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Digital transformation in higher education: Global trends and future research direction

Harjanto Prabowo[1], Agustinus Bandur[2]
BINUS Business School Doctor of Research in Management, BINUS University, Jakarta, Indonesia[1,2]

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Abstract
This paper explores global trends and future research direction of digital transformation in Higher Education Institutions (HEIs); A bibliometric study was conducted with a total of 125 Scopus-indexed articles in the areas of Arts and humanities; business, management, accounting; economics, econometrics and finances; and social sciences. Analysis results indicate a diversity of publications in the last decade, including various research designs, article types, and geographical distribution of the studies. Qualitative content analysis reveals the significant focuses for future studies, including HEIs digital transformation framework, business model, and leadership capability. This paper serves as a point of departure for future research in higher education digital transformation.

Keywords: Digital transformation; higher education; leadership

Introduction

Industry 4.0 and Society 5.0 have reshaped the organizational function due to the massive penetration of computer and network applications that force organizations to provision digitalized business processes, innovative products, and better services (Rodríguez-Abitia & Bribiesca-Correa, 2021). In Higher Education Institutions (HEIs), it is widely acknowledged that technology has become a fundamental key in the 21st Century university (Chauca et al., 2021). Digital transformation has become the top priority in Higher Education Institutions (HEIs) due to the Covid-19 pandemic (Deja, Rak, & Bell, 2021; Garcez, Silva, & Franco, 2022). Accordingly, HEIs do not live apart from digital transformation (Chauca et al., 2021), and it is a necessity in higher education (Valdés, Alpera, & Suárez, 2021). Similarly, other scholars affirm that digital transformation is a dominant feature of twenty-first-century higher education (Tømte, Laterza, Pinheiro, & Avramovic, 2020). More specifically, digital transformation in HEIs has gained momentum in the last decade (Rodríguez-Abitia & Bribiesca-Correa, 2021).

However, even though the education market is suffering changes due to technological advancement, universities seem slow to react. Consequently, universities are behind other sectors in digital transformation due to a lack of effective leadership and culture changes (Cabero-Almenara, Guillén-Gámez, Ruiz-Palmero, & Palacios-Rodríguez, 2021). Thus, HEIs must be adequate and holistically integrated with the digital world. More particularly, with the rapid development of technologies of the Fourth Industrial Revolution (4IR), such as robotics, Internet of Things (IoT), 3-D printing, nano-technology, big data, and Artificial Intelligence (AI), the university requires leadership and human capital management with adequate digital capabilities. In this context, the leadership dimension for sustainable HEIs digital transformation is related to organizational support, change management, and engagement of managers and employees (Rodríguez-Abitia & Bribiesca-Correa, 2021). To make digital transformation happen in higher education, several researchers emphasize the support of top-down university administration (Bond, Marín, Dolch, Bedenlier, & Zawacki-Richter, 2018) and digital leadership strategy (Chauca et al., 2021).

This bibliometric pattern-content analysis is highly relevant in contributing to the gaps in previous reviews and meta-analysis studies. Firstly, although scholars have conducted a literature review on Heis's digital transformation, the sources of these reviews differed from this study. For instance, several reviews were based on the Web of Science database (Garcez et al., 2022) and the B-ON and SCILIT databases (Sá & Serpa, 2020), but this study was grounded on Scopus-indexed articles. Secondly, other studies were conducted based on policy reports and news articles (Mhlanga & Moloi, 2020), while this study was based on academic journal articles. Thirdly, this study is also significant because most of the previous literature and conceptual reviews were focused on publications in developed countries such as the United States of

[1] *E-mail: harprabowo@binus.edu (Corresponding Author)*

America (Haggans, 2015), the United Kingdom (Handley, 2018), Denmark, Norway, and Sweden (Tømte et al., 2020), China (Huang, 2015) and Russia (Gafurov, Safiullin, Akhmetshin, Gapsalamov, & Vasilev, 2020). In contrast, this study made an effort to analyze all previous studies in both developed and developing countries.

Furthermore, little is known about how the university business model is being innovated due to the impact of digital transformation in the college context (Rof, Bikfalvi, & Marquès, 2020). Likewise, several researchers (Wolski et al., 2020) assert that the digital transformation framework of higher education institutions for research is still under-researched. Other scholars have also revealed the research gaps in the studies of digital transformation in HEIs. For instance, adopting sustainability in digital transformation remains an underdeveloped area (Mohamed Hashim, Tlemsani, & Duncan Matthews, 2022). They then pinpoint a need to develop an innovative blueprint for stimulating sustainable practice of HEIs digital transformation and its leadership implication.

Research questions for NVivo bibliometric analysis and Qualitative Content Analysis (QCA) were formulated to guide this study. Firstly, the research questions for the bibliometric examination were: What are the publication trends of higher education digital transformation in the last decade? What methodological approaches and research methods are used in the studies? What are the country origins or geographical distribution of these publications? In which disciplinary fields (journals) are these studies being published? Secondly, the research questions for QCA analysis were: What are the core concepts of HEIs digital transformation? What are the relationship patterns of higher education digital transformation? What are the links between HEIs digital transformation and leadership? In line with these research questions, the study's primary purpose was to explore global trends in HEIs digital transformation with particular reference to identifying the critical roles of leadership in building digital transformation capability and maturity. For this purpose, an effort was made to study a sample of 125 articles from scientific journals selected from the Scopus database of Elsevier between 2012 and mid-April 2022 period. Therefore, this study provides a significant contribution to the current development of HEIs digital transformation by presenting global trends of publication in the field and identifying the qualitative relationship pattern between leadership and digital transformation in the HEIs context. The methodology applied to build the framework was based on an extensive bibliometric analysis with NVivo software. More importantly, a research direction for future studies in this area is also presented.

