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Article

Evaluating the process of implementing digital transformation in Vietnamese universities

H. B. Dang[1], T. T. Q. Pham[2], T. H. Do[3,*], V. P. Nguyen[4], T. P. Vu[4,*]

[1] Board of Directors, Posts and Telecommunications Institute of Technology, Ha Noi 151100, Vietnam
[2] Department of Marketing (ERIPT), Posts and Telecommunications Institute of Technology, Ha Noi 151100, Vietnam
[3] Faculty of Business Administration, Macquarie University, Sydney 2113, Australia
[4] Faculty of Business Administration, Posts and Telecommunications Institute of Technology, Ha Noi 151100, Vietnam
*** Corresponding authors:** T. P. Vu, phongvt@ptit.edu.vn; T. H. Do, hiendo179@gmail.com

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Abstract: Industry 4.0 is revolutionizing businesses' operations and relationships with the communities to which they cater. The widespread use of computing and network programs compels firms to digitize their operations and offer novel goods, solutions, and business for practice. Universities appear to be slow to adapt to the changes in the education sector. This study suggests using consolidated digital transformation sources to evaluate the level of ability that universities have achieved in the implementation of digital procedures and to compare it to that of other business sectors across all cities and provinces in Vietnam. The text outlines specific factors that universities should consider when implementing the model. Although the objective with the expectation of education from digital transformation is high, compare it with other industries. And the scores achieved in structural agility and create of benefit for the transformative goals are 3.4, but the score of benefit of technologies is 3.0 lower than. Additionally, the organizational component's scores were primarily focused on leadership and culture, digital strategy, market digitalization, dynamic and digital capabilities, and strengthened logistics within each industry during the digital transformation. Our findings indicate that universities lag behind other industries, perhaps as a consequence of inadequate leadership and cultural shifts. This is exacerbated by a lack of innovation and inadequate financial assistance.

Keywords: digital transformation; e-readiness; evaluation of maturity; Vietnamese universities

1. Introduction

In the age of knowledge, it is increasingly crucial to comprehend the significance of information technology (IT) projects for enterprises. The introduction of technological applications has significantly transformed several businesses, adding value to their goods and services. This is particularly true for the recreational activities business, especially in relation to readily accessible upon request items that operate on subscription models as opposed to the direct purchase of tangible media for replication. Rationalization and adaptable manufacturing goods, together with improved logistical support, have been significant factors in the competitive landscape of heavy industrial sectors. Information technology has made it easier to integrate value chains and customize goods and services. The Internet of Things (IoT), three-dimensional printing, big data and analytics, machine learning, artificial intelligence, and cyber-physical systems are becoming increasingly influential in the development of

innovative business models and efficient processes as we continue to advance in the era of the Fourth Industrial Revolution.

The study have developed and used various terms, including IT development, digital transformation, and technological readiness, to describe the evaluation of value provision. Nevertheless, the progress has been gradual, starting with basic investigations into the financial viability of implementing an IT framework and progressing toward the notion of digital transformation.

The adoption of online education at universities has been relatively slow compared to other sectors, mostly due to academics' preference for conventional forms of education. It is crucial to acknowledge that blended-learning approaches, along with internet education, have significantly developed since their introduction a few decades ago, but their adoption levels differ significantly across different institutions.

This study aims to critically examine the key models that have originated and developed in the business and organizational domains, considering the current context of Industry 4.0 and the future of society. Given the assumption that universities are also companies, the model should accurately align with them by offering suitable contextualization. This study proposes a comprehensive digital transformation paradigm and utilizes a tool to assess its advancement at individual colleges. Assessing its level of maturity would initially give a higher-education institution a complete understanding of their progress toward digital transformation, as well as the specific actions they need to take to maximize the benefits of using IT intelligently, while considering the opportunities and challenges of a constantly changing competitive landscape. This digital transformation roadmap may assist organizations in strategic planning steps to gradually advance to greater degrees of maturity and IT use, ultimately enabling them to fulfill their business goals.

The specific intricacies that need attention in an educational setting, particularly in the context of higher educational institutions, are highlighted and addressed.

1.1. The productivity dilemma and business technology

During the last decade of the 1980s, the pace of growth in productivity at the national level declined, even with significant expenditures in information technology (IT) and exponential advancements in processing capacity. The term "productivity paradox" was used to describe this phenomenon. Erik Brynjolfsson conducted a seminal study in 1993, suggesting an inadequate understanding of the correlation between information technology (IT) and productivity (Hitt and Brynjolfsson, 1997). Brynjolfsson attributed the decline in productivity rates to inaccuracies in measuring and methodological methods, as well as mismanagement of IT advancement and utilization. Another potential reason was the reassignment of tasks across companies, which enabled them to achieve advantages related to their own operations rather than benefiting the whole sector. Alternatively, there may have been a delay in the realization of profits, creating a misleading perception that the investment in IT did not yield positive results. Assessing the value derived from IT cannot be approached from a single perspective; rather, it should be seen as the process of effectively aligning corporate goals with the implementation and utilization of IT.

1.2. Strategic collaboration and information technology planning

Several models have been developed to offer a structured approach for organizing IT operations inside enterprises. An example of a well-known model is the computing technology architecture model developed by Zachman (1987). This model aimed to provide a comprehensive framework for IT planning and development, including data, processes, and business operations, in a synergistic manner from various organizational levels or viewpoints. The model incorporates many approaches that were previously widely used in IT operations, including data flow diagrams and database modeling.

Additional models for planning originated compared to the field of executive management and were integrated or modified to serve as a tool for aligning IT and business strategy. The balanced scorecard technique established by Kaplan and Norton (1992) used cause–effect charts as a helpful instrument to include IT initiatives and achieve organizational goals.

As alignment gained importance over time, two theories became increasingly prevalent in the field of research. The primary model is the strategic alignment concept developed by Henderson and Venkatraman (1999). They constructed a model that considered the interconnections between the organization and IT facilities and procedures, as well as the interrelations between the organization and the IT strategy. However, Luftman (2000) developed a model that introduced the concept of IT-business alignment maturity. This model helps identify the steps needed for the organization to improve and progress in its position, thereby enabling IT to effectively contribute to the organization's overall strategy. The five degrees of maturity in this paradigm were determined by the degree of mutual knowledge, shared objectives or shared risks, governing concerns, and facilitating variables.

