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University of Eldoret, Kenya, Mount Kenya University, Kenya; Chukwuemeka Odemegwu Ojukwu University, Nigeria; Kyambogo University, Uganda and University of Makeni, Sierra Leone.

A systematic review of digital innovation in Higher Education Institutions in developing countries

Ruth Nthenya Wambua
School of Science and Technology, United States International University-Africa, Nairobi, Kenya
*Corresponding Email: ruwambua@usiu.ac.ke

Abstract

Among the United Nations' sustainable development goals is quality education, to ensure inclusive and equitable education and promote lifelong learning opportunities for all. Ensuring that all men and women have equal access to high-quality, reasonably priced technical and vocational education, as well as university education, is one of the goals. Universities are Higher education institutions (HEIs), and they have continued to experience immense digital innovations thanks to Information and Communication Technology (ICT) infiltration and advancements. Along with this, the premise of this systematic literature review is that, although research on digital innovation is growing, few studies are available on its consequences in developing countries, specifically on higher education institutions. Further, there is a strong argument for comprehending the body of research on this topic, especially when considering learning and teaching, stakeholder involvement, and research as cornerstones of education that are still undergoing the digital revolution. Therefore, the purpose of this review is to synthesize existing knowledge about digital innovation in HEIs in developing nations and to suggest a research agenda based on updated theoretical thinking to fill in knowledge gaps. Peer-reviewed journal publications for the past ten (10) years (2013-2022) were analyzed to inform the current trends and identify research opportunities. To expand knowledge of how digital innovation is evolving in developing countries' higher education institutions, this study specifically examines the existing body of information about digital innovation in higher education institutions in developing nations, as well as the research possibilities that exist to expand on this body of knowledge.

Keywords: Digital Innovation; Higher Education Institutions; Digital Transformation, Systematic Literature Review; Developing Countries

INTRODUCTION

Higher Education Institutions have in the digital innovation an opportunity to reduce the severity and intensity of poverty in developing countries, as well as offer the necessary tools and skills to face global problems of income disparities, health quality, education quality, and environmental crises, among others, (Díaz-Parra *et al*., 2022; Bogdandy *et al*., 2020; Bogers *et al*., 2022). Following COVID-19, there has been substantial work on digital transformation in HEIs, whereby educational processes, business models, and products continue to significantly adapt to technological changes (Aguirre *et al*., 2022; Rof *et al*., 2020; Marks *et al*., 2020; Ojutkangas *et al*., 2022). Institutions are greatly exploiting digital technologies for competitive advantage. Innovations' primary objectives are to raise standards, cut expenses, boost customer happiness, and make businesses more competitive, and the use of contemporary technology makes it possible to accomplish these objectives (Schmuck and Benke, 2020; Jo, 2022; Gardanova *et al*., 2020).

Digital innovation is a process (Serugendo and Friha, 2021; Mabić *et al*., 2022), and is influenced by many factors, among them the level of development in a country (Georgescu *et al*., 2022). For instance, while digital transformation is well rooted in businesses and governments of the developed worlds, whereby they have developed sophisticated techniques and are using technologies to create products and to deliver valuable services, other developing countries are still attempting to move from desire and ambition to planning, development, and delivery (Marks *et al*., 2020;

Kolade *et al*., 2022). Furthermore, the context of developing countries presents certain challenges to Information and Communication Technologies (ICTs) and necessitates different technologies and implementation approaches, which introduces the concept of frugal innovation to ICT for Development (ICT4D) research, arguing that innovation in a resource-constrained context is accomplished by doing more with less (Nielsen, 2017).

Notable highlights of digital innovation in Higher Education Institutions include competencies such as digital technologies access, internet access, and knowledge of key digital learning applications (Vishnu *et al*., 2022; Gardanova *et al*., 2020; Latifah *et al*., 2022). Further, digital development and diversification have led to emerging technologies of artificial intelligence (AI), internet of things (IoT), blockchain, cloud computing, big data analysis, e-commerce and a series of technological applications (Chen *et al*., 2022; Akter *et al*., 2022), as well as pedagogy switching to online (Nermend *et al*., 2022; Lytras *et al*., 2022), and with a majority of learners accessing online content mostly using smartphones, and other gadgets like laptops, tablets, and desktops (Vishnu *et al*., 2022). On the other hand, are innovative tools. According to Stecuła and Wolniak (2022), these tools include well-known e-learning-friendly services and programs like YouTube, Skype, Discord, and Facebook; and other e-learning-friendly programs for synchronous and asynchronous interactions like Microsoft Teams (MS Teams), Click Meeting, Google Classroom, Zoom, e-learning platforms, and email. Further, relevant support and guiding policies also impact innovation (Huang *et al*., 2022; Chen *et al*., 2022; Rafiq *et al*., 2021; María *et al*., 2017), as well as national standards regarding technical platforms (Liu *et al*., 2019), which also positively impact other economic sectors (Teixeira *et al*., 2021; Bonzanini *et al*., 2020).