Literature Review

Concepts of HEIs Digital Transformation

Concepts of digital transformation vary. Previous scholars (Deja et al., 2021) grounded their study's theoretical framework on seven pillars of effective digital transformation in academia: digital information, digital literacy, self-efficacy, information empowerment, information culture, information management, and information use. Based on an empirical survey with the active participation of 266 academic staff in six highly ranked universities in Poland, they found that information management did not significantly affect information use. However, their data findings support six hypotheses: 1) Information literacy has a statistically significant positive effect on digital literacy, information self-efficacy, and information empowerment during the digital transformation in academia; 2) Digital literacy has a statistically significant positive effect on Information culture and information empowerment during the digital transformation in academia; 3) Self-efficacy has a statistically significant positive effect on Information empowerment during the digital transformation in academia; 4) Information empowerment has a statistically significant positive effect on information culture during the digital transformation in academia; 5) Information culture has a statistically significant positive effect on information use information management during the digital transformation in academia; and 6) Information culture mediates the relationship between information empowerment and information management as well as mediates the relationship between information empowerment and information use during the digital transformation in academia.

Then, the notion of digital transformation of higher education has been put forward by researchers as a process (Reis, Amorim, Melão, & Matos, 2018; Vial, 2019). Specifically, Vial (2019) explained that digital transformation is a process that occurs in organizations in response to changes that occur using digital technology to create value or produce something or make something more valuable (value creation). In this regard, several researchers (Rodríguez-Abitia & Bribiesca-Correa, 2021; Rof, Bikfalvi, & Marquès, 2020) emphasize digital transformation as an evolutionary process. This evolutionary process leverages advanced technology and digital capabilities to enable business models, operational procedures, and consumer experiences that result in value creation (Rodríguez-Abitia & Bribiesca-Correa, 2021). This

evolutionary process transforms all higher education activities, teaching, research, and aspects of higher education administration and management (Rof et al., 2020).

In the context of sustainable management for higher education digital transformation, several researchers from Spain (Abad-Segura, González-Zamar, Infante-Moro, & García, 2020) emphasized that digital transformation is a process that integrates digital technology in all aspects. This process requires changes in the area of higher education technology, higher education organizational culture, and university operational procedures. Other researchers underlined the digital transformation of universities as change; for example, "digital transformation is, without doubt, institutional change" (Hinings, Gegenhuber, & Greenwood, 2018, p. 4) and organizational change (Deja, Rak, & Bell, 2021). Specifically, digital transformation is defined as the combined effect of various digital innovations that produce new actors, structures, practices, values, and beliefs that change, threaten, replace, or complement the rules of the game in organizations, ecosystems, and industries (Hinings et al., 2018). This understanding has consequences for new institutional arrangements necessary for digital transformation, namely digital organizational forms and digital institutional infrastructure.

Regarding the definition of digital transformation as change, some researchers explain that "Digital transformation is referred to as the global change of socio-economic relationships, characterized by the transfer of these relationships into the cyber-physical world" (Mikheev, Serkina, & Vasyaev, 2021, p. 4538). That is, digital transformation is defined as a global change in socio-economic relations that is marked by the shift of socio-economic ties to the virtual world. Moreover, as explained by several researchers (Abad-Segura et al., 2020), digital transformation is the 4th industrial revolution because these changes are related to technological changes and involve the adoption of new skills from each individual and the reinvention of higher education institutions. Of the stages of technology adoption, digital transformation is the third stage after digital competence (digital competence) and digital use (digital use).

Furthermore, for several other researchers (Reis et al., 2018), the meaning of digital transformation is viewed from three categories: technological, organizational, and social. The purpose of digital transformation in the technology category is related to using new technologies such as social media and its additional applications. The meaning of digital transformation in an organizational context is associated with the adoption of new business models and changes to existing business processes within an organization. Meanwhile, the notion of transformation in the social aspect is related to the influence of digital transformation on human life. Specifically related to the technological part, the digital transformation of higher education means the development of universities and higher education institutions focused on applying technology (Chauca et al., 2021). The categories of digital transformation above imply how digital technology foster the adoption of new business model in higher education to have high impacts on human life. Based on research literature and government policy documents, they call for future research to explore the complex and non-linear links between government policies, HEIs' strategies, and critical internal and external stakeholders in the higher education sector.

Recent Development of HEIs Digital Transformation

Other researchers also conducted a literature study (Mhlanga & Moloi, 2020). The primary purpose of their study was to assess the influence of the Covid-19 pandemic in motivating digital transformation in the education sector in South Africa. For this purpose, document analysis and conceptual analysis of secondary data sources were used, such as journal articles, policy, reports from national and international organizations, and news articles. Results of analyses indicate that South African universities have experienced digital learning using online-remote learning tools, such as the Internet (Websites), YouTube, Skype, Microsoft Teams, WhatsApp groups, and Zoom. Several scholars (Arnold & Sangrà, 2018) conducted an exploratory literature review focusing on leadership for technology-enhanced learning (TEL) in higher education. The study was based on 49 articles published within the period of between 2013 and 2017.