1.3. Digital development and technology readiness

Subsequently, the connection idea underwent further modifications, leading to the emergence of the words electronic readiness and digitized (IT) maturity. The initial concept of digital readiness was the degree to which a nation could leverage information and communications technology (ICT) to promote growth. Subsequently, this idea was applied at the organizational level, first defined as the extent to which a corporation was willing to participate in electronic commerce (Akour et al., 2022). However, the word was then broadened to include additional uses of information technology inside the company, which was then defined as the capacity to use IT to facilitate its operations for business and strategic planning. Occasionally, e-readiness is used on a national scale, while at the organizational level, it is known as IT capacity. When the ability to grow and develop is recognized, it may be referred to as digital maturity. Venkatraman (1994) proposed a model that illustrates the dynamic and changing nature of the influence of information technology on firms, particularly in terms of enabling business transformation.

1.4. Definition of digital transformation

Over the past decade, the widespread adoption of the concept of digital transformation has significantly increased. In contrast to the concepts previously

mentioned, it is not only intended to quantify the extent to which the organization may profit from the use of IT, although it also emerges as a process of evolution through which IT becomes an essential component of the organization's daily operations, impacting all aspects that include the organization and its employees.

However, the literature contains a wide range of interpretations of digital transformation. For certain individuals, it is merely an application of information technology to business processes (Legris et al., 2003). With regard to previous applications, these authors implemented an incremental methodology. In reality, they heavily rely on Venkatraman's model of IT maturity.

Some individuals believe that digital transformation is a much more disruptive and dramatic phenomenon capable of causing disorder in the business world (Moghrabi et al., 2023). Nevertheless, these authors view digital transformation as the outcome of incremental yet consistent digital innovations that are implemented at the firm level and subsequently spread to the industry level, ultimately resulting in an industrial ecosystem. Consequently, digital transformation is accomplished through the accumulation of digital innovations.

Perhaps the most equitable definition is that it is a process of evolution that utilizes digital abilities and technology to facilitate enterprise models, procedures for operation, and experiences for customers that create value (Martínez-Peláez et al., 2023).

The concepts of digitization, technological advances, and digital transformation are frequently used synonymously without any differentiation. Digitization is generally observed as a straightforward automated process that involves the provision of the necessary information systems to operate processes in their current state. In certain instances, digitalization and digital transformation are regarded interchangeably (Mergel et al., 2019), while others associate the latter term with a significant IT-driven organizational transformation (Sidorenko and Arx, 2020). Additionally, the term "digitalization" may be defined as a transformation that is facilitated by information technology. IT-enabled development and digital advancement are two distinct but related ideas. Both terms refer to the impact of computer technology utilization on how valuable an offering is. Nevertheless, the definition of digital transformation is the primary focus, whereas IT-enabled growth is centered on its support. Furthermore, digital transformation is associated with the development of an innovative organization's identity, while IT-enabled change pertains to the improvement of an existence identity (AlNuaimi et al., 2022).

Digital transformation can also be viewed from the perspective of the relationships among changes in structure, strategy, and technology to assist in meeting the demands of a digital environment (Aly, 2020), emphasizing the necessity of maintaining a balance between the organization's old and new components.

Product and process transformation, as well as other organizational issues, are the primary focus of digital transformation strategies, which are also innovation strategies that leverage new technology. These encompass the interaction between the consumer and the technology as a component of the product or service, which enables the joint definition of products, services, and business models (Bonnet and Westerman, 2021). These authors asserted that a harmonious equilibrium must be maintained between four transformational dimensions: financial aspects, the use of technology, changes in

value creation, and structural changes. They expanded upon their 2015 model by proposing eleven inquiries to facilitate the development of a digital transformation strategy. The elements of each query are delineated to assist in the evaluation of the actions required to develop the strategy (Correani et al., 2020). Rossman (Ladu et al., 2024) establishes a digital maturity model that is predicated on the expansion of capabilities across numerous dimensions. These dimensions include different aspects, such as strategy, leadership, the market, operations, people and skills, culture, governance, and technology. Nevertheless, the explicit integration of innovation is extremely marginal, and it appears to be more of an incremental trend than a disruptive one. Furthermore, there is no indication of what is impossible to accomplish in the absence of technological competencies and capabilities.

In 2023, Feliciano-Cestero et al. (2023) endeavored to classify the components of digital transformation into four categories, namely, drivers, goals, factors influencing success, and results, in accordance with previous multidimensional proposals.

The framework developed by Muehlburger et al. was derived from a comprehensive review of the existing models (Thordsen and Bick, 2023). The framework includes 9 permitting components that are divided into 4 groups: values of the organization, managerial capability, organizational facilities and workforce capability. Subsequently, those categories were explicitly assigned to a normative, strategic, tactical, and operational stratum. The 9 enablers identified in their model included information and communications technology (ICT) knowledge, individual creative and innovative abilities, leadership in digital technology, digital platform structures, dual IT architecture, dynamic culture in the organization, internal and external communication, collaboration strategic integration, established procedures for innovation, and the leadership of digital technologies. To facilitate validation, the model was further developed and implemented in German institutions (Huang and Ichikohji, 2023).

Alojail and Khan (2023) underscored the significance of offering managers advice on how to evaluate their progress in digital transformation initiatives. They suggested a six-dimensional paradigm that encompassed the vision for strategy, cultural aspects of creativity and innovation, abilities and intellectual properties, digital competencies, alignment of strategy, and technological resources. Managers self-reported their measurements, which were derived from the comparison of each dimension's progress within their respective organizations to that of the competition. The results were highly variable and contingent upon the company's activity.

