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## Digital Transformation and the Way We (Mis)Interpret Technology

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**Abstract:** For many people, digital transformation offers a great opportunity to keep pace with the requirements of the current age, while for others, it is all hype and needs to be approached with caution. However, be it opportunity or hype, digital transformation impacts every part of our human life, where we especially see and experience it in numerous areas of social domains, including education. Based on these arguments, this paper examines the research that has been conducted on digital transformation from the perspective of education by applying data mining and analytics approaches. Accordingly, in the examination of research papers on digital transformation, five emerging broad themes were identified: (1) strategies and technologies as pillars of digital transformation in social development, (2) digital transformation as a vision that goes beyond mere adaptation of technology, (3) innovative technologies as change agents of digital transformation, (4) the COVID-19 pandemic as a catalyst for digital transformation, and (5) confusion in terminology - digitization, digitalization, and digital transformation. This paper argues that by ignoring the social aspects and not positioning humans at the center of digital transformation and failing to understand the philosophy, vision and mission that lies behind it, we will be at risk of writing failure stories rather than success stories.

**Keywords:** digital transformation, technology adaptation, innovative digital technologies, hard and soft technologies, education.

### Introduction: In the Realm of 1s, 0s, and Digital Technologies

*Technology is the most useful servant but a dangerous master. - Christian Lous Lange*

Simply defined, digital transformation is a process that involves the use of 1s and 0s to synthesize and give meaning to a wide range of services in the current digitally intensive era. In today's world, the raw material is data, and we develop strategies and processes to benefit from the synthetic combination of 1s and 0s. Within this context, data is mined, gathered, and converted into information by contextualizing it, and knowledge is gained through the experience of understanding and utilizing this information. Knowledge transforms into wisdom through meaning-making, which is the ultimate level of the transformation. Though digital data is synthetic, the final form of the data, that is wisdom, is nested organically and can be observed in our behaviors and understood through our discourses.

*"Knowledge is not information, it's transformation." — Rajneesh*

A look at recent history reveals that many of the developments we have witnessed point to the need for transformation. For instance, according to the concept of the knowledge doubling curve (Fuller, 1982), the accumulation of knowledge is doubling at an increasing rate and, in line with this argument, the concept of the half-life of knowledge (Machlup, 1962) suggests that the shelf life of the most up-to-date knowledge is shortening at the same rate. In discussing the time when knowledge started to become a valuable asset (Büyüç and Bozkurt, 2017), Toffler (1980) highlights that the Third Wave refers to societies where power distribution is determined by possessing and managing knowledge. That being said, online networks function like a global brain (O'Reilly, 2005), where data are created collectively and take shape on the journey to information, knowledge, and wisdom.



## Digital Transformation: A Journey to becoming a Butterfly

*“When digital transformation is done right, it’s like a caterpillar turning into a butterfly, but when done wrong, all you have is a really fast caterpillar.” — George Westerman*

Just like the process governing the change of a caterpillar into a butterfly, digital transformation is a dynamic, constant process (Teichert, 2019), which makes it difficult to reach consensus on how to define it (Benavides et al., 2020; Schallmo & Williams, 2018). However, in an effort to explain digital transformation, Brooks and McCormack (2020, p. 3) note that digital transformation is “not a single transformative initiative but a process of increasingly consequential transformations”. Brown et al. (2020, para. 1) further define it as “a series of deep and coordinated culture, workforce, and technology shifts that enable new educational and operating models and transform an institution’s business model, strategic directions, and value proposition”.

The research on digital transformation largely approaches the subject from technological, organizational, and social perspectives, calling attention to the involvement of different actors in the transformation process (Benavides et al., 2020) and highlighting the importance of adopting a multi-dimensional and inclusive approach to digital transformation. In line with these thoughts, it has been argued that rather than being driven by pure technological implementations (Kane et al., 2015), digital transformation is actually a reflection of strategies that have been adopted (Kane et al., 2015; Zaoui, & Souissi, 2020) to make them effective and efficient for individuals, institutions, and societies.

Over time, there has been increased interest in digital transformation, especially starting from the end of the second decade of the 2000s (Abad-Segura et al., 2020; Benavides et al., 2020). The COVID-19 pandemic manifested how we need digital transformation in many spheres of our lives, including education (Bozkurt & Sharma, 2020; Iivari et al., 2020). Motivated by the above arguments, this paper examines digital transformation from the perspective of education to identify emerging research trends and patterns within this field.

### Methodology

In this paper, data mining and analytic approaches (Fayyad, et al., 2002), specifically, text mining (Feldman & Sanger, 2007) and social network analysis (Scott, 2017) were used to conduct the systematic review (Gough et al., 2012) of the publications on digital transformation. The purpose behind the use of these different analytical approaches was to triangulate the research data (Thurmond, 2001) to increase the reliability and validity of the research findings.