Several scholars (Blayone et al., 2017; Bond et al., 2018; Martín, Acal, Honrani, & Estrada, 2021) conducted an empirical survey with the active participation of both students and lecturers or professors. More specifically, Martin et al. (2021) conducted a study with the active involvement of 398 students at the Faculty of Education Sciences of Granada University, Spain. The study's primary purpose was to ascertain students' perceptions regarding the pedagogical model adopted by lecturers during the virtual learning processes. The significant findings of the survey indicate that the teaching staff had an outstanding knowledge of digital tools for collaborative work and the administration of networked files, internet search engines, and office tools. However, the students considered that the lecturers lacked appropriate knowledge of visual and audiovisual pedagogy resources, such as image editors, video editors, computer graphics editors, anti-plagiarism tools, social forums, and networks. The study suggests improving these skills for

effective virtual teaching and learning.

Moreover, a multinational study with the active participation of 224 students and 20 professors in Ukraine indicates that overall, students and teachers experienced lower general readiness for successful functioning in a fully online collaborative learning community (Blayone et al., 2017). In this context, the competencies required for fully online collaborative learning are file sharing, collaborative editing, and self-expression. The primary collaborative tools are Dropbox, Google Drive, and Google Docs. Regarding readiness for interacting with digital information, the study found that only professors achieved an average score in accessing online articles; this means that the students had low capabilities for accessing, evaluating, and appropriating various learning materials.

Dimensions of HEIs Digital Transformation

The dimensions of HEIs digital transformation are teaching, curriculum, infrastructure, administration, research, human resources, business processes, governance, information, and marketing (Bond et al., 2018; Martín et al., 2021). More specifically, incorporating digital technologies in teaching and pedagogy is crucial for transforming various dimensions of higher education (Alenezi, 2021). Digital advancement in higher education has impacted not only organizational and structural levels but also curricula (Bond et al., 2018). It can be affirmed that digital technologies are essential to engage teaching and learning methods and enhance learning collaboration and engagement. Curriculum and digital literacy are other significant dimensions of HEIs digital transformation (Alenezi, 2021). These dimensions relate to establishing digital skills and modernizing the curriculum to prepare the students for their future employability. In this context, universities need to prepare students to be a highly skilled workforce with technological knowledge and skills which are required in the digital era.

By the digital literacies framework proposed by scholars (Handley, 2018), there are seven elements of digital literacies, namely: ICT literacy (adopting, adapting, and using digital devices and services), learning literacy (studying and learning effectively in a technology-rich environment), digital scholarship (participating in emerging academic professional and research practices that depend on the digital system), information literacy (finding, interpreting, evaluating, managing, and sharing information), media literacy (critically reading and creatively producing scholarly and professional communication in a range of media), communication and collaboration (participating in digital networks for learning and research), career and identity management (managing digital reputation and online identity). Moreover, digital transformation is also applied to infrastructure and administration dimensions. Infrastructure is the enabling factor of digital transformation in higher education (Valdés et al., 2021). More particularly, the required infrastructures for HEIs digital transformation are digital media for teaching, security, data, and university software (Martín et al., 2021).

Research Method

Bibliometric Method with NVivo

Scientometrics is the scientific and empirical study of science and its results, as well as the research field that studies scientific production to measure and analyze its evolution and impact (Abad-Segura, González-Zamar, Luque-de la Rosa, & Cevallos, 2020). They further clarify that bibliometrics is a part of scientometrics that aims primarily to provide information about the results of scientific activity. More specifically, bibliometric analysis applies mathematical and statistical methods to the scientific literature and to the authors that produce it to examine and analyze scientific production. In practice, the bibliometric method has been widely applied in scientific research and has contributed decades to revising knowledge in multiple disciplines. To search studies on higher education digital transformation, the keywords used to explore the papers in the Scopus database were “digital transformation” AND “higher education” AND “leadership.”

NVivo software has been widely used in the last decade for bibliometric studies (Gilmore, McAuley, Gallagher, Massiera, & Gamble, 2013; Schulze, Bals, & Johnsen, 2019; Vijayakumar, Morley, Heraty, Mendenhall, & Osland, 2018). NVivo certified expert and trainer awarded by QSR International (Bandur, 2019) affirm that NVivo is powerful for analyzing quantitative and qualitative data. The articles were classified in SPSS software in this study and then imported into NVivo for further bibliometric and content analyses.

Characteristics of the Sources

This paper was limited to analyzing the articles. These articles were classified into seven journal papers based on Emerald Publisher’s classification: Research paper, Viewpoint, Technical paper, Conceptual paper; Case study; Literature review; and General review. By the category, a research paper is

referred to a report of any research undertaken by the author (s), including The construction or testing of a model or framework, action research, testing of data, market research or surveys, empirical, scientific, or clinical research, and papers with a practical focus. Viewpoint papers include any piece where content depends on the author's opinion and interpretation, including journalistic and magazine-style essays. Technical reports refer to articles that describe and evaluate specialized products, processes, or services.

Meanwhile, conceptual papers are articles focusing on developing hypotheses and documents that cover philosophical discussions and comparative studies of other authors' work and thinking. Case studies are papers that describe actual interventions or experiences within organizations. It can be subjective and doesn't generally report on research. These papers also cover a description of a legal case or a hypothetical case study used as a teaching exercise. Literature review papers are limited to documents with the primary purpose of annotating and critiquing the literature in a particular field. It could be a selective bibliography providing advice on information sources, or the paper may aim to cover the main contributors to the development of a topic and explore their different views. General review papers provide an overview or historical examination of some concept, technique, or phenomenon. Essays are likely more descriptive or instructional ('how to' articles) than discursive.

For this literature review study, the papers were limited to: Art and Humanities; Business, Management, and Accounting; Economics, econometrics and finances; and Social Sciences. The pieces were limited to the Final publication phase: Article document type, Journal source type, and Papers written in English. Based on these criteria, there were 131 Scopus-indexed papers. Still, several journals were discontinued in Scopus, such as papers published in the International Journal of Scientific and Technology Research, Universal Journal of Educational Research, and International Journal of Higher Education, discontinued in Scopus as of 2020. Consequently, 125 Scopus-indexed papers were downloaded from the database to write this bibliometric pattern content analysis.