This finding supports the notion that contextual factors may be of considerable significance. These may be associated with industry, magnitude, or location. Correani et al. (2020) argued that digital transformation is essential for competitiveness, and while large corporations appear to effectively implement it, small and medium-sized enterprises (SMEs) have difficulty doing so. They perceived digital transformation as a multidisciplinary endeavor. Additionally, they suggested the use of tools to evaluate the current state of a specific small and medium-sized enterprise (SME) and offered suggestions for enhancing digitalization by utilizing the placement stage of a digital transformation framework. This was accomplished through a cyclical process of implementation, review, and roadmap definition.

Industry-specific nuances may also be present in digital transformation, as evidenced by factors such as hardware intensity (Mergel et al., 2019). Their research was primarily centered on the advancement of manufacturing industry knowledge, which was particularly advantageous for the utilization of heavy apparatuses. They were of the opinion that industries that were not contingent on hardware were more susceptible to being transformed by digital transformation than industries that were solely physical, such as manufacturing.

A study by Wade and Shan demonstrated that the overall failure rate of digital transformation initiatives was 87.5% (Wade and Shan, 2020). Failing was defined as the failure to realize the anticipated return on investment. The reasons for failure may be attributed to inadequate governance, unrealistic expectations, and a restricted scope. The COVID-19 pandemic has substantially increased the priority of digital transformation. They asserted that organizations with a specific level of digital maturity outperformed others. Furthermore, they identified success factors that included the ability to avoid the need to persuade individuals who a change is necessary, the availability and maturation of technology, and familiarity with home office practices. The goals for digital transformation must be measurable, accurate, feasible, accessible, compact, and clearly defined.

It is logical to assume that the initiative may encounter implementation issues if industry and size-specific differences are not taken into account. This may also be the case when employee components are not considered during the planning process. The transformation of the workforce is necessary for digital transformation. This suggests alterations in capabilities and culture. This process can be facilitated by IT in three distinct ways, depending on the extent to which the technology is utilized: adjusting to outside demands and pressures within the constraints and resources at hand; effectively utilizing IT to change the organization's structure, roles, and capabilities; or even reassessing the field and the need for a customer-centered approach (Ketprapakorn and Kantabutra, 2022). Additionally, the transformation of the work process and the establishment of digital workplaces that enhance employees' experiences are critical components of digital innovation within an organization. To accomplish this, it is essential to consider two dimensions: employee connectedness and responsive leadership (Mazzetti and Schaufeli, 2022).

1.5. Use of ICT at Vietnamese universities

The velocity of transformation in higher education has not maintained a pace with the general transition in all other aspects of society. Kirschner asserted that the professor has been granted autonomy in the use of technology, with minimal or no institutional support (Kirschner et al., 2023). They also mentioned that the majority of academicians in the field acknowledged the delayed response to inertia that impeded innovation and change. Transformation necessitates an openness to change. Universities encounter numerous obstacles, such as the fragmentation of degrees into smaller open-source learning networks that can be credentialed to provide the necessary skills for employment.

The popular and finely chopped online resources for learning, such as open educational resources or even unapproved online videos with questionable content and academic potential, appear to align with this fundamental learning process.

Marks et al. (2020) suggested a model to evaluate the level of digital maturity in universities. The framework is based on universities' capacity to offer suitable infrastructure for IT (e.g., connectivity to the network, computer hardware in research facilities or financing structures, and supplied educational facilities), to employ technological advances in the process of teaching and learning (e.g., open-source instructional materials, interactive instruction, artificial intelligence and technology for robotics, 3D format systems, repositories, and virtual simulations), and to offer partnership and operational platforms that connect procedures and individuals (e.g., work process platforms, learning social networks, educational management systems integrated with educational management systems, and virtual communities). Contextual constraints in the political, social, and economic domains severely restrict universities' capacity to achieve these objectives.

The Networked Readiness Index, as published by the World Economic Forum, offers a comprehensive evaluation of the state of countries in terms of their capacity to leverage ICTs to enhance their competitiveness and development, thereby substantially enhancing the quality of life of their citizens. This index has undergone significant changes over time and is presently composed of four pillars: technology, governance, people, and impact (Open Development Vietnam, 2023). This framework is directly linked to the Sustainable Development Goals (SDGs) of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). Quality education, which is a critical component of the SDGs, is ranked fourth on the list (Bui and Nguyen, 2022).

The generational disparities between digital native students and ICT-adopting faculty present a significant obstacle to the promotion of educational digital transformation. Consequently, it is imperative to establish a policy that facilitates the development of innovative learning environments and infrastructure that are compatible with the requirements of the Industry 4.0 and Society 5.0 eras (Duc and Nguyen, 2023). This necessitates the implementation of a substantial faculty training and awareness development initiative.

Nevertheless, the attributes of digital natives continue to be the subject of widespread controversy among researchers. The concept that the Google generation (born in 1993 or later) was more web-literate than others could be disproven, as they were unable to critically evaluate the information they retrieved, according to an analysis. Nevertheless, they demonstrated a greater level of comfort and proficiency with technology and a consistent level of connectivity. Nevertheless, they exhibit a greater level of proficiency in the application of technology, a preference for immersive digital experiences over ineffective access to knowledge, excessive expectations for information technology, a preference for visual information over text, and a greater likelihood of engaging in plagiarism as a result of the availability of copy and paste, among other findings (Marks et al., 2020).