In identifying the research trends and patterns of research on digital transformation, predefined search strings ("Digital transformation" AND "education" OR "teaching" OR "learning") were used to find the relevant papers indexed by Scopus, the largest scholarly database for peer-reviewed publications, and create the research corpus. The final research corpus was composed of 284 papers published between 1999 and 2022. Although the study adopted an inclusive strategy, which can be counted as one of the study’s strengths, the researchers also acknowledge that the research corpus was limited to only peer-reviewed publications. Other publications from the grey literature could therefore yield complementary findings. Furthermore, despite the fact that Scopus is the most extensive publication database, it is considered a limitation that the data for this study were extracted from only a single database.

### Findings and Discussion

*“Transformation is a journey without a final destination.” — Marilyn Ferguson*

This section presents and discusses the five broad emerging themes identified through text-mining (Figure 1) and social network analysis (Figure 2) of 284 papers on digital transformation. These themes

are (1) strategies and technologies as pillars of digital transformation in social development, (2) digital transformation as a vision that goes beyond mere adaptation of technology, (3) innovative technologies as a change agent of the digital transformation, (4) the COVID-19 pandemic as a catalyst for digital transformation, and (5) confusion in terminology - digitization, digitalization, and digital transformation.

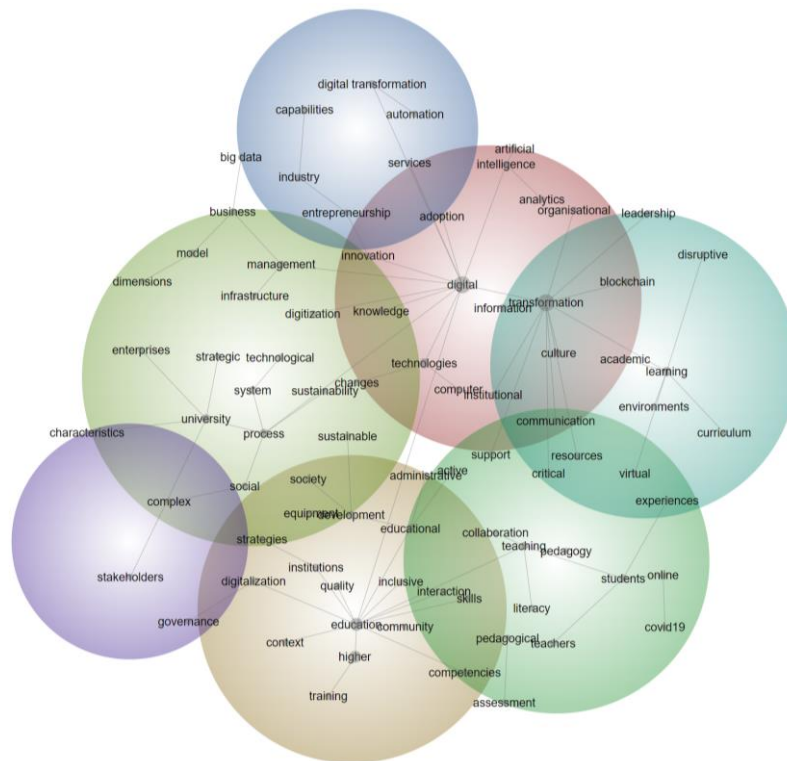


Figure 1. Text-mining of titles and abstract and their lexical relationships

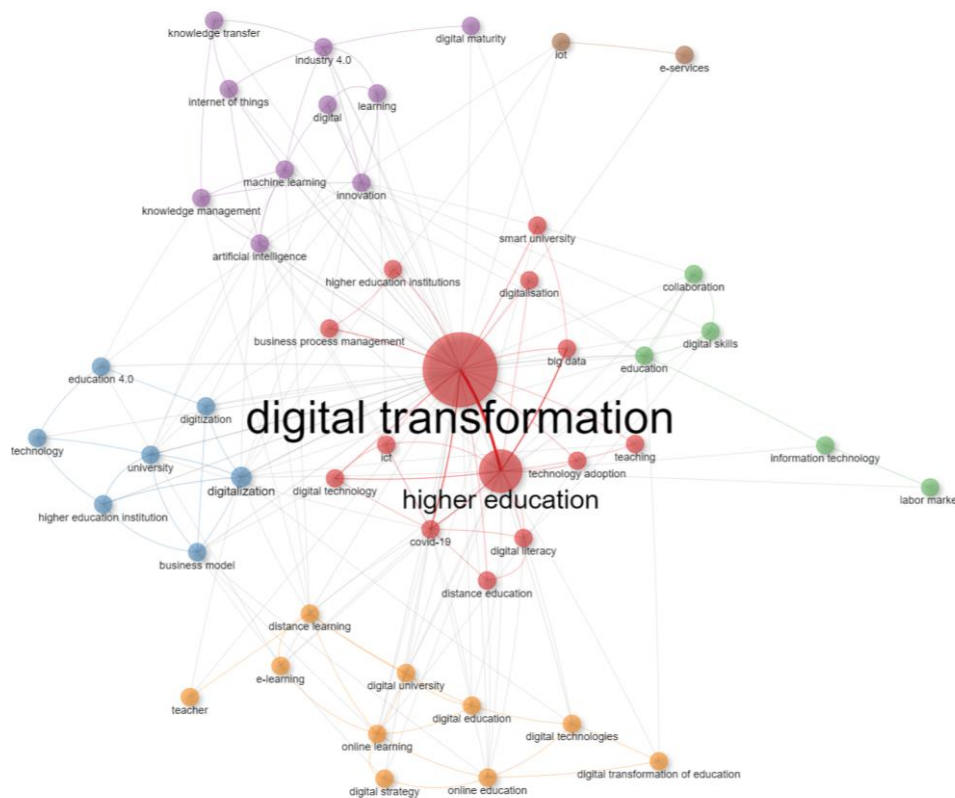


Figure 2. Social network analysis of the keywords to identify key terms

**Strategies and technologies as pillars of digital transformation in social development** (See paths in Figure 1: *university, characteristics, stakeholders, enterprises, strategic and technological, system, process, social, complex, sustainability, and higher, education, strategies, and educational, development, society*; See nodes in Figure 2: *higher education institution, business model, knowledge management, business process management, digital strategy*): The purpose of digital transformation is neither to create a techno-utopic future nor to mechanize social structures and relations. In other words, it would be a mistake to reduce digital transformation to a materialistic understanding. One of the ultimate aims of digital transformation is to facilitate social development (Gluckman & Allen, 2018) by using technologies and developing strategies that avoid harming any individuals or threatening any social structures through blind captivation of technologies. This requires developing strategies that amplify social well-being by feeding and nurturing social elements. From the perspective of the educational field, forging educational processes through digital transformation can contribute to the intellectual growth of any and all societies.