Qualitative Pattern Content Analysis

The papers were analyzed using the QCA analysis procedure with NVivo 12 Plus for Windows (Bandur, 2019). First, NVivo query techniques, including the "Word Frequency Query" and "Text Search Query," were used to identify and classify thematic unit analysis of leadership and digital transformation in higher education. In this stage, the "Word Frequency Query" was used to determine the most frequent words appearing in the papers, while the "Text Search Query" was frequently used to elaborate the contextual meaning of each topic or main word in the documents. These procedures are related to the steps of the thematic analysis procedure, namely data familiarization, initial code generation, theme searching, and theme naming (Braun & Clarke, 2008).

Second, NVivo Cluster Analysis was also applied to provide analytical categories of similar topics or contents of the papers. In the cluster analysis, the same units of text were grouped automatically by the software. These theoretical analyses resulted in five categories, which were grouped into three key themes. The saturation was reached in that all papers were allocated to the categories.

Result and Discussion

Global Trend of Publication

The papers included in the bibliometric analysis were published last decade, from 2012 until mid-April 2022. As shown in Figure 1, the paper publication between 2012 and 2015 was relatively stable, but there was a steady increase in journal paper publications between 2016 and 2019. However, there had been a dramatic increase in publication between 2019 and 2021, from only ten papers in 2019 to thirty-seven documents in 2020 and forty-two papers in 2021. By mid-April 2022, twenty-one papers were found in the Scopus database, which is predicted to be increased by the end of this year.

It is clear from the result of the publication trend that the Covid-19 pandemic has triggered the digital transformation in higher education. This result supports the previous studies. A qualitative study conducted in six universities in Jordan and Saudi Arabia (Amin Almaiah, Al-Khasawneh, & Althunibat, 2020) indicates that the Covid-19 pandemic has forced the universities to shift rapidly to digital transformation within the areas of distance and online learning. Similarly, other researchers (Tømte et al., 2020) assert that the Covid-19 health crisis undoubtedly impacts the adoption of digital technologies in Scandinavian HEIs. The governments declared the locked-down policy at a global level and in many countries. Accordingly, states and university academic authorities decreed that digital teaching and learning processes would be carried out digitally (Martín et al., 2021).

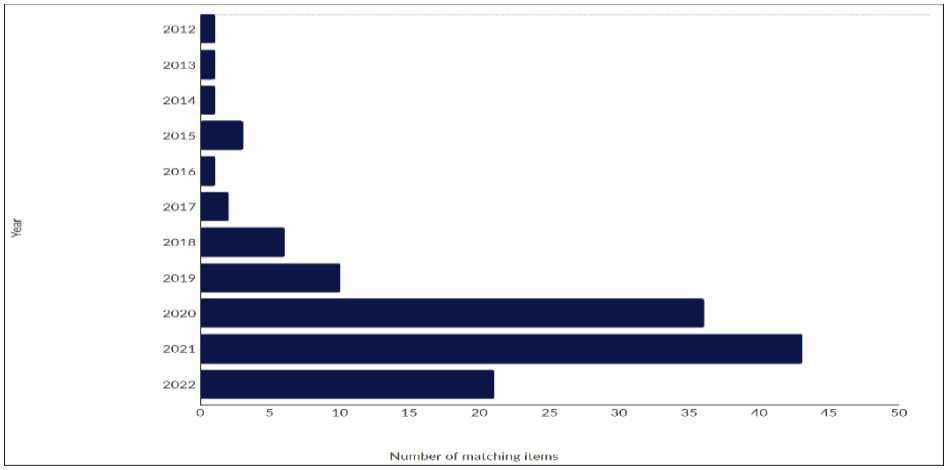

Figure 1. Global trend of publication

Research Methods of Studies in HEIs Digital Transformation

It was considered crucial to identify the research designs and methods of previous studies to be a basis for analyzing the methodological strengths and deficiencies in earlier studies on HEIs digital transformation. Overall, Figure 2 presents the result of bibliometric analysis with NVivo software.

Figure 2 presents the total number of previous studies (N = 125) by the research designs and methods employed in the papers. Forty-two percent (53 articles, N = 125) of the previous studies were based on quantitative studies. Subsequently, twenty-eight percent of the studies were based on literature reviews or meta-analytic studies. Then, twenty-three percent of earlier studies on HEI digital transformation were conducted using qualitative research. Only a small amount of papers were based on mixed-methods research (6%). The result of the bibliometric analysis indicates that a deficiency of methods was found in these studies. It then implies a calling for not just applying mono-method research in future studies but more using mixed-methods analysis. This calling is in line with the suggestion of other scholars (Tay & Low, 2017) that because of the limitation of research design and methods in their study, they recommend future studies apply both quantitative and qualitative research. Similarly, the limitation of a recent qualitative study (Marín et al., 2022) on the faculty perceptions and awareness of using open educational resources for teaching and learning in higher education requires further research to apply mixed methods.

