into European educational institutions [31].

NEW ISSUE IN DIGITAL EDUCATION: UNIVERSITY 5.0, WEB 5.0, SOCIETY 5.0

Universities that are embracing the digital world on their terms and expecting growth will eventually draw students. The Industry 4.0 age has brought about digitalization, and universities have been digitizing more and more in accordance with the University 4.0 idea. The Fig. 1 presents the evolution University from University 1.0 to university 4.0.

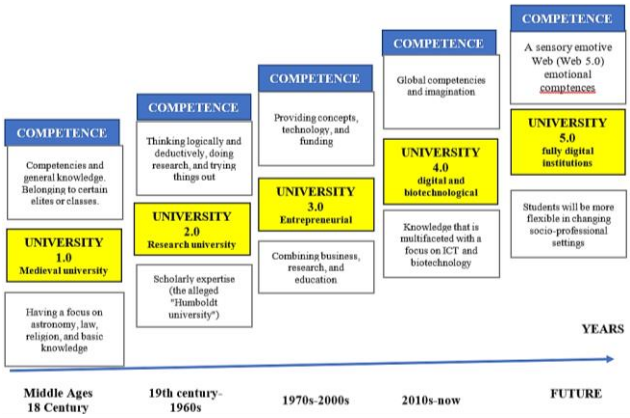

Fig. 1 The evolution University from University 1.0 to University 4.0

By the standards of the late Middle Ages, *The University 1.0* has made education a somewhat widespread activity. The activities that make up the University 1.0's "material body" match it. These are lecture rooms used for discussions and lectures, as well as a library for the preservation of books and discourses.

The University 2.0 postulates, implements, and replicates intellectual activity freed from scholasticism and religion. This includes empirical research and the creation of scientific models, as well as the later (in the 19th and 20th centuries) design of technologies and the apparatus, buildings, etc. needed to put them into practice. The university started to take part in the implementation of the industrial revolutions. University 2.0 include labs necessary to gather empirical information, to do research, and to conduct experiments, in addition to classrooms and libraries. The business and humanities departments' instructional and scientific divisions take center stage in *University 3.0.* Since it also necessitates the design of the activity and its constituent parts, policy and change management, just and management, and innovation management, social design and engineering, digital technical design, design and construction of signs and symbolic systems, and future research and foresight are all becoming increasingly vital subjects.

By implementing project work and "the creation of new practices," University 3.0 overcomes "the study of the world as it is." It challenges the "industrial" universities' robotic learning environment and their lifeless educational process, which consists of quickly aging conventional course packages. The "material body" of the University 3.0 comprises, in addition to classrooms, libraries, and labs, technology parks, business incubators, design offices, project offices, and unique platforms for interaction with the outside world, such as community centers and exhibition spaces.

The "reproduction of the given" – the predetermined framework, the predetermined modes of thought and action – is defeated by *University 4.0.* It turns into a highly open atmosphere that serves as a hub for many forms of communication and a node at the nexus of information, social, and activity-related networks. Along with instructors and students, a variety of other parties are involved in these communications, research initiatives, and development activities. It is possible to describe the University of the Fourth Generation as an infrastructure platform that supports the implementation of several search activities (research, projects, creation of new practices). The university presents itself as a platform for many themes (both individual and institutional) and facilitates communication and navigation for these kinds of activities. By comparison with industrial parks, it turns into a "hub" and "intelligent park." Instead of standard procedures, there are distinct career paths for workers who aren't necessary scientists, professors, or other professionals but who can create and carry out special competency packages. The complex reality of University 4.0 consists of the following: 1) creation of the conceptual foundations (categories, concepts, basic models); 2) generation of basic knowledge; 3) development of technologies as a "implementation of knowledge into reality"; 4) establishment of start-ups; 5) deployment of communication networks; 6) elucidation of new practices. Apart from classrooms, libraries, labs, business incubators, technological parks, and community centers, the University 4.0's "material body" also consists of communication and telecommunication infrastructure [11, 32].

The Internet is becoming into a place where the younger generation of "digital natives" may find amusement, new skills to learn, skill improvement, and job development in addition to being a source of information [33, 34]. Education's digitalization phenomena is linked to the traits of the current generation, which is quickly assimilating into the global educational arena [35]. The goal of creating the World Wide Web was to provide interconnected hypertext language for data access at any time and from any location. The most intrusive aspect of the internet, the World Wide Web (often referred to as the "web"), is a techno-social system that facilitates communication between technical networks and people. It is not comparable to the internet. Fig. 2. shows the evolution from Web 1.0 to Web 5.0.

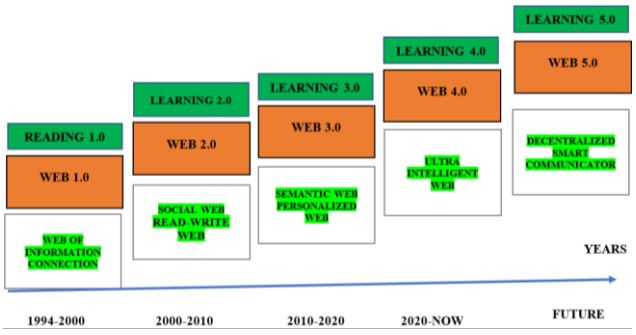

Fig. 2 The evolution from Web 1.0 to Web 5.0
Source: own study basis on: [36].

The web and associated technologies have advanced enormously. Web 2.0 is known as the web of verbalization, Web 3.0 as the web of affiliation, Web 4.0 as the web of integration, and Web 5.0 as the web of the decentralized smart communicator. Web 1.0 is known as the web of information or perception. One major reason why higher education instructors need to develop new emotional competencies is because of the increasing

importance of online learning [37, 38]. Teachers will be required to use and promote intra- and interpersonal emotional competences more than ever in the future, even though affections, feelings, and emotions have been gaining relevance in society and scientific thought for more than a decade. This is because we will be dealing with a sensory emotive Web (Web 5.0) [39]. The development of emotional capabilities by teaching staff and their transmission to students is necessary to generate graduates who will be more flexible in changing socio-professional settings. In the period of Society 5.0, universities exist. The figure 3 presents evolution from society1.0 to society5.0. Everyone should actively participate in incorporating digital technology into various processes and hastening its acceptance, according to the objectives of Society 5.0 [40], that is deeply entwined with both the real and virtual worlds [22].