**Digital transformation as a vision that goes beyond mere adaptation of technology** (See paths in Figure 1: *digital, transformation, critical, communication, culture, academic, virtual, learning, environments, curriculum, and teachers, students, pedagogy, teaching, literacy, skill, competencies, collaboration, education, interaction*; See nodes in Figure 2: *digital skills, collaboration, digital literacy, technology adaptation, distance education, distance learning, online learning, online education, digital university, digital technologies, digital transformation of education*): The idea of technology should never be limited to hard technologies (i.e., computers) but also include soft technologies (e.g., strategies, approaches, etc.) (Bozkurt, 2020). With this understanding, digital transformation is a multifaceted process that requires developing a vision that goes beyond the mere adaptation of technology. From the perspective of education, it requires investing in people to improve their digital competencies, literacies, and skills (Ala-Mutka, 2011; JISC, 2012; Redecker, 2017). Employing digital technologies necessitates the use of different educational modalities (e.g., online distance education, online learning, etc.), which further implies that we must adapt curricula to the changing nature of learning. In fact, when we take into account the factors of time, space, path, and pace within sequential or parallel designs, these modalities should include online modalities, onsite modalities, or a blend of both (Bozkurt & Sharma, 2021). To summarize, digital transformation should develop a vision that is inclusive, multifaceted, and addresses both hard and soft technologies in order to facilitate effective teaching and learning in an educational landscape.

**Innovative technologies as a change agent of the digital transformation** (See paths in Figure 1: *artificial, intelligence, analytics, and adaptation, digital, services, digital transformation, automation and digital, transformation, blockchain, and infrastructure, management, business, big data, model, dimensions*; See nodes in Figure 2: *Innovation, artificial intelligence, machine learning, internet of things, IoT, industry 4.0, education 4.0, big data, smart university, digital technology*): Innovative technologies, being major drivers of digital transformation (Besson & Rowe 2012; Hess et al., 2016; Nadkarni & Prügl, 2021), are important in terms of changing capabilities and capacities, as well as evolving environments. That is, innovative technologies are not only internal drivers but also external drivers that push organizations to adopt change and, therefore be more willing to embrace digital transformation in order to survive in the changing landscape. The innovative technologies (e.g., AI, IoT, blockchain, etc.) not only serve as a driver but also emerge as a disruptive change that reshapes and reengineers the environments wherein both individuals and institutions must adapt to change in order to survive in landscapes where change is triggered by innovative technologies.