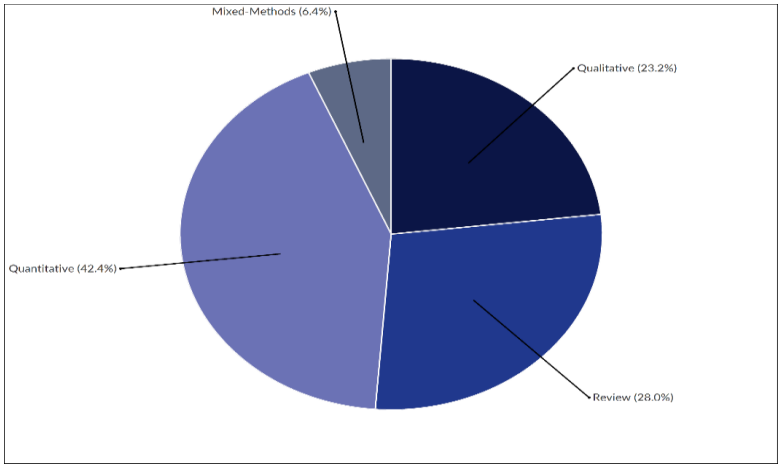

Figure 2. Research design of previous studies

Geographical Distribution of Publication

The geographical distribution of publication refers to the country of origins of previous studies on HEIs digital transformation (see Fig. 3). Figure 3 shows the geographical distribution or country origins of the studies. Apart from 23% of the articles (N = 125) whose origins were not applicable due to the nature of these papers as review studies, most of the research papers were published in developed countries such as Germany (Arnold, Vogel, & Ulber, 2021; Bond et al., 2018; Findeisen & Wild, 2022; Renz & Hilbig, 2020); the United States of America (Haggans, 2015; Herron & Wolfe, 2021); the United Kingdom

(Handley, 2018); Australia (Hardy & McKenzie, 2020; Parkes, Stein, & Reading, 2015), Portugal (Reis et al., 2018; Teixeira, Gonçalves, & Taylor, 2021). This finding implies future research to conduct empirical studies on higher education digital transformation in developing countries.

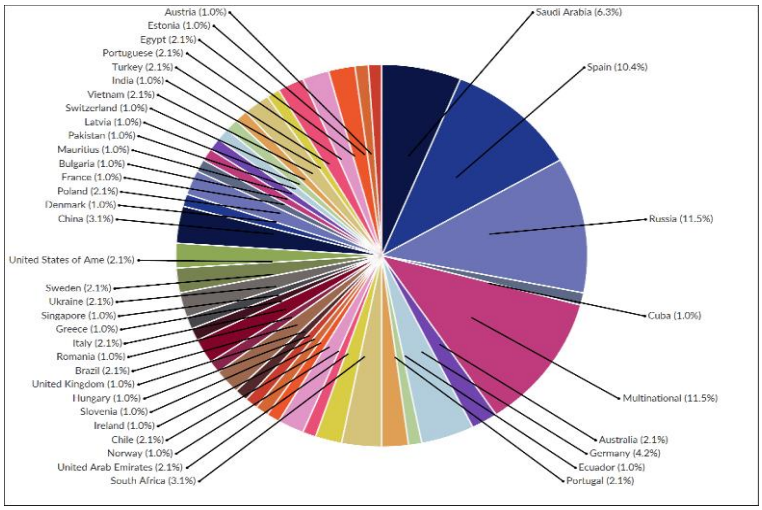

Figure 3. Geographical distribution of previous studies

Publishers of the Journals

Figure 4 presents the Publishers of the Journals that published articles on digital transformation in higher education. Overall, the articles on higher education digital transformation have been published in fifty publishers. Most of these publishers are corporate-based, such as Emerald, Elsevier, Springer, Taylor, and Francis, but other publishers are developed at either faculty or university levels. More particularly, twenty percent (21%, N = 125) of the journal articles were published by the Multidisciplinary Digital Publishing Institute (MDPI) Switzerland, explicitly referring to Sustainability.

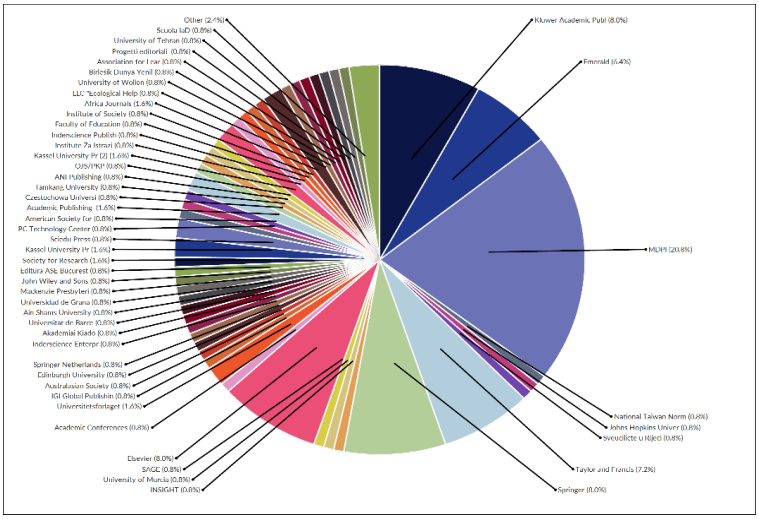

Figure 4. Publishers of the journal articles

Twenty-five percent (25%) of the papers were published by Springer (9%), Elsevier Ltd (8%), and Kluwer Academic Publishers (8%). Meanwhile, twelve percent (12%) of the total articles were published by Emerald Group Publishing Ltd (6%) and Taylor and Francis Ltd (7%). Nine percent (9%) of the Scopus-indexed articles on higher education digital transformation were published by the Kassel University Press (3%), the Academic Publishing House Researchers (2%), Africa Journals (2%), and the Society for Research and Knowledge Management (2%). The findings indicate how the higher reputable journals have accommodated scientific publications on higher education digital transformation.