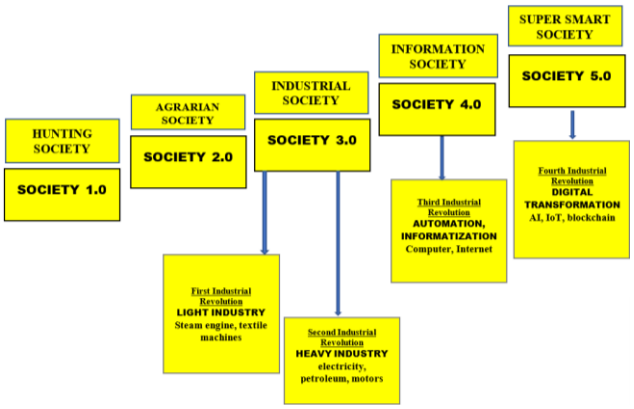

Fig. 3 The evolution from society1.0 to society5.0
Source: own study basis on: [40].

WOSviever ANALYSIS

In order to select the most relevant studies in the field, bibliometric analysis was used, with the principal source of scientific articles selected being the academic platform Scopus. The content of 3836 research articles has been taken into consideration from 2019 and 2023 years. The search documents related to "digitalization" issue in title, abstract and keywords. In order to highlight the structure of the scientific field, we used a content analysis, inspecting the most common words and the relationships between words. Additionally, a network of co-occurrences was taken into account. The analysis was performed using the WOSviever program, that can build multiple item maps, nation maps, publication maps, journal maps based on networks (co-citation), and maps with multiple publications. It also has the ability to construct keyword maps based on shared networks. Users have the ability to modify the quantity of keywords utilized and eliminate less relevant terms. In summary, the WOSviewer program facilitates data mining, grouping, and mapping of articles that are obtained from scientific databases. To respond to the following main research question by exploring the valuable information the world's clouds provided:

1) What does network visualization look like between co-authorships and countries?
2) Which are the most common words found in the full scientific articles on digitalization in higher education?
3) What are main key words used by authors?
4) What are co-citations and cited sources?

Table 1 presents selected articles on digitalization published in the Scopus database in 2023.

Table 1
Review of recent manuscripts about digitalization in education in 2023 – Scopus database

Authors	Title	Journal	Objective	Methodology	Findings
Alam et al. (2023) [20]	***"Digitalization of higher education to achieve sustainability: Investigating students' attitudes toward digitalization in Bangladesh"***	International Journal of Educational Research Open	The perspectives of Bangladeshi university students about digitizing higher education are investigated in this research. The research aims to investigate the nature and subjective origins of the views held by the students, as well as the impact of factors such as gender, previous exposure to digitalization, and socioeconomic background on these sentiments.	Qualitative study: manuscript uses the ABC Model of Attitudes and the Digital Divide Theory to prepare a questionnaire and analyze the data.	The results of the data analysis indicate that the majority of students have favorable opinions about the shift to digital learning.
Tettamanzi et al. (2023) [41]	***"Accounting education and digitalization: A new perspective after the pandemic"***	International Journal of Management Education	This research looks at how the Italian educational system responded to the COVID-19 pandemic and how instructors felt they could still provide a quality education in the face of this unique circumstance. The extent of academic digitalization was examined, with a focus on highlighting instructional modifications that may potentially be successful in the "new normal" and identifying the primary alterations brought about by the COVID-19 epidemic.	Qualitative study: explorative survey for professors of Italian universities, analysed by means of PLS-SEM techniques.	The manuscript emphasizes the necessity for higher education to move toward active learning strategies, especially in mixed or online learning environments. It also emphasizes the experiential nature of student-centered learning.

cont. Table 1

Devisakti et al. (2023) [42]	***"Digitalization in higher education: does personal innovativeness matter in digital learning?"***	Interactive Technology and Smart Education	Manuscript investigates how students from low-income households (B40) use technology in higher education.	Qualitative study: An online survey of undergraduate students from low-income households (B40) at Malaysian higher education institutions was used to collect the data. The structural equation modeling approach was used to analyze the data.	The results showed that performance expectancy and facilitating conditions have a significant relationship with digital usage.
Kryshtanovych et al. 2023 [35]	***"Modeling the Effective Digitalization of the Education Management System in the Context of Sustainable Development"***	International Journal of Sustainable Development and Planning	Manuscript provides new models for the successful digitalization of the education management system in order to guarantee its sustainable growth, considered especially as an institution of higher education.	Qualitative study: a structural model of the graphical scheme of achieving A0 - Integration of digitalization elements into the sustainable development management system of an educational institution	In order to secure the long-term growth of the education management system, particularly in higher education, the manuscript suggests new models for its efficient digitalization.
Alenezi (2023) [43]	***"Digital Learning and Digital Institution in Higher Education"***	Education Sciences	An overview of the key elements of the digital transformation implementation method used at higher education institutions may be found in the manuscript. Furthermore, how digital learning fits into the environment of contemporary higher education.	Literature review	This study shows that the digital transformational dimensions in higher education institutions go beyond merely suggesting technological advancement and, instead, alter meaning in ways that affect the institution's pedagogical approaches, teaching, research, outgrowth, and administrative regulations; as well as the institution's cultural context, people, SOPs, foundational activities, and their evaluations.
Borovchenko et al. (2023) [44]	***"Transforming Design Education in Ukraine: Insights from Global Best Practices"***	Journal of Curriculum and Teaching	Through the lens of global experience, the paper highlights some of the challenges associated with changing the Ukrainian system of design education.	The theoretical analysis: Analyse certain aspects of the educational activities of higher education institutions abroad, in particular Seian University of Art and Design (Otsu, Shiga, Japan), Royal Collage of Art (London, Great Britain), KEDGE Design School (Marseille, France), Istituto Pantheon Design & Technology (Rome, Italy).	The manuscript proposes vectors for the reform of domestic design education while identifying the best practices from across the world in this field. These include focusing on the educational requirements of students, introducing a practical component of student training based on business institutions and firms, using novel digital technologies actively, and engaging in multidirectional international collaboration.

cont. Table 1

Aubakirova et al (2023)	***"Experience in forming entrepreneurial education in Kazakhstan universities in the conditions of information and digital development"***	Frontiers in Education	The manuscript focuses on the creation of entrepreneurial education experiences in Kazakhstani institutions, taking into account the country's current global difficulties as well as the advancement of information and digital technologies.	Experimental design was employed to ascertain the effectiveness of integrating MOOC through the amalgamation of statistical data analysis and paired t-tests.	It has been shown that taking online courses helps students do better in the entrepreneurship course. This enhanced the effectiveness of the educational process and allowed for the productive integration of digital and information technologies in an online setting. The manuscript demonstrates the need of including digital and information technology in entrepreneurship education.