On the other hand, digital innovation is impactful in many ways. First, online education is a feasible alternative that offers students more flexibility to ensure the development of generic and specific skills (Portnoy *et al*., 2022). Secondly, digital innovation in HEIs leads to the transformation of actors and dimensions, such as Learning and teaching, research, as well as human resource, and related processes (Castro Benavides *et al*., 2020; Wang, 2021; Giang *et al*., 2021; Arshad *et al*., 2014). In all these factors, data-related procedures and operations greatly inform innovation (Tungpantong *et al*., 2022).

Among the theories in studying digital innovation is Schatzkian practice theory which explains the contextuality of platforms and technologies and their intrinsic dynamism because of their interdependence with the social practices of which they are a part (Lanamäki *et al*., 2020). There is the socio-technical theory which focuses on the idea of technological change as a composite of technical and human factors that shape it (Kolade and Owoseni, 2022). Additionally, the Diffusion of Innovation Theory and the Technology Acceptance Model explore the factors necessary for technological acceptance as well as the dispersion and permanence of the resulting innovation (Rof *et al*., 2022). Other noted related theories include resource-based theory, dynamic capability theory, and competitive strategy to explore digital transformation strategy, culture, leadership, and organization; Transaction cost theory to explore the operations management of emerging technologies; Information System (IS) success theory, and sociomateriality of Information Technology (IT), to explore technology infrastructure, privacy, and security of digital transformation; and IT business value to explore the business value (Akter *et al*., 2022).

However, even in the wake of digital innovations in HEIs, advances such as learning objects and other technologies continue to expand the scope of possibilities with which educational institutions must grapple to ensure effective education, majorly within HEIs in developing countries. For instance, some technologies may require more sophisticated infrastructure and ICT competencies, which might not be available or evenly distributed among students in different geographical areas and with varying economic statuses (Rof *et al*., 2022; Antwi-Boampong, 2021). Additionally, exposure to these innovations is required to enhance awareness and use (Raphael, 2022). Also, the ability to purchase appropriate electronic devices, the accessibility of internet connectivity, and technological know-how and skills are all

factors that limit digital innovation in developing nations (Mavuru *et al*., 2021). Other significant difficulties include immediate focus and inadequate prioritizing, decentralized decision-making, internal resistance, faculty members' lack of digital literacy, and a limited perspective on Return on Investment (ROI) (Alenezi, 2021).

Researchers and academics have reviewed a lot of the general literature on digital transformation (Kuldosheva, 2021; Kohli & Melville, 2019; Serugendo & Friha, 2021). Previous research on digital innovation in HEIs focused on digital transformation enablers (Marks *et al*., 2020; Omorede, 2023; Seyam *et al*., 2021; Kamsker *et al*., 2020), and outcomes (Zhashkenova, 2021; Saddiqa *et al*., 2021). Other studies looked at varied analyses and reviews of digital innovation (Díaz-García *et al*., 2022; Kohli & Melville, 2019; Bogdandy *et al*., 2020; Bogers *et al*., 2022), and digitization challenges (Yureva *et al*., 2020; Fleaca *et al*., 2022; Aguirre *et al*., 2022). In addition, several other studies reviewed digital technologies and methods that inform the transformations, (Katyeudo & de Souza, 2022; Wambua, 2023).

Digital technologies have a positive influence on Higher Education Institutions, and creates access to new opportunities, such as improved access to talent and skills, expanded access to financing, improved communication and teamwork, and increased access to technologies and applications, sizeable educational development, and enhanced student engagement. Consequently, digital technologies are institutional enablers. Despite the potential advantages of digital technologies, HEIs in developing nations are hesitant to participate in digital innovation or do not reap the rewards of new technologies. Moreover, knowledge about digital innovation in HEIs remains vague, despite the lots of reviewed literature.