Recent research has investigated the following the numerous components of the digital transformation process in Vietnamese higher education have been the subject of recent research. In 2023, Tuong et al. (2023) was employed to conduct a

comprehensive assessment of policy documents related to the digital transformation of Vietnamese universities. The analysis revealed critical components that are prioritized in the policy framework, including the utilization of technology to foster innovation in teaching and learning, the improvement of access to education, and the enhancement of management efficiency. It emphasized the necessity of a comprehensive legal framework, the need to alter management capacity and perspectives, upgrade IT infrastructure, and cultivate digital skills. The digital competencies that university lecturers in Vietnam must possess in order to effectively implement digital transformation were examined in 2024 (Nguyen et al., 2024). These recent studies offer valuable insights into the evaluation and implementation of the digital transformation agenda in Vietnamese higher education institutions. A variety of facets of the digital transformation process in Vietnamese higher education. In 2023, Quy et al. (2023) was employed to conduct a comprehensive assessment of policy documents related to the digital transformation of Vietnamese universities. The analysis revealed critical components that are prioritized in the policy framework, including the utilization of technology to foster innovation in teaching and learning, the improvement of access to education, and the enhancement of management efficiency. In 2022, Tran and Do (2022) examined the vision and methodology of a particular Vietnamese university in the context of the digital transformation process. It emphasized the necessity of a comprehensive legal framework, the need to alter management capacity and perspectives, upgrade IT infrastructure, and cultivate digital skills (Bui and Nguyen, 2022). In 2024, research study of Nguyen et al. (2024) investigated the digital competencies that university lecturers in Vietnam must possess in order to effectively implement digital transformation. These recent studies offer valuable insights into the evaluation and implementation of the digital transformation agenda in Vietnamese higher education institutions.

This is in accordance with a study that found that the youngest members of the "next generation," or digital residents, are more intensive technology consumers (AlNuaimi et al., 2022). However, they employ informal technologies for nonacademic purposes. They are acquainted with and at ease with ICTs; however, they may not be proficient in their application across various fields. They cannot be classified as technologically proficient solely because they are reared in digital environments (Thordsen and Bick, 2023). According to additional research, the evidence suggests that there are no such entities as digital natives, and they are incapable of multitasking due to their birth into a digital world. Presuming that they are creating the danger of utilizing learning models that do not benefit their education; rather, they hinder their performance. Despite the fact that multitasking abilities were effectively demonstrated, there is evidence that this attribute may actually facilitate interference from irrelevant stimuli (Charfeddine and Umlai, 2023).

To more effectively confront the obstacles it presents, organizations have been compelled to digitize in response to the COVID-19 pandemic. Universities were not immune to the necessity of transformation, as the implementation of new delivery models necessitated significant modifications to the educational process. With appropriate instruments and creativity, Wade and Shan (2020) reported that challenges could be transformed into opportunities. Consequently, digital technologies can enhance social interaction, electronic collaboration and meeting tools can facilitate the

organization of work, and a broader population of guest lecturers and project evaluators can be accessed on a global scale. However, models must be modified to accommodate the demands of online delivery. In contrast to a face-to-face environment, pupil engagement is susceptible to loss or reduction, among other factors. The course has not necessarily been able to adjust to its new, sudden nature as a result of the precipitous transition from a traditional setting to wholly online delivery. To encourage student engagement and participation, it is imperative to establish rapport, establish communication linkages, and effectively utilize content (Pak-Kwong et al., 2022).

2. Materials and methods

The current investigation was conducted in three distinct phases. The initial model was conceptually derived with the goal of combining the constructs of the various models that were examined to create a single, integrated digital transformation paradigm. This was accomplished by creating parallels between the numerous components that composed the models. Second, a tool was created and validated to evaluate the components of the combined framework that were derived. This instrument was subsequently implemented in select universities. To ascertain the specific nuances that are necessary when implementing the model in universities, as opposed to any general organization, a general evaluation of the results was conducted. Ultimately, the conclusions derived from the preceding procedures are reported.

The comprehensive methodological framework is illustrated in **Figure 1**.

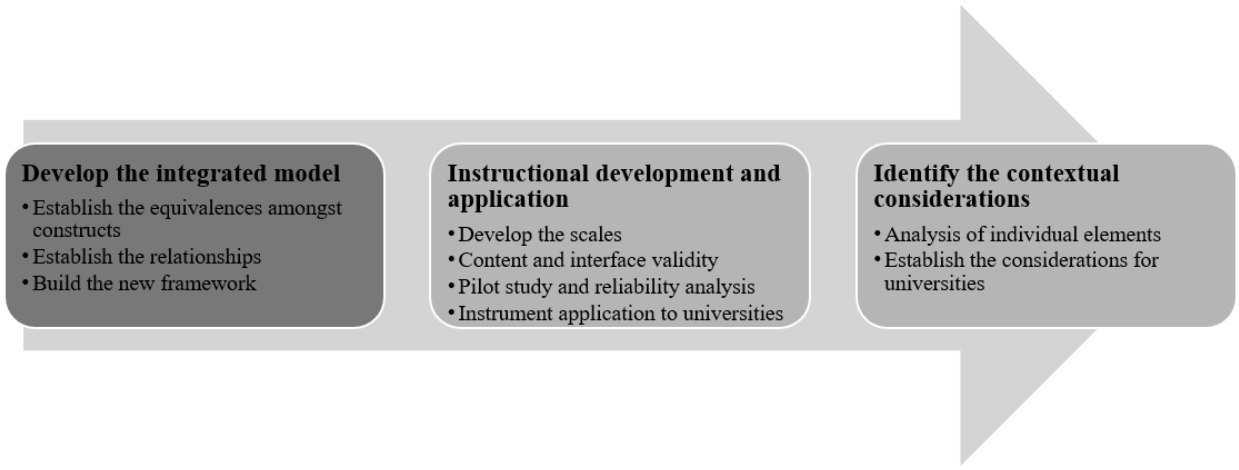

Figure 1. Illustration of the general methodology.

The objective of the research is not to confirm the interactions among the various elements of the approach, although certain components are quantitative in character. Rather, it aims to establish an overall framework to facilitate the primarily qualitative analysis of the outcomes. Consequently, it is crucial to establish conceptual foundations at this juncture to facilitate subsequent investigation and verification.

3. Results and discussion

The subsequent sections provide a detailed account of the outcomes of the various phases of the methodology.

3.1. The integrated model of digital transformation

The features of the models reviewed can be combined to create a single, well-integrated framework that explains the benefits of IT use in organizations, which is the ultimate objective of digital transformation.

To achieve this objective, the proposed model begins with Rossman's digital maturity model (Marks et al., 2020) and then relates its components to the analysis approaches of Ladu et al. (2024). Therefore, strategic alignment and the development factors of a digital business strategy, in addition to the implications of emerging business models, may be related to the strategic facet.