In order to illustrate the level of contact between nations and the leading nations in this subject, a country co-authorship study was carried out. In specifics, VOSviewer can build multiple item maps, nation maps, publication maps, journal maps based on networks (co-citation), and maps with multiple publications. It also has the ability to construct keyword maps based on shared networks. Users have the ability to modify the quantity of keywords utilized and eliminate less relevant terms. In summary, the VOSviewer program facilitates data mining, grouping, and mapping of articles that are obtained from scientific databases. Fig. 4 presents the country co-authorship network of digitalization related publications with four clusters (minimum number of documents of a country: 5). Figure 4 has a variety of colors, indicating the diversity of research topics. The large nodes represent the influential countries. The links between nodes represent the cooperative relationships among countries. The distance between the nodes and the thickness of the links represent the level of cooperation among countries. France is the leader of the red cluster, which has the most significant number of countries, this is 5. It is followed by the green cluster, with five countries, including the USA, Poland, India, and Malaysia. China is a leader here (with 26 documents and 30 citations). The next cluster is blue, covering four countries: Denmark, the Russian Federation, and the Netherlands. Italy is the leader here (with 16 documents and 5 citations). The yellow cluster includes the fewest countries (only 3); it includes Germany, the United Kingdom, and Spain, and the clear leader is Germany (with 30 documents and 3 citations).



Fig. 4 Co-authorship countries

To study the contents, the author examined the distribution of all key words (Fig. 5).

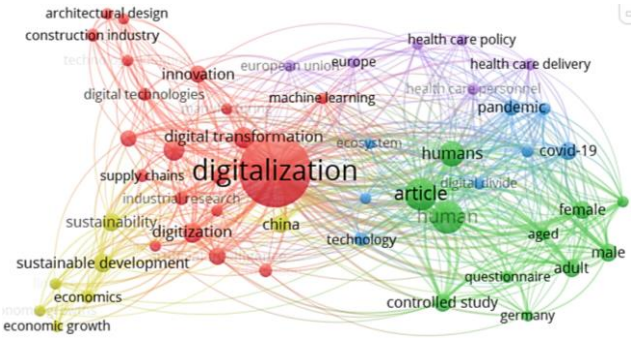

Fig. 5 Co-occurrence all key words

The keywords that are analyzed here are those that authors employ in the titles, abstracts, and keywords sections of their papers. Co-occurrence is the phrase used to describe how often one term occurs with another. The use of keywords highlights trends in earlier works and forecasts themes that might become popular in the future, which could help researchers find unexplored subjects. Research hotspots may be efficiently represented by keyword co-occurrence analysis of a study region, providing more evidence in favor of scientific research. VOSviewer divided the keywords of digitalization publications into five clusters. Cluster 1 is red colour (digitalization, automation, artifical intelligence, digital transformation, innovation, architectural design, construction industry, digital technologies, supply chains, digitization, decision making, technology adoption, manufacturing, internet of things, life cycle. Cluster 2 is green colour (humans, article, human, controlled study, germany, aged, female, male, adult, quastionnaire). Cluster 3 is yellow colour (sustainability, sustainable development, china, economics, economic growth). Cluster 4 is blue colour (ecosystem, technology, COVID-19, pandemic, digital divide, information technology). Cluster 5 is violet colour (european union,

europe, healthcare policy, healthcare delivery, healthcare personnel, telemedicine). The node, "digitalization", with total links of 486, has higher link strength with "human" (261), "humans" (177), "article" (251), "female" (116) and "male" (106), implying close integration of digitization and these research topics. To study the contents, the author examined the distribution of author key words (Fig. 6). The figure shows two clusters. The cluster 1 is marked in red (digitalisation, industry 4.0, artifical intelligence, sustainability), and the cluster 2 is marked in green (digitalization, covid, innovation).



Fig. 6 Authors key words

Figure 7. shows the co-citations and the most cited sources where the minimum number of citations of a source is 20. Of the 5706 sources, 45 met the threshold.



Fig. 7 Co-citations and cited sources

Cluster 1 is followed by the green colour, with 11 journals, including the Journal of International Business Studies as the leader. This cluster has the most co-citations in 23 journals. Sustainability Journal is the leader of the red cluster, which is cluster 2. In cluster 2, there are co-citations in 11 journals. Cluster 3 is blue colour, covering co-citations in five journals. The Journal of Business Research is the leader here. The yellow cluster 4 includes co-citations in 4 journals, of which Energies Journal is a leader.
Table 2 shows the percentage of participation cited by sources. It can be seen from Table 2 that the most often cited sources are the following (minimum number of citations of the source: 20): Sustainability (9.4%), Journal of Cleaner Production (6.61%) and Journal of Business Research (5.31%).