This systematic literature review is, therefore, based on the claim that, while research on digital innovation is expanding, research on its effects in the contexts of developing countries is scarce (Kolade *et al*., 2022, and in this case, on Higher Education Institutions. Considering learning and teaching, stakeholder engagement, and research, as pillars of education that continue to experience digital innovation, there is a compelling case for understanding the existing literature on this subject (Forliano *et al*., 2021). Against this backdrop, this study, therefore, is a systematic review of literature on digital innovation in HEIs in developing countries, to inform scholarship and provide an informed sense of direction. Specifically, the study answers the following research questions:

What is known about digital innovation in HEIs in developing countries?

What are the research opportunities to enhance current knowledge of digital innovation in HEIs in developing countries?

This study includes the method process. Thereafter, a presentation of the results and discussion, and ends with the conclusion and recommendation section.

METHODOLOGY

A systematic literature review uses a process that is scientific, repeatable, and replicable to gather data on a particular topic by carrying out a series of tasks in the study. For this specific case, the topic is related to digital innovation in HEIs in developing countries. For the period 2013 to 2022, this study follows the Kitchenham approach for review (Kitchenham, 2007).

Data sources

The search was conducted using the electronic databases EBSCOhost and Science Direct, for their in-depth publications within the scientific discipline and for having publications that most related to the study area. Moreover, both databases allowed for advanced searches using logical operators.

Search strategy

The search strategy aimed at answering the research questions on what is known about digital innovation in HEIs in developing countries, and what were the research opportunities to enhance current knowledge of digital innovation in HEIs in developing countries. To do so, the search string ("digital innovation*" OR digital transformation*) AND ("higher education institution*" OR universit*) AND ("developing count*") was used.

Study selection and screening

The literature search was performed by looking at the keywords in the title of the articles. The number of results retrieved was analyzed to gather the papers that were relevant to this research topic only. Studies were screened and selected using publication type; publication period; language; relevance; and geographical location, to guide the inclusion and exclusion criteria. The included studies were peer-reviewed journal articles where full-text was available; articles published within the past 10 years (2013 to 2022); articles reported in English to avoid bias, by recognizing this language as the universal language; articles whose focus was on digital innovation in HEIs in developing countries; and studies that focussed on developing countries.

Data extraction

The tools used to code, manage data, and analyze articles information, and for reference management, were Microsoft Excel and Mendeley respectively. Mendeley was used to manage all resulting articles from the search, and to eliminate any noted duplicate references., whereas Microsoft Excel was used to document, code, and manage the data. The coded categories included: Journal, author(s), and publication year; Study location; Research theme (main idea behind the research study); and Methodology (research method used).

RESULTS AND DISCUSSION

The study's results and discussion are presented in relation to research questions. The first research question sought to understand what was known about digital innovation in HEIs in developing countries. To answer this question, we explored different categories as follows:

Development of the literature

In this category, we presented the number of papers published per year within the study period (2013-2022) and the journals that the authors(s) published in.

The total number of publications in the study period was 30. The highest number of publications was 15 in the year 2022, followed by 7 publications in the year 2021, and 5 publications in 2020. Previously, between 2013 and 2019, very few related publications were noted, with only one publication in the year 2014, 2017, and 2019, whereas the rest of the years (2013, 2015, 2016, and 2018), had none, as shown in Fig. 1 below. Such a result indicates that there has been an increase in research related to digital innovation in HEIs in developing countries since the year 2020, and the growth trend continues.

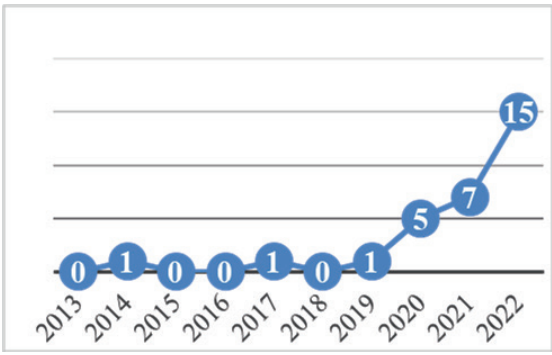

Figure 1. Publication count per year

Regarding the publication outlets, Fig. 2, the majority of the papers were published in unique journals. From the 30 reviewed articles, we had 15 journals publishing a single article each, whereas 3 journals published 2 papers each, and another 3 journals published 3 articles each. Consequently, the following were the journals with the most publications in this study: Education Sciences; Journal of Innovation and Knowledge; and Procedia Computer Science.