Quartiles of the Journals

Figure 5 presents the quartile ranking of the journals in which papers on higher education digital transformation have been published. Forty-two percent of previous studies on HEIs digital transformation have been published in quartile two journals. Thirty-eight percent of these papers were published in quartile-one journals. Only a small amount of documents were published in quartile-four journals (5%) and quartile-three (15%). The result indicates that scholars in digital transformation are publishing widely in reputable international journals.

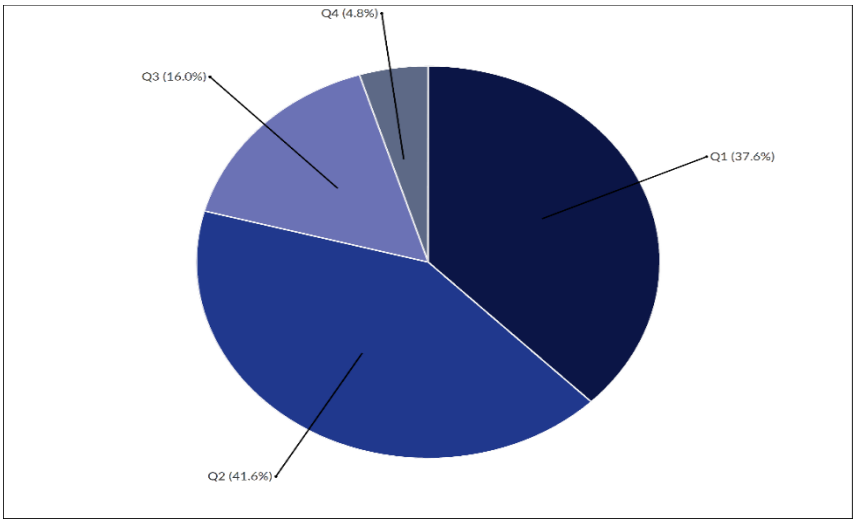

Figure 5. Quartiles of the Journals

Results of Pattern Content Analysis

Table 1 presents the Scopus journal publishing articles on digital transformation in higher education. Seventeen papers (14%, N = 125) were published in Sustainability Journal, and ten papers in education and Information Technologies published ten papers (8%)pers (5%) were published in the International Journal of Educational Technology in Higher Education. The Education Sciences published five papers (4%). Above all, studies on higher education digital transformation over the last ten years have been published in eighty journals worldwide.

Table 1. Scopus journal publishing articles (2012-2022)

Journals	Frequency	Percentage
Academic Conferences and Publishing International	1	.8
Academy of Entrepreneurship Journal	1	.8
Advances in Engineering Education	1	.8
African Journal of Hospitality, Tourism and Leisure	2	1.6
Ain Shams Engineering Journal	1	.8
Amfiteatru Economic	1	.8
Australasian Journal of Educational Technology	1	.8
Business Process Management Journal	1	.8
Competitiveness Review	1	.8
Computer Standards & Interfaces	1	.8
Computers and Education	1	.8
Computers in Human Behavior	1	.8
Digital Education Review	1	.8
Distance Education	1	.8
Eastern-European Journal of Enterprise Technologies	1	.8
Economic Annals-XXI	1	.8
Education and Information Technologies	10	8.0
Education Sciences	5	4.0
Educational Philosophy and Theory	1	.8
Educational Technology and Society	1	.8

Electronic Journal of Knowledge Management	1	.8
Empirical Research in Vocational Education and Training	1	.8
Eurasian Journal of Educational Research	1	.8
European Journal of Contemporary Education	2	1.6
Frontiers in Education	1	.8
Industry and Higher Education	1	.8
Information and Organization	1	.8
Information Sciences Letters	1	.8
Information Systems Management	1	.8
Interaction Design and Architecture(s)	1	.8
International Information and Library Review	2	1.6
International Journal of Educational Management	3	2.4
International Journal of Educational Technology in Higher Education	6	4.8
International Journal of Emerging Technologies in Learning	3	2.4
International Journal of Engineering Pedagogy	1	.8
International Journal of Entrepreneurial Behavior and Research	1	.8
International Journal of Environmental Research and Public Health	1	.8
International Journal of Higher Education	1	.8
International Journal of Humanities and Arts Computing	1	.8
International Journal of Information and Education Technology	1	.8
International Journal of Information Technologies and Systems Approach	1	.8
International Journal of Innovation and Learning	1	.8
International Journal of Instruction	1	.8
International Journal of Learning and Change	1	.8
International Journal of Learning, Teaching and Educational Research	2	1.6
International Journal of Productivity and Performance Management	1	.8
International Journal of Web-Based Learning and Teaching Technologies	1	.8
International Journal on Advanced Science, Engineering and Information Technology	1	.8
Internet and Higher Education	1	.8
Journal of Academic Librarianship	1	.8
Journal of Applied Engineering Science	1	.8
Journal of Business Research	1	.8
Journal of Digital Learning in Teacher Education	1	.8
Journal of Futures Studies	1	.8
Journal of Strategic Information Systems	1	.8
Journal of the Australian Library and Information Association	1	.8
Journal of Theoretical and Applied Electronic Commerce Research	2	1.6
Journal of University Teaching and Learning Practice	1	.8
Nordic Journal of Digital Literacy	2	1.6
On the Horizon	1	.8
Open Review of Educational Research	1	.8
Perspectives of Science and Education	1	.8
Polish Journal of Management Studies	1	.8