Table 2
Co-citations and cited sources within digitalization issue – Scopus database

Journal name	Number of co-citations	Percentage participation [%]
Sustainability	**152**	**9.4**
Journal of Cleaner Production	**107**	**6.61**
Journal of Business Research	**86**	**5.31**
Journal of International Business Studies	75	4.63
Technological Forecasting and Social Change	69	4.26
International Journal of Management And Business Research	59	3.64
International Journal of Production Economics	48	2.96
Industrial Marketing Management	48	2.96
Mis Quarterly	48	2.96
International Journal of Production Economics	47	2.9
International Journal of Production Research	46	2.84
Strategic Management Journal	46	2.84
Technovation	35	2.16
Technological Forecasting and Social Change	34	2.1
Procedia Cirp	33	2.04
Journal of Management Studies	31	1.91
International Journal of Information Management	30	1.85
Ieee Access	30	1.85
Energies	29	1.79
Renewable and Sustainable Energy Reviews	29	1.79
Journal of Marketing	28	1.73
Small Business Economics	28	1.73
Energy Economics	28	1.73
Business Horizons	26	1.6
International Journal of Operations and Production Management	26	1.6
Energy	26	1.6
Journal of Operations Management	25	1.54
International Journal of Production Economics	25	1.54
Computer Industry Journal	25	1.54
Science of the Total Environment	25	1.54

cont. Table 2

Telecommunication Policy	25	1.54
Energy and Buildings	24	1.48
Applied Energy	24	1.48
Energy Policy	23	1.42
Plos One	22	1.36
Research Policy	22	1.36
Journal of Management	22	1.36
Government Information Quarterly	21	0,92
Harvard Business Review	20	1.23
Resources Policy	20	1.23
Journal Environmental Management	20	1.23
Environmental Science and Pollution Research	20	1.22
Technological Forecasting and Social Change	20	1.22
TOTAL 43	**1617**	**100%**

Designation in the table 2:
Cluster 1 is followed by the green colour,
Cluster 2 is followed by the red colour,
Cluster 3 is followed by the blue colour,
Cluster 4 is followed by the yellow colour.

In the next part of the research, the term digitalization was examined in more detail. The Scopus search engine uses filters, including the terms "digitalization" and "higher" and "education", but is limited to key words. The content of 104 research articles has been taken into consideration since 2019 and 2023. To respond to the following main research question by exploring the valuable information the world's clouds provided: *What are co-occurrence all key words in network visualisation?* Co-occurrence all key words in network visualisation has been presented on Fig. 8, with the minimum number of occurrence of a keywords: 5.

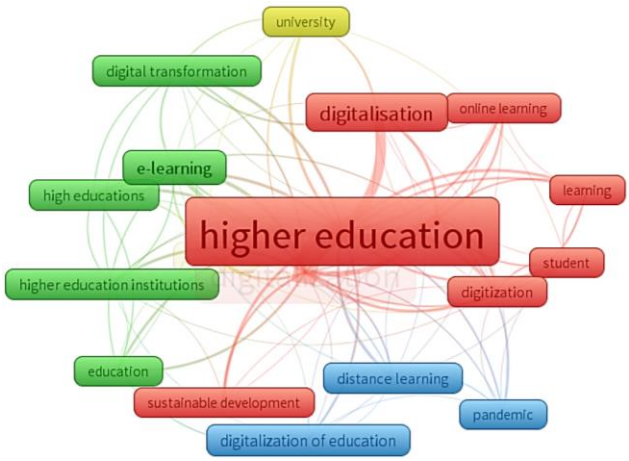

Fig. 8 Co-occurrence all key words network visualisation

The Figure 8 shows 3 clusters. The first cluster (red colour) consists of the words: "higher education", "digitalization, "sustainable development", "online learning", "digitization", "student", "learning". The second cluster (green colour) consists of the words: "e-learning", "digital transformation", "high education ", "higher education institutions", "education". The third cluster (blue colour) consists of the words: "pandemic", "distance learning" and "digitalization of education". Table 3 presents distribution of manuscripts by research area.

Table 3
Distribution of articles by research area – Scopus database

Research area	Manuscript's number	Percentage particiation [%]
Social sciences	**83**	**45,1**
Computer science	**22**	**12**
Business, Management and Accounting	**21**	**11,4**
Psychology	15	8,15
Arts and Humanities	10	5,43
Energy	8	4,34
Health Professions	7	3,8
Engineering	7	3,8
Chemical engineering	4	2,17
Medicine	2	1,08
Decision Sciences	2	1,08
Mathematics	1	0,55
Materials Science	1	0,55
Chemistry	1	0,55
TOTAL	**184**	**100**

As can be seen from Table 3, a total of 184 manuscripts were published in the Scopus database from the digitalization in higher education area. Specifically, 83 manuscripts, representing 45.1%, were published in the Social sciences research area, 22 manuscripts (12%) in the Computer sciences research area, and 21 manuscripts (11.4%) in the business, management, and accounting research area.

DISCUSSION

Today's pupils and students are used to using digital gadgets such as laptops, tablets, and smartphones, even in elementary school and higher education. These gadgets are often used by them for amusement and communication. But, the demands of a changing global environment are primarily focused on teaching and learning using these gadgets for the pupils. It is difficult for trainers and educators who deal with these gadgets for extended periods of time to understand them. The research conducted by Zeehan et al. (2020) reveals that teachers find it difficult

to get current technology training. For the purpose of developing digital technology education skills, educators must maximize the use of digital technologies in the classroom. Learning and working skills are changing as a result of the recent growth of digitalization in education. As digital technology advances, there is a chance to prepare students for careers as "Scientists of the Future," with the ability to acquire information that bridges disciplines [17]. With the increasing prevalence of digital resources in recent times, students and academics may acquire skills more easily thanks to digital gadgets and the Internet of Things (IoT). The demands of the global socioeconomic crisis put pressure on higher education in the twenty-first century to use big data analytics and digital technology to provide personalized learning skills under intelligent educational models with added value. Academicians might choose the most effective learning models for teaching in a collaborative learning environment made possible by this. The development of skills and cumulative knowledge may be facilitated in communities.

Researchers assert that universities need to immediately reconsider and update their purpose and strategy in order to become intelligent organizations capable of keeping up with the rapid evolution of technology [45]. HEIs must embrace technological advancements and move as much of their operations into the digital work zone as possible in order to become competitive. HEIs should prioritize supporting the adoption of digital-based procedures for their own operational systems and going one step further by offering digital channels for teaching and learning. It is possible to directly or indirectly link HEIs to the most recent technological developments that are having an impact on the economy. HEIs may be the sources of these innovations, act as channels for their dissemination through research publications, or collaborate with the industry [46, 47]. Thus, HEIs' primary roles of teaching and research persist even as they advance and embrace digitalization; they are just updating their toolkits [48].

