

An Overview of the Digital Transformation Plan for Higher Education Developments in Vietnam

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Abstract: - Higher education's digital transformation is a current trend to meet the demands of the digital economy and plays a vital part in modernizing the educational system. However, there are many obstacles in the way of higher education institutions' digital transformation. Higher education institutions' digital transformation initiatives must be successfully developed, categorized, and assessed in order to be successful. In addition to offering competitive advantages to Vietnamese universities today, this article analyzes the strategies employed in the process of digital transformation in higher education institutions across the globe and suggests the development of some suitable digital transformation models.

Key-Words: - Digital transformation, teaching methods, curriculum, digitalization, universities, Vietnam.

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1 Introduction

Within the larger dynamics of globalization and the Fourth Industrial Revolution, digital transformation can be viewed as a fundamental movement changing numerous facets of social life, rather than a passing policy fad. Higher education is at the heart of this shift, especially in Vietnam, where state development targets expressly identify education and training as major drivers of digital change. This perspective is evident in significant policy frameworks, such as the National Digital Transformation Program to 2025 with a 2030 goal, which prioritizes education among the country's top industries. Higher education institutions see digital transformation as an opportunity to reconfigure teaching and learning processes, boost research and innovation capabilities, and expand learning opportunities beyond traditional bounds. At the same time, the implementation of digital transformation in higher education is unequal and limited by a variety of contextual variables. These developing conflicts highlight the importance of assessing both opportunities and difficulties in order to build policy and institutional solutions tailored to

Vietnam's unique context. Information technology infrastructure serves as the foundation for digital transformation in higher education. Several Vietnamese universities have made significant efforts in recent years to reinforce the technical underpinnings of teaching and learning, including investments in campus networks, learning management platforms, virtual teaching environments, and digital library systems. Despite these achievements, the level of preparation for digital transformation differs significantly among institutions. Universities located in big urban areas, particularly national and leading public institutions in Hanoi and Ho Chi Minh City, have better infrastructure and support systems. In contrast, many regional colleges and smaller training providers continue to confront chronic challenges due to insufficient equipment, inconsistent internet connectivity, and a shortage of skilled technical experts. This disparity creates a digital divide inside the higher education system, preventing online learning and digitalized administration from gaining widespread success. At a more sophisticated level, the

application of technology such as artificial intelligence, big data, and cloud computing in both teaching and administrative activities is very limited.. In most situations, its use is limited to isolated or experimental projects within a small number of institutions, rather than being incorporated in everyday operations or adopted on a large, system-wide scale.[1]

A further barrier is the level of digital competence among both instructors and students, which continues to influence the boundaries of digital change in higher education. Many lecturers whose professional practice is based on traditional teaching methodologies struggle to develop digitally mediated learning activities, administer online learning environments, or engage meaningfully with learning analytics. As a result, digital transformation is sometimes perceived as a source of instructional creativity rather than an additional professional need. Students, by contrast, tend to be comfortable with everyday uses of technology, yet this familiarity does not necessarily translate into effective digital learning practices. Gaps persist in critical areas such as self-directed learning, strategic use of free educational resources, and fundamental data analysis skills for academic and research reasons. This skill gap implies that, even when digital tools and platforms are accessible, they are not being exploited to their full potential, [2]. This problem is not limited to Vietnam; it is also visible in many emerging nations where the teaching workforce's digital competency falls behind the rapid speed of technological change. Data management and system communication remain significant concerns. Data on training, scientific research, student records, and human resource management in Vietnamese higher education remains partially and unevenly digitalized. Many institutions continue to organize information systems around distinct and poorly integrated software platforms, which hampers data sharing and effective usage. As a result, academic records, especially student learning data, are difficult to transfer between undergraduate and postgraduate levels or across institutions, complicating processes such as credit recognition and accumulation. At the system level, the lack of a national higher education database capable of integrating institutional data undermines governance, evaluation, workforce planning, and long-term strategic decision-making. This fragmentation not only decreases administrative efficiency, but it also limits the potential use of big

data analytics to promote research and evidence-based policy formation.