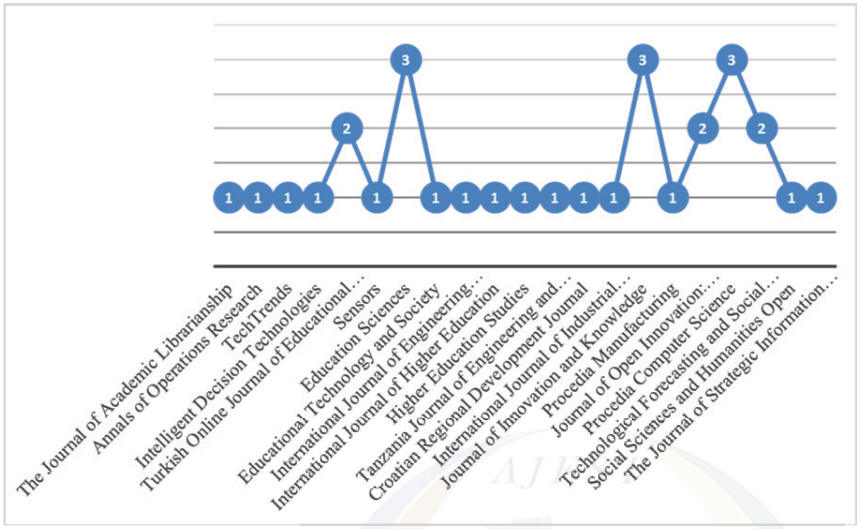

Figure 2. Publication journal outlets used

Based on country, China, Colombia, and Poland had researchers investigating the context of digital innovations in HEIs compared to other developing countries.

Research trends observed

This was addressed through an evaluation of the research focus, and the methodologies adopted. In line with HEIs, reviewed articles highlighted varied aspects of digital transformation and innovation in HEIs, among them, being, readiness and acceptance (Giang *et al*., 2021; Latifah *et al*., 2022; Kolade *et al*., 2022), adoption (Tungpantong *et al*., 2022; Antwi-Boampong, 2021), implementation of digital transformation (Raphael, 2022; Arshad *et al*., 2014; Castro Benavides *et al*., 2020; Bonzanini *et al*., 2020; Alenezi, 2021; Teixeira *et al*., 2021), strategies, technologies and

techniques (Schmuck and Benke, 2020; Mavuru *et al*., 2021; Gardanova *et al*., 2020; María *et al*., 2017; Akter *et al*., 2022), and the influence of COVID-19 pandemic (Stecuła and Wolniak, 2022; Rafiq *et al*., 2021; Rof *et al*., 2022; Lytras *et al*., 2022; Portnoy *et al*., 2022; Vishnu *et al*., 2022), among other related issues of digital innovation.

On the other hand, methodologies applied in the reviewed articles were either qualitative or quantitative, as shown in Fig. 3 below. There was no case of mixed-methods research.

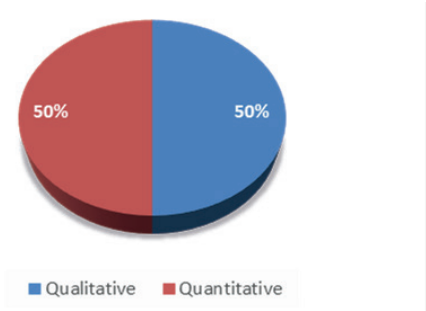

Figure 3. Research methodologies used

Qualitative research methods used included in-depth interviews, document reviews, case studies, and observation, whereas quantitative research methods used were mainly questionnaire surveys.

The second reseach question for this study was to find out the research opportunities available to enhance current knowledge of digital innovation in HEIs in developing countries. To start with, digital innovation in HEIs in developing countries seems to have increased following the COVID-19 pandemic of 2020. Faced with the challenge of lockdowns and other enforced restrictions over the pandemic period, most HEIs resulted to technology and digital innovation to uphold their businesses. As of the year 2020, there were notable pandemic-accelerated digital innovations in most HEIs, among them the development and operation of massive open online courses (MOOCs) (Liu *et al*., 2019), the adoption of blended learning (Antwi-Boampong, 2021), and distance learning (Gardanova *et al*., 2020), as well as reviews structured to inform, desired digital innovations in HEIs in developing countries (Castro Benavides *et al*., 2020; Gardanova *et al*., 2020). Progressively, researchers are reviewing the responses from digital innovation (Rafiq *et al*., 2021; Teixeira *et al*., 2021; Antwi-Boampong, 2021; Mavuru *et al*., 2021; Tungpantong *et al*., 2022; Vishnu *et al*., 2022; Portnoy *et al*., 2022), as well as reviewing related factors like digital transformation readiness, implementation, and adoption (Tungpantong *et al*., 2022; Raphael, 2022; Latifah *et al*., 2022; Lytras *et al*., 2022).