The whole society has been affected and stimulated by digitalization in recent years, which has resulted in the creation of new job skills, contemporary cultural settings, and creative instruments for enterprise and communication [49]. Regarding the reform and modernization of the global educational environment, the process of digitalization in education is a powerful trend. A computer-playable digital format for text, photos, video, and audio is created during the digitalization of the educational process. Computers, the internet, smartphones, digital cameras, scanners, projectors, printers, and so on may all be considered digitalization tools. Online tests, online admissions, online knowledge sharing, digital assistance materials (in many forms, such as ppt, pdf, and doc), social networks, digital publishing, and online collaborations are some examples of digitalization methods. In examining the phenomenon of digitalization, it is important to highlight that various analysts and forecasters, particularly those from the United Kingdom, such as Tim Berners-Lee, one of the founders of the World Wide Web, view the shift in education to the digital sphere as a watershed in educational history. As far as the inclusion of software engineering and information technology in the obligatory education curriculum for students in grades 5 through 16 goes back to 2015, the United Kingdom was the pioneer in the world in this regard. The 2020 Strategy, which promotes increasing the use of digital technology, was the inspiration for this project when it was first launched in 2014. Aiming to integrate cutting-edge digital resources, solutions, and techniques into the operations of EU educational institutions, this strategy set lofty goals to yield remarkable accomplishments in the field of education [50]. To offer their students with digital experiences, teaching, learning, and, ultimately, digital skills, Higher Education Institutions (HEIs) must first transform into digital organizations. Organizations that want to go digital must hire specialists and have digital endowments. It is critical that all people involved recognize the need for change, approve it, and prepare themselves appropriately. Author Sheail [17] claims that the use of contemporary 3D technology improves computer control learning. In order to increase employability potential for engineering courses and degrees and to pique future students' interest in them, 3D technologies are being used in education to teach new skills and approaches. Although digitalization makes it possible for each person to study on their own, critical learning remains difficult. The learning process is being greatly impacted by digital technology. It is already impossible to resist digitalization; future education will be entirely dependent on digital platforms and tools. The ability to collaboratively address a multitude of important techno-social challenges is a benefit of effectively using digital learning environments in academic contexts [51, 52]. As the literature shows [23, 53], in order to grow and thrive as a world-class university, universities should develop the following assets: (1) physical infrastructure, (2) digital infrastructure, (3) innovative academic and training infrastructure to build trust, (4) ownership infrastructure intellectual, (5) emotional infrastructure, and (6) network infrastructure.

CONCLUSION

The manuscript is a review of the literature on digitalization in higher education. Articles from the Scopus database for the years 2019-2023 were taken into account. The analysis was performed using the WosViever program. The research results showed that the fields of technology, education, and management provide the theoretical basis for research on the digitalization of higher education. The findings also demonstrate the topic's interdisciplinary character (as seen by publications published in several fields) and its strong relationship to concepts like online learning, digital transformation, and sustainable development.

The author posed the following questions in the manuscript:

Where do Universities 4.0 go?

The way that the Web has evolved to change corporate orientation indicates that it will have a clear impact on the standard and content of higher education. Change and

the emergence of new production and innovation models based on knowledge, its uses, and information processing characterize the contemporary economic environment. Teachers must therefore take into account this context as the one in which they must implement their training project if we are to face a sensory and emotive Web (Web 5.0) in the future, one that is intended to personalize interactions between computers and humans and to create experiences that excite users. More than ever, instructors will need to develop and practice their intra- and interpersonal emotional competencies, making emotional competencies crucial. As a result, emotional resources and coping mechanisms must be mobilized as part of competency training, in addition to information and training exercises, to enable individuals to behave in complicated situations. A high intellectual coefficient or extensive technical knowledge will no longer be sufficient for teachers to succeed in the online classroom; instead, they must be able to develop skills like self-knowledge, self-mastery, zeal and persistence, the capacity to motivate themselves and others, and the ability to work well in a team. The fields of technology, education, and management provide the theoretical basis of research on the digitalization of higher education. Based on the literature analysis the author proposed a model (Fig. 9).

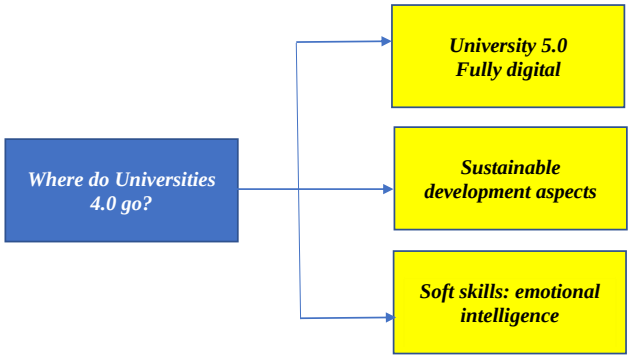

Fig. 9 Model of Universities 4.0 future

With the general shift to a distance-based interaction style, digital technologies in education generate a new, rapidly growing market segment that is in high demand [9]. It can be concluded from Fig. 9 that University 4.0 will be fully digital, will take care of aspects of sustainable development, and will develop teachers' soft skills, especially emotional intelligence. Digitalisation of education has significantly changed the relationship between the teacher and the student", thus, teaching methods should be more interactive and attractive [54, 55, 56]. According to market demand, universities will provide more hybrid model courses until 2030. These courses will be offered at varying rates in a variety of academic subjects, including the social sciences, engineering, medicine, and many more. While digital higher education institutions will begin their inevitable expansion, conventional universities will continue to adopt blended learning beyond 2030. Fully digital institutions, dubbed University 5.0, may emerge as a necessary development in higher education. Numerous higher education institutions joined the worldwide online higher education business after few pioneering universities, including State University of New York (SUNY), University of Phoenix, and University of London. Many notable inventions have also recently made headlines throughout the world. For example, Stanford University in the United States launched its virtual classroom to support the existing remote learning system [21]. Facebook, which changed its name to Meta, has said that it would launch ten digital universities as model campuses throughout the US in 2021 [57]. Consequently, University 5.0 is set to be executed shortly, bolstered by prominent digital enterprises [58]. Furthermore, China Communication University has partnered with search engine Baidu's metaverse platform XiRang to establish its digital campus [59]. The University of Miami likewise declared their intention to enter the metaverse space. It is a compelling argument to be made today that colleges will have to provide hybrid learning in the years to come. This aligns with the expectations and viewpoints of the Z generation as well. University 4.0 might be the name given to this changeover phase. Then, with their unstoppable digital transformation, the successors like generation Alpha and Beta may completely digitalize universities and change the face of higher education. Higher education may provide both physical and virtual spaces for social and interpersonal relationships, as COVID-19 has shown to be crucial [60]. Digital connections are not reflected in the digital university as a form of outreach from the campus to the global community; rather, they can be understood as an extension of the idea of the university, embodied and projected through strong links across various locations, times, and temporalities [61, 62]. In the highly competitive global market of the twenty-first century, a digital university, or University 5.0, may hire academic personnel from all over the globe and provide higher education to any location in the world. The 2030 Agenda's primary goal of ensuring inclusive and equitable quality education is closely linked to the general framework of action known as "Leave no one behind," which is made possible by the economic, social, and environmental dimensions of the concept of sustainable development. This allows for the achievement of development that is both dynamic and sustainable. In order to meet the urgent demands of our local societies – both present and future – professionals and individuals with sustainability skills are needed to address the global issues confronting the globe. To prepare the professionals of the future, education must bridge the gaps between many fields of knowledge.