Publicaciones	1	.8
Publishing Research Quarterly	1	.8
Qwerty	1	.8
Research and Practice in Technology Enhanced Learning	1	.8
Research in Learning Technology	1	.8
Revista de Administracao Mackenzie	1	.8
Revista de Educacion a Distancia	1	.8
Society and Economy	1	.8
Sustainability	17	13.6
System	1	.8
Systems Research and Behavioral Science	1	.8
Technological Forecasting & Social Change	1	.8
Technology, Pedagogy and Education	1	.8
TechTrends	2	1.6
Journal of Information Technology Management	1	.8
World Journal on Educational Technology: Current Issues	1	.8
Zbornik Radova Ekonomskog Fakultet au Rijeci	1	.8
Total	125	100.0

Main Themes of HEIs Digital Transformation

The NVivo 12 software was used to visualize a pattern content analysis to extract distinct themes within the higher education digital transformation. First, the analysis using NVivo Word frequency was used to identify possible themes by examining the most frequently used words. Fig. 6 presents the most frequent words within the last decade of literature in varying font sizes. In this context, the most frequently occurring words have a larger font size.

Figure 6. World-cloud frequency query result

As presented in Figure 6, the main themes were indicated by words: digital (frequency word count (WFC) 10.288; weighted percentage (WP) 1.35), education (WFC 7.164; WP 0.94), learning (WFC 6.706; WP 0.88), research (WFC 4.073; WP 0.53), university (WFC 4015; WP 0.53), students (WFC 3926; WP 0.51), transformation (WFC 3.229; WP 0.42); information (WFC 3.068; WP 0.40), technology (WFC 2.999; WP 0.39), online (WFC 2.524; WP 0.33), teaching (WFC 2.399; WP 0.31); development (WFC 2.267; WP 0.30); management (2.157); WP 0.28), innovation (WFC 2.001; WP 0.26), systems (WFC 1.765; WP 0.23); business (WFC 1.691; WP 0.22); process (WFC 1.650; WP 0.21); model (WFC 1.635; WP 0.20); skills (WFC 1.196; WP 0.16), change (WFC 1.151; WP 0.15); sustainability (WFC 1.135; WP 0.15); leadership (WFC 1.133; WP 0.15), value (WFC 1.086; WP 0.14), resources (WFC 1.070; WP 0.13), training (WFC 963; WP 012), challenges (WFC 9.20, WP 0.11).

HEIs Digital Transformation and Leadership

Table 2 shows the authors who have linked higher education digital transformation with leadership. HEIs digital transformation has just been related to the administration since 2018. For instance, researchers (D. Arnold & Sangrà, 2018) conducted an exploratory review to explore the specific concept

of e-leadership as well as leadership and organizational change for technology-enhanced learning (TEL) in higher education. For the study, they reviewed the literature of 49 articles from 2013-2017. The findings indicate that none of the empirical studies identified in the literature refer explicitly to e-leadership. However, exciting insights in the theoretical articles highlighted different interpretations of the concept. Accordingly, they called for further multidisciplinary research in the fields of educational management and educational technology, focusing on values, strategy, organization, and leadership, as well as public policy and leadership development for TEL in higher education.

Table 2. Digital transformation and leadership by authors

First/Single Author and Year	Frequency	Coverage
Alba Carvalho (2022)	11	1.31%
Mohammed Ashmel (2022)	2	0.02%
Yngve Røe (2021)	3	0.04%
G.Rodríguez-Abitia (2021)	15	0.13%
Marita McPhillips (2021)	1	0.01%
Mario Chauca (2021)	1	0.02%
Francisco D. S. Luna (2021)	15	0.11%
Luis M. Cerdá Suárez (2021)	7	0.05%
Marcin Lis (2021)	1	0.01%
Karen Núñez Valdés (2021)	19	0.09%
F.J. García-Peñalvo (2021)	1	0.01%
Ignacio Carnicero (2021)	25	0.12%
Josh Herron (2021)	2	0.02%
Gerald Midgley (2021)	8	0.02%
Francisco M.Perez (2021)	4	0.02%
Rajaraman Eri (2021)	1	0.01%
Cornelia Connolly (2021)	1	0.01%
Carlos Hervás-Gómez (2021)	8	0.07%
Lykke Bertel (2021)	2	0.03%
Andreia F. Teixeira (2021)	2	0.02%
Abdulaziz Alhubaishy (2021)	2	0.02%
Mamdouh Alenezi (2021)	4	0.04%
Malcolm Wolski (2020)	19	0.12%
Tommaso Agasisti (2020)	1	0.01%
Ali Murad Syed (2020)	1	0.01%
André Renz (2020)	1	0.01%
Osmar A. Bonzanini (2020)	1	0.01%
Maria José Sá (2020)	47	0.41%
Hera Antonopoulou (2020)	320	2.64%
Amy Hardy (2020)	1	0.01%
Junhong Xiao (2019)	1	0.01%
Gregory Vial (2019)	11	0.03%
Huub Ruel (2019)	112	0.94%
Mingzhuo Liu (2019)	5	0.05%
Alina Ruiz Jhones (2019)	4	0.05%
Bob Hinings (2018)	3	0.02%
Fiona J. L. Handley (2018)	4	0.05%
Marlen G. Arnold (2018)	301	1.47%

Similarly, other researchers (Antonopoulou, Halkiopoulos, Barlou, & Beligiannis, 2020) conducted quantitative research on effective leadership for HEIs digital transformation. The primary purpose of their study was to examine the associations between leadership types (change and transactional leadership) and leadership outcomes. The leadership outcomes were measured by the degree of motivation provided by the leader, the interaction of the leader at the various university levels, and the degree of satisfaction resulting from the leader's working methods and collaboration. They found that effective digital leadership is correlated with transformational leadership. A higher degree of transformational leadership implies greater efficiency and satisfaction of university senate members.