Conversely, leadership measurement can be associated with the engagement of managers and employees, as well as organizational support and change management.

The market element may then be related to factors such as the behavior of customers and their expectations, industry digital developments, and changes in the competitive environment. It may also be linked to the goals of digitally improved goods, novel business models, and digital channels of distribution, as well as the consequences of new business models using knowledge from both internal and external elements (given that this serves as the basis for market knowledge).

As a result, the element of operations is clearly related to the goal of adopting novel product innovation practices, the factor of dynamic capacity growth, and the connotation of the influence on performance and outcome.

The personnel and abilities measurements are linked to the goal of ensuring digital readiness, as well as the development of dynamic capabilities and the expansion of IT capacity, as well as the impact on outcomes and performance in terms of personal productivity.

The cultural component is connected to management and employee involvement, as well as variables influencing organizational support culture. It also refers to the goal of adopting product innovation methods. Governance is related to managerial and employee participation and serves as the driving force behind regulation. Furthermore, technology is inextricably tied to the goal of guaranteeing digital readiness, as are aspects such as IT capacity expansion, the creation of dynamic capabilities, the formulation of a digital strategy, business alignment, and the consequences of reformed IT areas.

The digital enabling factors suggested by Muehlburger et al. (2019) can also be used to obtain coincidences. Strategic embeddedness is unquestionably associated with the strategic dimension, while digital leadership pertains to the leadership dimension. The market dimension can be represented by internal and external collaboration, while the operation dimension is associated with institutionalized innovation processes, bimodal IT structures, and digital platform infrastructures. Individual creativity and innovation capabilities, as well as ICT literacy, are somewhat comparable to the people and skills dimension. Additionally, the culture dimension is inextricably linked to an innovative organizational culture. Finally, the aspects that

relate to the strategic and operational dimensions overlap with the management and technology elements.

These dimensions may be classified according to their degree of agreement. This applies to both leadership and culture elements, as well as strategy and governance elements. Similar mergers between the operations and technology dimensions are possible, and some technology-related components may also be merged into the strategic dimension. This resulted in the addition of five final organizational elements to the framework. These new elements were classified as digital strategy, leadership and culture, market digitalization, improved logistics, and dynamic and digital capabilities. The transformative aims of the new dimensions, which we described as value generation, technical benefit, and structural agility, may be seen from three separate viewpoints, as obtained from Matt et al.'s paradigm (Matt et al., 2015). The financial aspect and innovation, which were marginally addressed in these models, may be incorporated as cross-sectional aspects rather than as a singular perspective or dimension, as they have an impact on all of the elements that have already been studied.

3.2. Method developed for the instrument of measurement

The diagram in the model represents the relationships between 5 organizational factors and 3 revolutionary aims. The technology infrastructure is particularly indicated in the second column, but it is not regarded as a distinct purpose. Instead, it serves as a catalyst for generating value and promoting organizational flexibility. Subsequently, a tool was created to quantify each of these intersections, including those between transforming goals and both cross-sectional aspects: innovation and sustainable financial performance.

The model used a five-point Likert scale to assess each junction, with a minimum of three questions assigned to evaluate each intersection and its accompanying cross-sectional factors. Demographic questions were included to enhance the contextual information and bring the total number of questions to 90. Three questions were formulated using inverted coding for the purpose of control.

After the instrument was constructed, a group of researchers from various cities and provinces in Vietnam assessed its face and content validity. The majority of observations resulted in modifications to include neutral language words, enabling their use in other nations without requiring further validation. The instrument's initial language was Vietnamese. Following the implementation of the modifications, a comprehensive verification was conducted on virtual panels prior to their implementation in a pilot study.

The tool was subsequently administered to 30 enterprises spanning various sectors and scales and disseminated across all cities and provinces in northern, central and southern Vietnam. The study group used convenience sampling by using their own networks throughout their respective nations. Following the collection of data, a reliability study was conducted using Cronbach's alpha. Four factors posed difficulties, three had low magnitudes, and one had a negative value. One might be readily rectified by removing a conflicting item. However, the remaining ones were reconstructed, and more components were included for each respective aspect.

A further pilot involving 129 distinct organizations across Vietnam was conducted, followed by a repetition of the reliability study for the newly obtained measures. The Cronbach's alpha coefficients exceeded 0.72, and in the majority of instances, they approximated 0.89. The ultimate apparatus had a total of 85 components.

As part of extensive research, the instrument was used to assess organizations, resulting in a total of 320 answers. However, only 182 responses included all the necessary information and were considered valid. The sample consisted of firms from nine distinct categories: financial services, education, entertainment and gaming, retail, payment, manufacturing, healthcare, real estate and infrastructure, and logistics and supply chain. The latter included a range of sectors, including financial and ICT services, as well as health and public services. The arrangement of the organizations in the sample is shown in **Figure 2**.

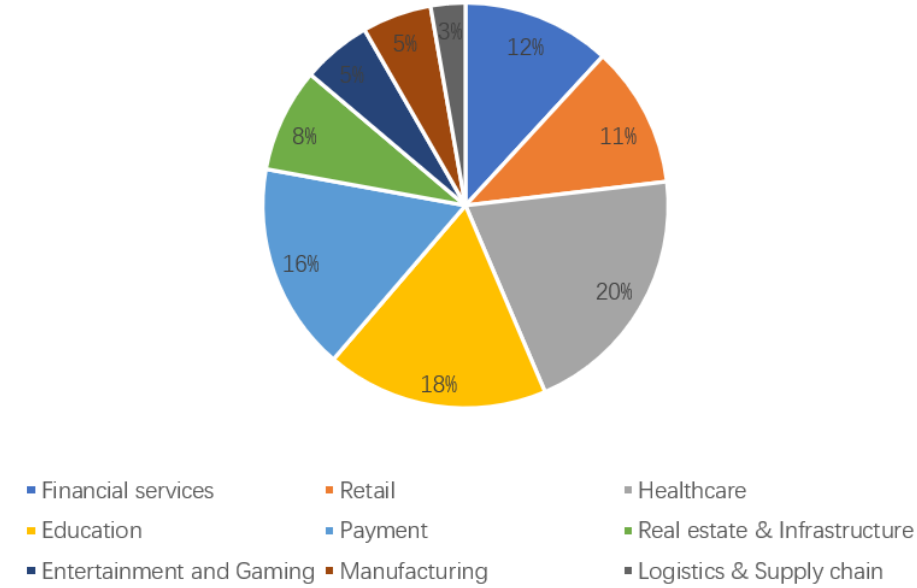

Figure 2. The composition and distribution of a sample, including the frequency and proportion of each category.