The results revealed the need to study the issue of digitalization in education, which is an integral element in the pursuit of a modern and conscious education towards sustainable development and the use of modern educational solutions to make classes at universities more attractive, which has recently been the main area of research. Additionally, the analysis demonstrated that society 5.0 expects digitization to be a component. The keyword co-occurrence map also highlights the importance of digitalization for achieving sustainable development in education. Therefore, digitalization plays a significant role in

sustainable development. This is the core of “smart education of the future”.

In the future, the author wants to conduct a literature analysis on the development of innovation in the University 4.0 system based on smart technologies in the aspects of digitalization and sustainable development, as well as analyze the development of soft skills (emotional intelligence) in the proper functioning of a modern university.

LIMITATIONS

Similar to other review works, this one has its share of restrictions. The first constraint of the research stems from the chosen publications and reviews pertaining to digitalization. Since many scientific disciplines are covered by digitalization, findings may vary if publications from other domains are fully included. Because of this, great care should be used when applying the study's findings to the wide field of digitalization. The research timeframe (2019-2023) is another restriction; future findings may differ since we expect that the evolving digitalization landscape will bring new subjects, ideas, and methodologies that will fundamentally alter our study's conclusions. Lastly, since the study is based on data from Scopus, this research may potentially be subject to Scopus's limitations. Therefore, data from other sources, including Web by Science, should be included in future analyses. Furthermore, this kind of researcher may assess the scholarly and societal significance of study findings by using Altmetrics, an advanced and systematic bibliometric method. This may be used to new study fields and to better clarify field dynamics in combination with scientometric analysis. Nonetheless, the bibliometric data analysis carried out in this study adds to the body of literature by offering a thorough and in-depth examination of important publications in the subject of digitalization and digitalization research.

REFERENCES

[1] T. Fenwick and R. Edwards, "Exploring the impact of digital technologies on professional responsibilities and education," *European Educational Research Journal*, vol. 15, no. 1, pp. 117–131, 2016, doi: 10.1177/1474904115608387.

[2] E.V. Frolova, O.V. Rogach, and T.M. Ryabova, "Digitalization of Education in Modern Scientific Discourse: New Trends and Risks Analysis," *European Journal of Contemporary Education*, vol. 9, no. 2, pp. 313-336, 2020. [Online]. Available: https://eric.ed.gov/?id=ej1262557

[3] *Experience in the organization of the scientific club of the department of information technologies of russian state social university" Future technologies of digital …*, 2019. [Online]. Available: https://elibrary.ru/item.asp?id=38554007

[4] *Breakthrough technologies of Russia's digital economy*, 2018.

[5] A.V. Shutaleva, A.A. Kerimov, and Y.V. Tsiplakova, "Humanization of education in digital era," (in ru), *2307-2334*, vol. 42, no. 6, pp. 32-44, 2019, doi: 10.32744/pse.2019.6.3.

[6] O.A. Nesterchuk, O.E. Grishin, and A.M. Chepurnaya, "Digitalization as the “new normal” of higher education," *J. Phys.: Conf. Ser.*, vol. 1691, no. 1, p. 12068, 2020, doi: 10.1088/1742-6596/1691/1/012068.

[7] Nadya Velinova-Sokolova, "Digitalization in Financial Education in The Universities," *Годишник на УНСС*, vol. 2, no. 2, pp. 61-75, 2022. [Online]. Available: https://www.ceeol.com/search/article-detail?id=1101898

[8] W.-K. Chiu, "Pedagogy of Emerging Technologies in Chemical Education during the Era of Digitalization and Artificial Intelligence: A Systematic Review," *Education Sciences*, vol. 11, no. 11, p. 709, 2021, doi: 10.3390/educsci11110709.

[9] D.A. Petrusevich, "Modern trends in the digitalization of education," *J. Phys.: Conf. Ser.*, vol. 1691, no. 1, p. 12223, 2020, doi: 10.1088/1742-6596/1691/1/012223.

[10] *THE DIGITALIZATION IN EDUCATION: A NEW ERA*, 2020. [Online]. Available: http://mrida.highereduhry.ac.in/assets/pdf/mrida24.pdf

[11] S.A. Apostu, V. Vasile, R. Vasile, and J. Rosak-Szyrocka, "Do Smart Cities Represent the Key to Urban Resilience? Rethinking Urban Resilience," *International Journal of Environmental Research and Public Health*, vol. 19, no. 22, p. 15410, 2022, doi: 10.3390/ijerph192215410.

[12] M. Pan, X. Zhao, K. lv, J. Rosak-Szyrocka, G. Mentel, and T. Truskolaski, "Internet development and carbon emission-reduction in the era of digitalization: Where will resource-based cities go?," *Resources Policy*, vol. 81, p. 103345, 2023, doi: 10.1016/j.resourpol.2023.103345.

[13] J. Rosak-Szyrocka, J. Zywiolek, A. Zaborski, S. Chowdhury, and Y.-C. Hu, "Digitalization of Higher Education Around the Globe During Covid-19," *IEEE Access*, vol. 10, pp. 59782-59791, 2022, doi: 10.1109/access.2022.3178711.