Studies in the last decade on digital transformation in higher education underline three significant issues to be discussed. First of all, it is no doubt to state that with the turn of the 21st Century, with specific reference to the Covid-19 pandemic, higher HEIs leaders must be ready to transform university activities into a digital operation model. The Covid-19 pandemic has had an impact on the implementation of digital transformation for universities around the world. In this context, the International Association of Universities (2020) surveyed the impact of Covid-19 on higher education involving universities in 409 countries across five continents (Africa, America, Asia, Pacific, and Europe). One of the significant findings is that Covid-19 impacts the teaching and learning process. Almost all universities replace face-to-face lectures with distance learning. At the same time, Covid-19 brings new opportunities in the field of education and teaching, namely the formation of a flexible learning system, exploration of blended or hybrid learning, and a mixture of synchronous and asynchronous learning. The survey results also show that 60% of universities stated that Covid-19 had increased virtual mobility and online learning collaboration.

Furthermore, leadership and digital capabilities are required to implement a digital transformation effectively. Several researchers (Hashim et al., 2022) assert that sustainable digital transformation requires leadership to develop digital transformational capabilities for an effective operation of universities' business sustainability. Other scholars pinpoint that university leaders need to encourage higher education teaching reform and increase lecturers' technological skills (Roe, Wojniusz, & Bjeerke, 2022). Recently, other scholars have conducted a literature review to explore the links between leadership styles and digital transformation in state higher education (Carvalho, Alves, & Leitão, 2022). Based on previous publications indexed in the ISI Web of Science and Scopus databases, their review reveals that transformational leadership is the most common style in the articles.

Leadership constraints are considered one of the predominant factors that hold back the digital transformation of universities (Rodríguez-Abitia & Bribiesca-Correa, 2021). In this context, from the perspective of organizational dimensions, education appears to be the industry with the lowest scores for digital transformation. The manufacturing industry leads the digital transformation, followed tightly by the commerce and service industries. More specifically, the lowest scores for education were the ones referring to leadership and culture. This implies that universities have strict chains of command, high bureaucracy, and a lack of empowerment at all levels. Meanwhile, the cultural components of academia are related to resistance to change and little or no initiative regarding organizational decisions. These facts contradict the universities' centers for free thought and reflection, questioning, and knowledge creation. But these characteristics might apply especially to purely academic practice, not business processes, innovation, and techniques. Accordingly, building suitable leadership for higher education digital transformation is crucial.

Higher education's leadership capabilities and digital capabilities have been considered critical dimensions of digital masters (Luna & Breternitz, 2021). They then categorized four clusters of universities based on universities' leadership and digital capabilities, namely, blue cluster, green cluster, yellow cluster, and red cluster. The blue cluster refers to universities with high digital and leadership capabilities. Recommendations to this cluster are to better document the digital transformation processes and to create more formal control means for monitoring the indicators of both digital and leadership capabilities. Then, the green cluster universities are referred to as institutions with evolving digital capabilities and well-structured leadership skills. The major characteristic of this type of university is the inconsistency between planning and technical implementation. In this case, even though the technology had already been implemented, there is no proper management or measurement of the results obtained. Moreover, the technologies are implemented over time, but there is no integration with other systems. Recommendations for these institutions are to review the mission and guidelines of the digital transformation process and to devote more time to planning the technology implementation for more excellent user value.

Furthermore, the yellow cluster of universities is referred to as higher education institutions with growing digital capabilities but limited leadership capabilities. Recommendations are to elaborate specific digital transformation plans, define digital transformation goals and indicators, and seek investments in existing technologies for increasing performance. Lastly, the red cluster refers to universities still struggling to develop digital capabilities and to try to justify the board of directors. This means that these higher education institutions have limited leadership capabilities and lack directions about the impacts of technology on the universities' future. Recommendations are to review universities' internal processes to find digital opportunities, develop specific planning for digital transformation, and find internal leaders to provide contemporary agile management models.

Conclusion, Suggestions and Limitations

This study concludes that although higher education transformation has been widely studied, there have been enormous research gaps. Further research direction could be taken, such as examining the impacts of digital change on higher education digital business models. Further research is needed to develop a digital transformation framework model that integrates administration, the teaching-learning process, research, and community services at HEIs. Accordingly, digital platforms strategy needs to be studied in-depth to develop various ways of current online or digital learning methods using multiple digital technology applications. These technological tools are aimed at strengthening research, teaching, and community services and helping students attain excellent performance and achievements.

Further research direction could also be taken, such as examining the effect of digital transformation on academic organizational efficiency and spending efficiency with particular reference to the provisions of university electronic services. Besides, given the current literature that little is known about how digital transformation impacts the business model of higher education institutions, future research is needed to explore how digital transformation changes the digital business model innovation of HEIs. This study implies that higher education policymakers provide regulations and policy support for implementing digital transformation in higher education institutions. On the part of university leadership and management, this study could be an academic reference for moving forward with digital transformation.

Beyond the several contributions of this bibliometric-pattern content analysis, the study has several limitations. Firstly, the review has been limited to Scopus-indexed journal articles. Therefore, it excludes other studies published in conference proceedings and books, indexed by the Scopus database and other databases such as the Web of Sciences and Google Scholar. Secondly, the search strategy comprised two main key phrases, “digital transformation,” “higher education,” and “leadership.” Therefore, it might have missed other scholarly papers with different keywords. Finally, this review has focused on Art and Humanities; Business, Management, and Accounting; Economics, econometrics and finances; and Social Sciences. Other papers in the areas of, i.e., computer science and engineering, were excluded from the review.

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