3.3. Identifying contextual concerns for universities

Industry-specific scores were derived for every organizational scale, cross-sectional part, and transformative aim. The purpose of this was to obtain a comprehensive understanding of the level of digital transformation in various businesses, specifically to compare the progress of higher education with that of other sectors.

The analysis findings for the accumulated scores of the transformative aim were computed and are shown in **Figure 3**.

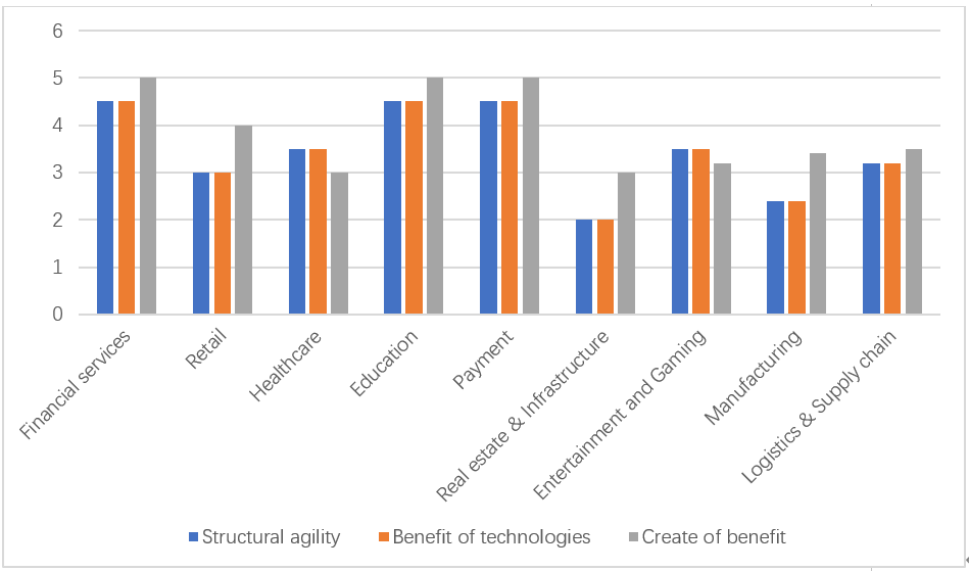

Figure 3. Objective analysis with respect to transformation.

Figure 3 clearly indicates that manufacturing was the dominant industry for all transformative aims. This finding is unexpected given the findings of the study (Huang and Ichikohji, 2023), which suggested that heavy hardware-dependent businesses would have fewer digital transformation skills than light industries such as education. This suggests that there is potential for leverage in all sectors, but the specific approach may vary based on the unique characteristics of each industry. Therefore, the use of robots, machine learning, and autonomous vehicles in the manufacturing industry may enhance logistics. This, in turn, led to the development of electronic delivery systems, repositories, and collaborative platforms specifically designed for education. However, given that the target maturity number is five and taking into account the likelihood of score inflation caused by self-reported problems, there is still a significant distance to go. The lack of structural agility was apparent across all industries, indicating that innovation efforts and technology expenditures did not always result in a hierarchical structure that would enable more adaptable frameworks and genuine empowerment at all levels of the organization.

Value creation received the highest scores in all industries, suggesting that every organization is to some extent involved in the recent developments brought about by the fourth industrial revolution. They are seeking novel methods to create and distribute their goods and services, with various degrees of success. The manufacturing and education sectors have a one-unit size difference. Universities are failing to understand the need to modernize their learning methods and educational offerings to successfully meet the demands of new future generations in rapidly evolving periods.

Figure 4 displays a graph that represents a gap analysis of the scores achieved for the transformative goals in the education sector. Despite the evidently low ratings for value generation and technological benefit, the issue of structural agility is more relevant. This phenomenon may be attributed to the conventional hierarchies prevalent in universities, characterized by a well-defined promotion trajectory for academics and a standardized chain of command. However, it often has two different structures. One approach is centered on educational institutions; particular areas of study are offered,

and all courses are taught by in-house faculty, regardless of the subject matter. An alternative, however less prevalent but still quite widespread, is the university-wide departmental system. This method involves the organization of faculty members into a department focused on a certain area of expertise, which caters to the whole institution. Therefore, it is typical to see mathematics courses being taught to business, medical, or engineering students by professors who belong to the same organizational unit. This structure is somewhat uncommon, although it may be seen as more adaptable to changes and more resilient in its composition. Achieving structural agility in a business with a strongly entrenched conventional culture is undeniably challenging.

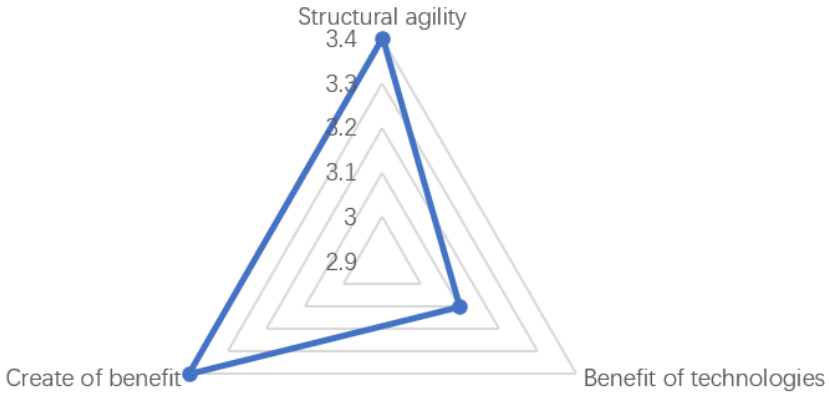

Figure 4. The scores achieved for the transformative goals in the education sector.