[14] A. Eskinat and S. Teker, "DIGITAL ERA FOR UNIVERSITIES: SOON OR FAR," (in en scheme="ISO639-1";en), *Pressacademia*, vol. 17, no. 1, pp. 46-52, 2023, doi: 10.17261/Pressacademia.2023.1752.

[15] K. Stecuła and R. Wolniak, "Advantages and Disadvantages of E-Learning Innovations during COVID-19 Pandemic in Higher Education in Poland," *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 8, no. 3, p. 159, 2022, doi: 10.3390/joitmc8030159.

[16] Ruxandra Bejinaru, "Impact of Digitalization on Education in the Knowledge Economy," *Management Dynamics in the Knowledge Economy*, vol. 7, no. 3, pp. 367-380, 2019. [Online]. Available: https://www.ceeol.com/search/article-detail?id=943863

[17] P. Sheail, "The digital university and the shifting time–space of the campus," *Learning, Media and Technology*, vol. 43, no. 1, pp. 56-69, 2018, doi: 10.1080/17439884.2017.1387139.

[18] M. Tahir, "Effective Da'wah in the Era of Society 5.0: The Perspective of Students in Indonesian State Islamic Higher Education," *Jurnal Dakwah Risalah*, vol. 34, no. 1, p. 52, 2023, doi: 10.24014/jdr.v34i1.23277.

[19] M. Alenezi, S. Wardat, and M. Akour, "The Need of Integrating Digital Education in Higher Education: Challenges and Opportunities," *Sustainability*, vol. 15, no. 6, p. 4782, 2023, doi: 10.3390/su15064782.

[20] M.J. Alam, R. Hassan, and K. Ogawa, "Digitalization of higher education to achieve sustainability: Investigating students’ attitudes toward digitalization in Bangladesh," *2666-3740*, vol. 5, p. 100273, 2023, doi: 10.1016/j.ijedro.2023.100273.

[21] *Stanford course allows students to learn about virtual reality while fully immersed in VR environments*, 2022.

[22] M. Karim, A. Syafrul, O. Karlini, and T.A. Santosa I. Kerinci, "The Effect of Teacher Professionalism in Islamic Religious Education in the Era of Society 5.0 in Indonesia: A Meta-Analysis," *JPDK*, vol. 5, no. 2, pp. 1710-1717, 2023, doi: 10.31004/jpdk.v5i2.13129.

[23] J.M. Lane, "Developing The Vision: Preparing Teachers To Deliver A Digital World-Class Education System," *AJTE*, vol. 37, no. 4, 2012, doi: 10.14221/ajte.2012v37n4.7.

[24] Olha Prokopenko, "Technological challenges of our time in the digitalization of the education of the future," *FED*, vol. 1, no. 2, pp. 4-13, 2021, doi: 10.57125/FED/2022.10.11.14.

[25] D.A. Petrusevich, "Modern trends in the digitalization of education," *J. Phys.: Conf. Ser.*, vol. 1691, no. 1, p. 12223, 2020, doi: 10.1088/1742-6596/1691/1/012223.

[26] P. Parviainen, M. Tihinen, J. Kääriäinen, and S. Teppola, "Tackling the digitalization challenge: how to benefit from digitalization in practice," *IJISPM*, vol. 5, no. 1, pp. 63-77, 2017, doi: 10.12821/ijispm050104.

[27] E. Bolisani and C. Bratianu, "Knowledge strategy planning: an integrated approach to manage uncertainty, turbulence, and dynamics," *JKM*, vol. 21, no. 2, pp. 233-253, 2017, doi: 10.1108/jkm-02-2016-0071.

[28] *The role of transformational leadership in mergers and acquisitions in emergent economies*, 2011. [Online]. Available: https://search.proquest.com/openview/303fa259d9f766867a2a5778ebf8eb29/1?pq-origsite=gscholar&cbl=226548

[29] V. Lefter, C. Brătianu, A. Agapie, S. Agoston, and I. Orzea, "Intergenerational knowledge transfer in the academic environment of knowledge-based economy," *Amfiteatru Economic Journal*, vol. 13, no. 30, pp. 392-403, 2011. [Online]. Available: https://www.econstor.eu/handle/10419/168725

[30] P. Parviainen, M. Tihinen, J. Kääriäinen, and S. Teppola, "Tackling the digitalization challenge: how to benefit from digitalization in practice," *IJISPM*, vol. 5, no. 1, pp. 63-77, 2017, doi: 10.12821/ijispm050104.

[31] Ruxandra Bejinaru, "Impact of Digitalization on Education in the Knowledge Economy," *Management Dynamics in the Knowledge Economy*, vol. 7, no. 3, pp. 367-380, 2019. [Online]. Available: https://www.ceeol.com/search/article-detail?id=943863

[32] A.V. Lapteva, V.S. Efimov, А. Лаптева, and В. Ефимов, "New Generation of Universities. University 4.0," 2016. [Online]. Available: https://elib.sfu-kras.ru/handle/2311/29969

[33] *Tsifrovizatsiya obrazovaniya kak osnova podgotovki uchitelya XXI veka: problemy i resheniya [Digitalization of education as the basis for the training of a …*, 2019.

[34] V.V. Degtyareva, D.A. Sozaeva, and Z. Dong, "The Era of Digitalization: Philosophical, Social, and Managerial Factors," *Socio-economic Systems: Paradigms for the Future*, vol. 314, pp. 1691-1700, 2021, doi: 10.1007/978-3-030-56433-9_175.

[35] S. Kryshtanovych, O. Inozemtseva, O. Voloshyna, I. Ostapiovska, and O. Dubrova, "Modeling the Effective Digitalization of the Education Management System in the Context of Sustainable Development," *IJSDP*, vol. 18, no. 5, pp. 1507-1514, 2023, doi: 10.18280/ijsdp.180521.

[36] K. Nath, S. Dhar, and S. Basishtha, "Web 1.0 to Web 3.0 - Evolution of the Web and its various challenges," in *2014 International Conference on Reliability Optimization and Information Technology (ICROIT)*, 2014.