Based on the publication outlets, most articles appeared in unique journals and the journal with the most articles in this review had a total of 3 articles. This could mean that more research targeting digital innovation in HEIs in developing countries is required. Further, research targeting most developing countries would go a long way in advancing noted digital innovations in these countries (Antwi-Boampong, 2021; Nermend *et al*., 2022).

On the other hand, considering the research trends observed, developing countries would benefit from the review and implementation of highlighted issues towards digital innovation. Further, such research would guide and inform institutions desiring to implement an innovation that is already working and is reported from another institution. For instance, digital innovation strategies, technologies, and techniques (Schmuck and Benke, 2020; Mavuru *et al*., 2021; Gardanova *et al*., 2020; María *et al*., 2017; Akter *et al*., 2022), as well as factors that influence adoption (Tungpantong *et al*., 2022; Antwi-Boampong, 2021), among other related matters around digital innovation in HEIs in developing countries.

CONCLUSION AND RECOMMENDATION

This study conducted a systematic literature review to better understand the research landscape of digital innovation in HEIs in developing countries and identified 30 articles published between 2013 and 2022. The articles were selected, reviewed, categorized, and analyzed to address the research questions on what was known about digital innovation in HEIs in developing countries; and what were the research opportunities to enhance current knowledge of digital innovation in HEIs in developing countries.

The results of this review highlight a need for more publications in the study area covering most developing countries. This is evidenced by the few publications in noted research outlets. Further, this study calls for more research in the area to ensure more growth and understanding of digital innovation in HEIs in developing countries.

The findings given in this study advance the understanding of how digital innovation in higher education institutions in developing nations is progressing. However, additional comprehensive systematic reviews in the field are required and recommended, considering the limitations of this study whereby the search was limited to peer-reviewed journal articles and only considered publications made in the English language, and between the years 2013 to 2022.

REFERENCES

[1] Aguirre, T., Aperribai, L., Cortabarría, L., Verche, E., & Borges, Á. (2022). Challenges for Teachers' and Students' Digital Abilities: A Mixed Methods Design Study. Sustainability (Switzerland), 14(8). https://doi.org/10.3390/su14084729

[2] Akter, S., Michael, K., Uddin, M. R., McCarthy, G., & Rahman, M. (2022). Transforming business using digital innovations: the application of AI, blockchain, cloud, and data analytics. Annals of Operations Research, 308(1–2), 7–39. https://doi.org/10.1007/s10479-020-03620-w

[3] Alenezi, M. (2021). Deep dive into digital transformation in higher education institutions. Education Sciences, 11(12). https://doi.org/10.3390/educsci11120770

[4] Antwi-Boampong, A. (2021). Blended Learning Adoption in Higher Education: Presenting the Lived Experiences of Students in a Public University from a Developing Country. In TOJET: The Turkish Online Journal of Educational Technology (Vol. 20, Issue 2). https://orcid.org/0000-0003-2887-2807

[5] Arshad, Y., Ahlan, A. R., & Ajayi, B. A. (2014). Intelligent IT governance decision-making support framework for a developing country's public university. Intelligent Decision Technologies, 8(2), 131–146. https://doi.org/10.3233/IDT-130183

[6] Barzman, M., Gerphagnon, M., Aubin-Houzelstein, G., Baron, G. L., Bénart, A., Bouchet, F., Dibie, J., Gibrat, J. F., Hodson, S., Lhoste, E., Martin, C., Moulier-Boutang, Y., Perrot, S., Phung, F., Pichot, C., Siné, M., Venin, T., & Mora, O. (2021). Exploring Digital Transformation in Higher Education and Research via Scenarios. Journal of Futures Studies, 25(3), 65–78. https://doi.org/10.6531/JFS.202103_25(3).0006

[7] Bogdandy, B., Tamas, J., & Toth, Z. (2020). Digital transformation in education during COVID-19: A case study. 11th IEEE International Conference on Cognitive Infocommunications, CogInfoCom 2020 - Proceedings, 173–178. https://doi.org/10.1109/CogInfoCom50765.2020.9237840