The value creation score may remain low due to the prevailing belief among teaching members, managers, and students who believe that traditional education offerings are consistently superior. There are no plans to include either advanced technical courses or a more adaptable approach to creating bespoke curricula.

The technological value score may range considerably between public and private educational institutions, owing to variations in finance and strategic collaborations with suppliers. However, this component goes beyond establishing sufficient networking and computer architecture. It also includes the university's ability to successfully employ information and communication technology (ICT) to support instructional techniques and foster academic collaboration and administration integration. A visible connection between the registrar's office's control systems and learning management systems (LMSs), in which lessons are kept and grades and activities are recorded and maintained, is one example of this. This approach is similar to flexible manufacturing procedures and web-based retailing and distribution for commerce enterprises.

Figure 5 displays the resulting scores for each sector's organizational aspects.

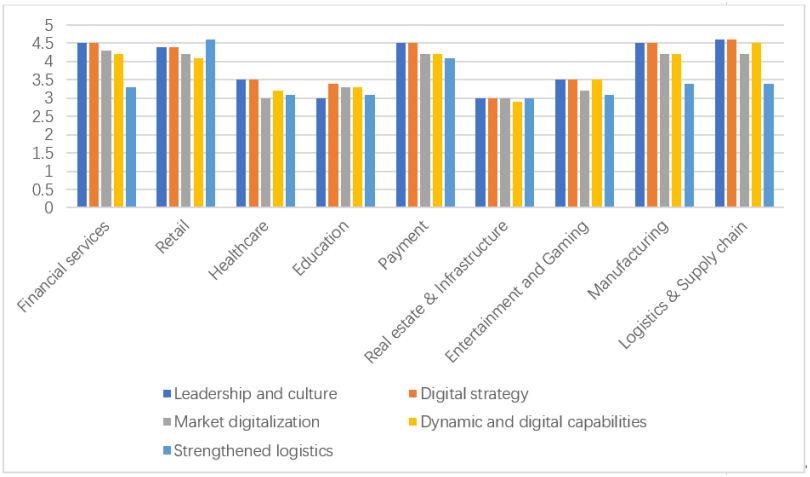

Figure 5. The scores of the organizational component of each industry in digital transformation.

Once again, the education sector seems to have the lowest ratings for digital transformation, namely, in terms of organizational aspects. Manufacturing maintained its position at the forefront, with commerce and services closely trailing behind. Among the several sectors, the education sector had the lowest score, specifically in the area of leadership and culture. This system is characterized by rigid hierarchies, extensive administrative procedures, and limited delegation of authority across all organizational levels. Evidently, the cultural elements of academics tend to oppose change and provide little or no opportunity to take initiative in organizational choices. This is unexpected, given that colleges serve as hubs for independent thinking, critical inquiry, and the generation of knowledge. While this may hold true in the realm of intellectual pursuits, it does not necessarily hold true for the realm of corporate innovation and operational methodologies. The inability to establish effective leadership and culture may hinder the progress of other aspects. The score for dynamic and digital capabilities was on par with that of commercial businesses, indicating the presence of environmental intelligence, cooperation, and flexibility but potentially underutilized.

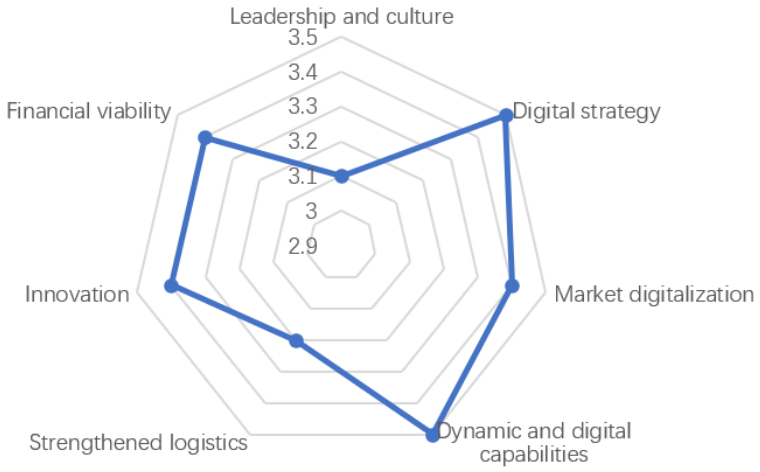

Figure 6. The gap between organizational dimensions and cross-sectional variables in the field of education.

Figure 6 presents a gap analysis that allows for a more thorough examination of the statuses of the organizational dimensions and cross-sectional components in the education business.

Although there seemed to be a well-defined digital strategy in most instances, it was likely constrained in terms of the institutions' desired outcomes for adopting and implementing ICT. There is a high probability that there is a vision that focuses heavily on developing infrastructure but lacks the desire to use ICT to allow new educational models and delivery methods. Blended learning settings are often rare and are usually not mandatory for faculty members to utilize. Market digitalization may be compelling institutions to adopt pedagogical and technical methods that are in line with the tendencies of the Fourth Industrial Revolution. The digital transformation of universities seems to be hindered by leadership limitations, inadequate financing and a lack of encouragement of innovation. The COVID-19 epidemic is likely influencing universities' perceptions of and requirements for adapting and fully embracing digital prospects. This transformation represents a significant jump forward in time, perhaps similar to the advances that might have been achieved in five to 10 years, but condensed into a much shorter period.

4. Discussion

The concept of digital transformation, while not novel, has become more significant in recent years due to rapid advancements in technology and the widespread use of communications networks. Advancements in hyperconnectivity, artificial intelligence, the Internet of Things, blockchain, 3D printing, cybersecurity, big data, and cyber-physical systems have facilitated the emergence of novel behaviors and business models, therefore altering the dynamics of interactions between individuals and enterprises. Therefore, individuals belonging to younger generations who have grown up in a completely digital world exhibit distinct wants and perspectives that have not been seen before. Every ordinary individual assumes many jobs, including content creators, service suppliers, social influencers, and various others. The use of sharing economy methods and social networks enables individuals to engage in connections that were previously unparalleled.