[37] *Evolution of the world wide web: from web 1.0 to 6.0*, 2016. [Online]. Available: http://ijodls.in/uploads/3/6/0/3/3603729/ijodls121.pdf

[38] D. Benito-Osorio, M. Peris-Ortiz, C.R. Armengot, and A. Colino, "Web 5.0: the future of emotional competences in higher education," (in En;en), *Glob Bus Perspect*, vol. 1, no. 3, pp. 274-287, 2013, doi: 10.1007/s40196-013-0016-5.

[39] D. Benito-Osorio, M. Peris-Ortiz, C.R. Armengot, and A. Colino, "Web 5.0: the future of emotional competences in higher education," (in En;en), *Glob Bus Perspect*, vol. 1, no. 3, pp. 274-287, 2013, doi: 10.1007/s40196-013-0016-5.

[40] R. Wahyuningtyas, G. Disastra, and R. Rismayani, "Toward cooperative competitiveness for community development in Economic Society 5.0," *JEC*, vol. 17, no. 3, pp. 594-620, 2023, doi: 10.1108/JEC-10-2021-0149.

[41] P. Tettamanzi, V. Minutiello, and M. Murgolo, "Accounting education and digitalization: A new perspective after the pandemic," *1472-8117*, vol. 21, no. 3, p. 100847, 2023, doi: 10.1016/j.ijme.2023.100847.

[42] A. Devisakti and M. Muftahu, "Digitalization in higher education: does personal innovativeness matter in digital learning?," *ITSE*, vol. 20, no. 2, pp. 257-270, 2023, doi: 10.1108/ITSE-10-2021-0182.

[43] M. Alenezi, "Digital Learning and Digital Institution in Higher Education," *Education Sciences*, vol. 13, no. 1, p. 88, 2023, doi: 10.3390/educsci13010088.

[44] A. Brovchenko, O. Krykun, T. Borisova, A. Korkushko, and V. Tymenko, "Transforming Design Education in Ukraine: Insights from Global Best Practices," *JCT*, vol. 12, no. 5, p. 1, 2023, doi: 10.5430/jct.v12n5p1.

[45] *In search of intelligent organizations*, 2006. [Online]. Available: https://ideas.repec.org/a/eph/journl/v1y2006i4n9.html

[46] C.-V. Hapenciuc, R. Bejinaru, C. Roman, and D.-M. Neamtu, "The role of hes within the evolution of the business sector," in *EDULEARN proceedings*, 2016.

[47] *Innovations in industry 4.0 conditions*, 2023. [Online]. Available: https://www.researchgate.net/profile/radoslaw-wolniak/publication/370064087_innovations_in_industry_40_conditions/links/64737c2259d5ad5f9c803a77/innovations-in-industry-40-conditions.pdf

[48] M. Trippl, H.L. Smith, and T. Sinozic, *The 'third mission' of universities and the region: comparing the UK, Sweden and Austria*: Louvain-la-Neuve: European Regional Science Association (ERSA), 2012. [Online]. Available: https://www.econstor.eu/handle/10419/120460

[49] Sue Newell and Marco Marabelli in *Strategic Information Management*: Routledge, 2020, pp. 430-449. [Online]. Available: https://www.taylorfrancis.com/chapters/edit/10.4324/9780429286797-19/strategic-opportunities-challenges-algorithmic-decision-making-sue-newell-marco-marabelli

[50] O.N. Machekhina, "Digitalization of education as a trend of its modernization and reforming," *Revista ESPACIOS*, vol. 38, no. 40, 2017. [Online]. Available: https://www.revistaespacios.com/a17v38n40/17384026.html

[51] M.I. Qureshi, N. Khan, H. Raza, A. Imran, F. Ismail, and UniKL BiS, "Digital Technologies in Education 4.0. Does it Enhance the Effectiveness of Learning?," *18657923*, 2021. [Online]. Available: https://ir.unikl.edu.my/jspui/handle/123456789/25661

[52] J. Rosak-Szyrocka, J. Żywiołek, A. Nayyar, and M. Naved, *The Role of Sustainability and Artificial Intelligence in Education Improvement*. Milton: CRC Press LLC, 2023.

[53] P.S. Aithal and S. Aithal, *Building World-Class Universities: Some Insights & Predictions*, 2019.

[54] R. Wolniak, M. E. Grebski, and B. Skotnicka-Zasadzień, "Comparative Analysis of the Level of Satisfaction with the Services Received at the Business Incubators (Hazleton, PA, USA and Gliwice, Poland)," *Sustainability*, vol. 11, no. 10, p. 2889, 2019, doi: 10.3390/su11102889.

[55] W. Nielsen, K.A. Miller, and G. Hoban, "Science Teachers' Response to the Digital Education Revolution," (in En;en), *J Sci Educ Technol*, vol. 24, no. 4, pp. 417-431, 2015, doi: 10.1007/s10956-014-9527-3.

[56] M. Blašková, A. Sokół, and I. Figurska, "Organizational Barriers of a Knowledge-Based Organization in the Aspect of Sustainable Creativity Development," *1*, vol. 10, no. 4, pp. 46-62, 2023, doi: 10.15330/jpnu.10.4.46-62.

[57] *Meta, VictoryXR to Launch 10 Metaverse Campuses. XrToday*, 2021.

[58] L.K. Gurieva, R.I. Btemirova, and M.A. Kovaleva, "University 4.0:new education technologies in the digital economy," *International Scientific and Practical Conference on Digital Economy (ISCDE 2019)*, pp. 211-216, 2019, doi: 10.2991/iscde-19.2019.94.

[59] *Top Chinese university launches on Baidu's metaverse. Forekast*, 2022.

[60] E. Sabzalieva, *Thinking higher and beyond: perspectives on the futures of higher education to 2050*: UNESCO and UNESCO International Institute for Higher Education in Latin America and the Caribbean, 2021. [Online]. Available: https://www.voced.edu.au/content/ngv:90677

[61] P. Sheail, "The digital university and the shifting time–space of the campus," *Learning, Media and Technology*, vol. 43, no. 1, pp. 56-69, 2018, doi: 10.1080/17439884.2017.1387139.

[62] A. Uyar, R. Benkraiem, K. Nimer, and F. Schneider, "Education, Digitalization and Tax Evasion: International Evidence," *International Journal of Public Administration*, vol. 47, no. 1, pp. 41-56, 2024, doi: 10.1080/01900692.2022.2082471.

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