**The COVID-19 pandemic as a catalyst for digital transformation** (See paths in Figure 1: *higher, education, teaching, pedagogy and COVID-19, online, experiences, teachers, students*; See nodes in Figure 2: *COVID-19, digital technology, ICT, technology adaptation, higher education, digital transformation*): According to the Horizon Report 2021 (Pelletier et al., 2021), "The COVID-19 pandemic has transformed the higher education landscape. Though it remains to be seen whether those

transformations have taken root and will persist into the future, it is not hard to imagine that higher education may never be the same in some important ways (good or bad)" (p. 4). Digital transformation strategies were embraced as a means to ensure agility and resilience in the face of the turbulence of the pandemic, and ideas like digital learning ecosystems and digital twins became central topics of discussion for many higher education institutions. The pandemic and the necessities that emerged in the new normal revealed the need for higher education to develop strategies directed at strengthening the resilience and sustainability of higher education institutions and the services they offer (Bozkurt, 2022). Although the pandemic itself was an undesirable experience for the whole world, it triggered winds of change and emerged as a catalyst of digital transformation.

**Confusion in terminology - digitization, digitalization, and digital transformation** (See paths in Figure 1: *digitalization, higher, education, and digitization, digital, transformation*; See nodes in Figure 2: *digitization, digitalization, and digital transformation, ICT*): In addition to the ambiguities in the definition of terms, confusion in the use of terminology has also been a problematic issue. The terms *digitization, digitalization, and digital transformation* are generally used interchangeably despite differing in essence and referring to different things (Kopp et al., 2019; Brooks & McCormack, 2020; Verhoef et al., 2021). For example, digitization refers to the process of converting analog to digital form, whereas digitalization refers to converting processes into digital form by using digital technologies. The right use of terminology is crucial in terms of developing our road maps and defining our practices during digital transformation processes.

## Conclusion

*"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change." — Charles Darwin*

Using data mining and analytic approaches, this paper examined the body of digital transformation research and identified the following broad themes: (1) strategies and technologies as pillars of digital transformation in social development, (2) digital transformation as a vision that goes beyond mere adaptation of technology, (3) innovative technologies as a change agent of the digital transformation, (4) the COVID-19 pandemic as a catalyst for digital transformation, and (5) confusion in terminology - digitization, digitalization, and digital transformation.

In addition to identifying the above-named themes, we also wish to highlight the following issues as final remarks on this subject. Digital transformation primarily involves adapting to change, where change is viewed as a constant and inevitable phenomenon, while growth and development are optional, so long as we adopt the change by interpreting it in the right manner. Digital transformation is commonly associated with heavy investment in digital technologies, yet this view is a misinterpretation of digital transformation. Technology, by its definition, refers to hard (e.g., tools, devices) and soft technologies (e.g., approaches, strategies), and digital transformation processes employ both types of technologies in order to find a right balance in the adoption of innovative technologies. Moreover, digital transformation is a process that has many paths and stages and as such, it concerns the business models, strategic orientations and values of institutions. In effect, it is a process that involves not only technical but also social dimensions.

Approaching the subject from a social perspective, a question that should be regularly asked and considered to be a priority is: Where and how should we position humans in the transformation process? Moreover, another question that needs to be considered is whether the practices we carry out in the digital transformation process are human and learner-centered. Scenarios wherein humans are placed at the center will create success stories, whereas, scenarios wherein digital technologies are placed at the center of the overall digital transformation processes will reduce the human-centered approach to a passive state and thereby lead to stories of failure. In digital transformation strategies that position

humans at the center, the transformation should not start with the technology, but rather, with the humans themselves. Thus, we must first undergo a mental transformation and change the way we think in order to embrace the change.

In many cases, the term *digital transformation* is used loosely and therefore can be confusing and result in misinterpretation of digital transformation and digital technologies. In fact, without understanding the philosophy, vision, and mission that lie behind the term, digital transformation will fail to be realized and instead be a blindly crafted so-called transformation. In the digital information age, it is vital to understand and internalize digital transformation in order to correctly position it in our discourses and practices. Digital transformation is not simply a process whereby we adorn the relevant ecosystem with digital tools, but rather, it is a change involving the strengthening of the ecosystem with digital processes. In the end, the ultimate purpose of digital transformation is to use digital technologies to improve the quality of our life, not to make these technologies our life. However, it should also be noted that technology is not free of moral and ethical dimensions and has never been. Intense exposure to technology will definitely have side effects and collateral damages in the long run, and therefore, our priorities should always be human-centered to prevent blind devotion or even worship of technologies.

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