[8] Bogers, M. L. A. M., Garud, R., Thomas, L. D. W., Tuertscher, P., & Yoo, Y. (2022). Digital innovation: transforming

research and practice. Innovation: Organization and Management, 24(1), 4–12. https://doi.org/10.1080/14479338.2021.2005465

[9] Bonzanini, O. A., Silva, A., Cokins, G., & Gonçalves, M. J. (2020). The interaction between higher education institutions and professional bodies in the context of digital transformation: The case of Brazilian accountants. Education Sciences, 10(11), 1–14. https://doi.org/10.3390/educsci10110321

[10] Castro Benavides, L. M., Tamayo Arias, J. A., Arango Serna, M. D., Branch Bedoya, J. W., & Burgos, D. (2020). Digital Transformation in Higher Education Institutions: A Systematic Literature Review. In Sensors (Basel, Switzerland) (Vol. 20, Issue 11). NLM (Medline). https://doi.org/10.3390/s20113291

[11] Chen, N., Sun, D., & Chen, J. (2022). Digital transformation, labour share, and industrial heterogeneity. Journal of Innovation and Knowledge, 7(2). https://doi.org/10.1016/j.jik.2022.100173

[12] Díaz-García, V., Montero-Navarro, A., Rodríguez-Sánchez, J. L., & Gallego-Losada, R. (2022). Digitalization and digital transformation in higher education: A bibliometric analysis. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.1081595

[13] Díaz-Parra, O., Fuentes-Penna, A., Barrera-Cámara, R. A., Trejo-Macotela, F. R., Trejo-Macotela, F. R., Ramos-Fernández, J. C., Ruiz-Vanoye, J. A., Zezzatti, A. O., & Rodríguez-Flores, J. (n.d.). Smart Education and future trends. In International Journal of Combinatorial Optimization Problems and Informatics (Vol. 13, Issue 1). https://www.researchgate.net/publication/358164450

[14] Fleaca, B., Fleaca, E., & Maiduc, S. (2022). Digital Transformation and Current Challenges of Higher Education. TEM Journal, 11(3), 1235–1241. https://doi.org/10.18421/TEM113-32

[15] Forliano, C., de Bernardi, P., & Yahiaoui, D. (2021). Entrepreneurial universities: A bibliometric analysis within the business and management domains. Technological Forecasting and Social Change, 165. https://doi.org/10.1016/j.techfore.2020.120522

[16] Gardanova, Z., Ponkratov, V., Kuznetsov, N., Nikitina, N., Dudnik, O., Latypova, E., & Shcherbatykh, S. (2020). A model for optimizing the structure of teaching techniques for distance learning in the russian higher education system. Journal of Open Innovation: Technology, Market, and Complexity, 6(4), 1–21. https://doi.org/10.3390/joitmc6040147

[17] Georgescu, M. R., Stoica, E. A., Bogoslov, I. A., & Lungu, A. E. (2022). Managing Efficiency in Digital Transformation - EU Member States Performance during the COVID-19 Pandemic. Procedia Computer Science, 204, 432–439. https://doi.org/10.1016/j.procs.2022.08.053

[18] Giang, N. T. H., Hai, P. T. T., Tu, N. T. T., & Tan, P. X. (2021). Exploring the readiness for digital transformation in a higher education institution towards industrial revolution 4.0. International Journal of Engineering Pedagogy, 11(2), 4–24. https://doi.org/10.3991/IJEP.V11I2.17515

[19] Huang, Y., Li, S., Xiang, X., Bu, Y., & Guo, Y. (2022). How can the combination of entrepreneurship policies activate regional innovation capability? A comparative study of Chinese provinces based on fsQCA. Journal of Innovation and Knowledge, 7(3). https://doi.org/10.1016/j.jik.2022.100227

[20] Jo, H. (2022). Success Factor of Smart Factory: Moderating Role of Commitment to Learning. Procedia Computer Science, 204, 736–743. https://doi.org/10.1016/j.procs.2022.08.089

[21] Kamsker, S., Janschitz, G., & Monitzer, S. (2020). Digital transformation and higher education: A survey on the

digital competencies of learners to develop higher education teaching. International Journal for Business Education, 160. https://doi.org/10.30707/ijbe160.1.1648090946.696630

[22] Katyeudo, K. K., & de Souza, R. A. C. (2022). Digital Transformation towards Education 4.0. Informatics in Education, 21(2), 283–309. https://doi.org/10.15388/infedu.2022.13

[23] Kitchenham, B. (2007). Guidelines for performing Systematic Literature Reviews in Software Engineering. https://www.researchgate.net/publication/302924724