Education is not exempt. Emerging generations need alternative distribution methods and curriculum material. Universities are anticipated to adopt flexible and tailored offers since they have become a standard feature across all industries. Nevertheless, the entrenched customs and perspectives of faculty members and administrators hinder the implementation of change, necessitating students to conform to an existing educational system that is no longer responsive to the demands and traits of the present day.

It is crucial for every business to have a framework in place that allows them to evaluate the progress of their digital transformation and provides guidance on the necessary actions to advance the transformation process. Numerous endeavors and frameworks have been suggested since the introduction of computers in the nonmilitary domain to assist in ensuring profitability from the utilization of information technology in day-to-day activities. However, this issue has not been thoroughly explored in the field of education.

Our concept incorporates the fundamental elements of digital transformation in companies, drawing from many models found in the literature. We enhance value by offering tools to assess the degree of digital transformation maturity and pinpoint the areas that need attention to advance and enhance the process. Furthermore, the factors may be tailored to certain situations, such as industry, size, or other environmental variations, to better align with the requirements of the businesses being evaluated. Ultimately, the first assessment reveals that universities are lagging behind other sectors, despite the need to adapt and align with the demands of the digital age.

5. Conclusions, limitations and directions for future research

The importance of educational institutions' adaptation to an increasingly digital landscape is underscored by the study that evaluates the process of instituting digital transformation in Vietnamese universities. It underscores the significance of cultivating innovative teaching and learning methods, improving digital infrastructure, and providing both educators and students with the requisite digital skills. Although there are substantial opportunities for modernization and development, the results indicate that obstacles such as inadequate infrastructure and disparate levels of digital literacy must be resolved. The study's findings show that the scores for structural dynamism and the creation of benefit for transformative objectives are 3.4, while the score for the benefit of technologies is 3.0 lower. Furthermore, the scores of the organizational component were determined by the following criteria: the enhanced logistics of each industry under digital transformation, digital strategy, market digitalization, and leadership and culture. Our results suggest that universities are not as advanced as other industries, which may be due to cultural shifts and inadequate leadership. Inadequate financial assistance and a lack of innovation exacerbate this. This study adopts an approach that considers universities as organizations similar to other sectors. It recognizes that universities have organizational structures, operate in dynamic marketplaces, manage human resources and talent, have a distinct culture, follow certain procedures, and include all the other aspects of a value chain. However, it is important to recognize and take into account subtle distinctions when implementing a digital transformation initiative. This is crucial not only for effectively implementing automation but also for enhancing the educational process, expanding the range of goods and services, and fostering cooperation and integration. The specific characteristics may significantly differ based on contextual elements such as geographical location, scale, university purpose, educational framework, and amount of technological accessibility. Public colleges in underdeveloped countries are likely to encounter specific obstacles, such as inadequate infrastructure and a lack of digital literacy among professors and students. However, it is possible to alter the features of the model to satisfy particular requirements while still taking into account the unique characteristics of each dimension. Success is highly dependent on the application of criteria that are based on a thorough understanding of the situation.

Higher-education institutions have been shown to be slower than other kinds of companies in implementing proactive measures for digital transformation. Other sectors may have been compelled to accelerate their pace due to market pressure. However, the educational industry is now incorporating several alternative learning

options that may be more appealing to younger generations. If universities are unable to anticipate these changes and entrants, they may face difficulties when they eventually take action since they will be constrained by their established methods, inflexible structures, and bureaucratic procedures.

The findings reported in this study indicate that the educational sector is not just lagging behind other sectors but also that its primary issue may be insufficient leadership techniques and resistance to change within its culture. This aligns with the notion that positions in academia are often seen as very stable. Resistance to change is likely to occur if it poses a threat to job stability. This is exacerbated by the lack of both new approaches and sufficient financial resources for implementing digitization objectives.

Nevertheless, it is important to highlight some constraints. Initially, it is evident that the sample used was significantly restricted, hence justifying the need for prudence when interpreting the findings. Furthermore, it is important to note that the sample only consisted of higher-education institutions, hence limiting the ability to generalize the findings to other educational levels. Furthermore, no data were collected about potentially significant variables such as financing sources, university size and specialization, or the quality and reputation of the institutions.

The information acquired from this research provides the foundation for further investigation. The sample size should be increased, and further information should be documented on the characteristics of the organizations included in the research. To ensure the accuracy of the data supplied by the respondents, interviews and direct observations are recommended. This approach helps to prevent measurement mistakes caused by misinterpretations or difficulties related to self-reports.

Triangulation is necessary to validate the links between the components in the model using quantitative methods. It is possible to create a composite index of digital transformation in future research, and a diagnostic and predictive model may be generated from the current conceptual framework. Using these models, it would be straightforward to develop consulting approaches that, when implemented at various institutions, may provide significant insights to guide them toward achieving effective digital transformation. Although the finding results offer an achievable starting point, the development of robust models for evaluating the implementation of digital transformation in Vietnamese universities necessitates additional empirical research, a broader scope, the consideration of contextual factors, and quantitative metrics. Without a stringent evaluation framework, universities may encounter difficulties in evaluating their progress, identifying areas for development, and ultimately realizing the complete benefits of digital transformation. Future research needs to focus on several critical areas when assessing the process of instituting digital transformation in Vietnamese universities. Future research could examine the role of partnerships between Vietnamese universities and international institutions, particularly in the sharing of knowledge and resources to improve digital capabilities. This collaboration could be essential for the creation of an expansive plan for digital transformation that promotes innovation in teaching and learning and addresses extant gaps in opportunity. It will be imperative to evaluate the success of these initiatives and guarantee that they make a positive impact on the higher education landscape in Vietnam by examining the impact of digital transformation on educational outcomes and student engagement.

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