[24] Kohli, R., & Melville, N. P. (2019). Digital innovation: A review and synthesis. Information Systems Journal, 29(1), 200–223. https://doi.org/10.1111/isj.12193

[25] Kolade, O., Odumuyiwa, V., Abolfathi, S., Schröder, P., Wakunuma, K., Akanmu, I., Whitehead, T., Tijani, B., & Oyinlola, M. (2022). Technology acceptance and readiness of stakeholders for transitioning to a circular plastic economy in Africa. Technological Forecasting and Social Change, 183, 121954. https://doi.org/10.1016/j.techfore.2022.121954

[26] Kolade, O., & Owoseni, A. (2022). Employment 5.0: The work of the future and the future of work. Technology in Society, 71. https://doi.org/10.1016/j.techsoc.2022.102086

[27] Kuldosheva, G. (2021). ADBI Working Paper Series Challenges and opportunities of digital transformation in the public sector in transition economies: examination of the case of Uzbekistan Asian Development Bank Institute. https://www.adb.org/publications/challenges-opportunities-digital-transformation-uzbekistan

[28] Lanamäki, A., Väyrynen, K., Laari-Salmela, S., & Kinnula, M. (2020). Examining relational digital transformation through the unfolding of local practices of the Finnish taxi industry. Journal of Strategic Information Systems, 29(3). https://doi.org/10.1016/j.jsis.2020.101622

[29] Latifah, R., Budiyanto, C., & Saputro, H. (2022). Digital Transformation Readiness in Higher Education Institutions in Indonesia: A Systematic Literature Review.

[30] Liu, M., Zha, S., & He, W. (2019). Digital Transformation Challenges: a Case Study Regarding the MOOC Development and Operations at Higher Education Institutions in China. TechTrends, 63(5), 621–630. https://doi.org/10.1007/s11528-019-00409-y

[31] Lytras, M. D., Serban, A. C., Ruiz, M. J. T., Ntanos, S., & Sarirete, A. (2022). Translating knowledge into innovation capability: An exploratory study investigating the perceptions on distance learning in higher education during the COVID-19 pandemic - the case of Mexico. Journal of Innovation and Knowledge, 7(4). https://doi.org/10.1016/j.jik.2022.100258

[32] Mabić, M., Praničević, D. G., & Dražena, G. (2022). Toward Regional Development: Digital Transformation of Higher Education Institutions. Croatian Regional Development Journal, 3(1), 1–14. https://doi.org/10.2478/crdj-2022-0001

[33] María, E., Enciso, V., Jácome, E. P., Valencia-Arias, A., & Nelcy Jiménez Hernández, C. (2017). Analysis of University Management of Emerging Technologies and Recommendations for Developing Countries. In TOJET: The Turkish Online Journal of Educational Technology (Vol. 16, Issue 2).

[34] Marks, A., Al-Ali, M., Atassi, R., Abualkishik, A. Z., & Rezgui, Y. (2020). Digital Transformation in Higher Education: A Framework for Maturity Assessment. In IJACSA) International Journal of Advanced Computer Science and Applications (Vol. 11, Issue 12). www.ijacsa.thesai.org

[35] Mavuru, L., Pila, O. K., & Kuhudzai, A. G. (2021). Pre-Service Teachers' Levels of Adaptations to Remote Teaching and Learning at A University in A Developing Country in the Context of COVID-19. International Journal of Higher Education, 11(1), 12. https://doi.org/10.5430/ijhe.v11n1p12

[36] Nermend, M., Singh, S., & Singh, U. S. (2022). An evaluation of decision on paradigm shift in higher education by digital transformation. Procedia Computer Science, 207, 1959–1969. https://doi.org/10.1016/j.procs.2022.09.255

[37] Nielsen, P. (2017). Digital Innovation: A Research Agenda for Information Systems Research in Developing Countries. 269–279. https://doi.org/10.1007/978-3-319-59111-7_23ï

[38] Ojutkangas, K., Rossi, E., & Matinmikko-Blue, M. (2022). A deep dive into the birth process of linking 6G and the UN SDGs. Telecommunications Policy, 46(1). https://doi.org/10.1016/j.telpol.2021.102283

[39] Omorede, A. (2023). Business in the digital age: Digital innovation outcome, exit and the founder's start-up experience role. Journal of the International Council for Small Business, 4(1), 68–78. https://doi.org/10.1080/26437015.2022.2125355

[40] Portnoy, I., Manosalva-Sandoval, J., & Torregroza-Espinosa, A. C. (2022). Impact of COVID-19 on Students' Generic Skills - A Case Study in a University from a Developing Country. Procedia Computer Science, 203, 508–513. https://doi.org/10.1016/j.procs.2022.07.071

[41] Rafiq, M., Batool, S. H., Ali, A. F., & Ullah, M. (2021). University libraries response to COVID-19 pandemic: A developing country perspective. Journal of Academic Librarianship, 47(1). https://doi.org/10.1016/j.acalib.2020.102280

[42] Raphael, C. (2022). Implementation of Digital Transformation in the Technical Higher Education Institutions in Tanzania. Tanzania Journal of Engineering and Technology, 41(1), 38–47. https://doi.org/10.52339/tjet.vi.771

[43] Rof, A., Bikfalvi, A., & Marquès, P. (2020). Digital transformation for business model innovation in higher education: Overcoming the tensions. Sustainability (Switzerland), 12(12). https://doi.org/10.3390/su12124980

[44] Rof, A., Bikfalvi, A., & Marques, P. (2022). Pandemic-accelerated Digital Transformation of a Born Digital Higher Education Institution: Towards a Customized Multimode Learning Strategy. In Educational Technology & Society (Vol. 25, Issue 1).

[45] Saddiqa, M., Magnussen, R., Larsen, B., & Pedersen, J. M. (2021). Digital innovation in education: Perspectives, opportunities and challenges of educational open data and sensor data.

[46] Schmuck, R., & Benke, M. (2020). An overview of innovation strategies and the case of Alibaba. Procedia Manufacturing, 51, 1259–1266. https://doi.org/10.1016/j.promfg.2020.10.176

[47] Serugendo, G. D. M., & Friha, L. (2021). Digital innovation process in the academic sector - The case of the University of Geneva. ITM Web of Conferences, 38, 03004. https://doi.org/10.1051/itmconf/20213803004

[48] Seyam, M., Elbasuony, H., & Hemeda, S. (2021). The Effect of Digital Transformation on the Smart Educational Services of Egyptian Universities. International Journal of Instructional Technology and Educational Studies, 2(4), 14–18. https://doi.org/10.21608/ihites.2021.203999

[49] Stecuła, K., & Wolniak, R. (2022). Influence of COVID-19 Pandemic on Dissemination of Innovative E-Learning Tools in Higher Education in Poland. Journal of Open Innovation: Technology, Market, and Complexity, 8(2). https://doi.org/10.3390/joitmc8020089

[50] Teixeira, A. F., Gonçalves, M. J. A., & Taylor, M. de L. M. (2021). How higher education institutions are driving to digital transformation: A case study. Education Sciences, 11(10). https://doi.org/10.3390/educsci11100636

[51] Tungpantong, C., Nilsook, P., & Wannapiroon, P. (2022). Factors Influencing Digital Transformation Adoption among Higher Education Institutions during Digital Disruption. Higher Education Studies, 12(2), 9. https://doi.org/10.5539/hes.v12n2p9

[52] Vishnu, S., Raghavan Sathyan, A., Susan Sam, A., Radhakrishnan, A., Olaparambil Ragavan, S., Vattam Kandathil, J., & Funk, C. (2022). Digital competence of higher education learners in the context of COVID-19 triggered online learning. Social Sciences & Humanities Open, 6(1), 100320. https://doi.org/10.1016/j.ssaho.2022.100320

[53] Wambua, R. N. (2023). Digital Learning Strategies Within Universities in Developing Countries: A Systematic Literature Review. International Journal of Research Publications, 117(1). https://doi.org/10.47119/ijrp1001171120234446

[54] Wang, P. (2021). Connecting the parts with the whole: Toward an information ecology theory of digital innovation ecosystems. MIS Quarterly: Management Information Systems, 45(1), 397–422. https://doi.org/10.25300/MISQ/2021/15864

[55] Yureva, O. v., Burganova, L. A., Kukushkina, O. Y., Myagkov, G. P., & Syradoev, D. v. (2020). Digital transformation and its risks in higher education: Students' and teachers' attitude. Universal Journal of Educational Research, 8(11 B), 5965–5971. https://doi.org/10.13189/ujer.2020.082232

[56] Zhashkenova, R. (2021). Analysis of the transformation of higher educational institutions through entrepreneurship in the conditions of digitalization. In International Journal of Entrepreneurship (Vol. 25, Issue 4).