In parallel, the legal and policy environment that governs digital transformation in higher education has yet to adequately respond to the rate of technological development. Existing restrictions remain limited in scope, leaving key issues unaddressed. For example, clear and uniform regulations for recognizing online learning credits, particularly those gained through foreign platforms such as Coursera, edX, or Udemy, have not been firmly established. In a similar vein, systems for certifying and ensuring the quality of programs transmitted digitally are still in their infancy. There is also a lack of clarity about more general legal matters, such as the protection of student and faculty personal information, intellectual property rights for digital learning resources, and institutional obligations in the event of cybersecurity incidents. Many colleges adopt a cautious approach as a result of this legal ambiguity, favoring a wait-and-see strategy over more definitive and extensive experimentation with digitalized training methods. [3], [4].

Lastly, governance arrangements and financial resources provide yet another significant barrier. Higher education institutions face significant financial challenges as a result of digital transformation, which goes beyond investments in physical infrastructure to encompass staff training, digital learning materials, and the development of integrated data systems. Finding enough money for these uses is still a constant problem in Vietnam, where a large number of public universities still rely heavily on governmental budgetary allotments and tuition income. Because of this, certain institutions' digitalization initiatives are often carried out in a disjointed or symbolic way without a defined implementation pathway or overarching plan. Furthermore, current university governance models, which are frequently based on strict administrative processes, are still not entirely in line with the concepts of digital governance, which place an emphasis on flexibility and openness, and data-driven decision-making, [5]. Digital transformation runs the risk of being "half-hearted," with significant investments but little impact, in the absence of governance reform. When considered collectively, the difficulties mentioned above indicate that digital transformation in Vietnamese higher education should be viewed as a systemic and all-encompassing process rather than merely a technology change. Infrastructure development, human capital, data governance, regulatory frameworks, and

institutional governance structures are just a few of its many interconnected facets. These interrelated problems reveal a larger reality where Vietnam faces both significant potential and significant obstacles in its efforts to keep up with international advancements in digital higher education. Therefore, an integrated and coordinated reaction is necessary to fully realize the promise of this transition. This strategy requires a clear legislative and policy orientation from the state, as well as aggressive institutional reforms inside universities, particularly in governance and management procedures. Simultaneously, professors and students must improve their digital skills, while broader social actors, such as industry and technology suppliers, can help by providing financial and technical support. Without a combination of shared responsibility and coordinated action, higher education's digital transformation is likely to be incremental, limiting its contribution to the creation of high-quality human resources in the digital age.

2 Methodology

In this study, the literature review approach is utilized to synthesize, analyze, and systematize research papers, theoretical and practical materials on the topic of digital transformation in higher education. This method clarifies the theoretical background, current research trends, research gaps, and digital transformation methods used at domestic and international universities. The document review process is carried out in the following steps: Identify focus research questions, which are organized as follows:

- What is digital transformation for higher education?
- What factors encourage or hinder digital transformation at universities?
- What digital transformation methods and policies have been implemented?

Sources of Information and Document Analysis

Based on secondary data gathered from reliable academic and policy sources, this study uses a qualitative document analysis methodology. Major international databases, such as Google Scholar, Scopus, Web of Science, JSTOR, and ScienceDirect, were used to obtain academic material. International organizations including UNESCO, the OECD, and the World Bank, as well as policy studies and analytical materials from the Ministry of Education and

Training, were examined concurrently. The collection also contains pertinent peer-reviewed journal papers, master's and doctoral theses, and academic monographs published both domestically and abroad to guarantee thorough coverage.

Explicit inclusion criteria were used to guide the selection of documents. Only resources that specifically addressed digital change in higher education were taken into account. Priority was given to publications from the past ten years in order to capture recent developments, while earlier works were included selectively when they provided essential theoretical or conceptual foundations. All chosen papers had a clearly recognizable source and showed academic or institutional reputation, as shown by their peer-review status, frequency of citations, or authorship by reputable institutions, in order to increase the dataset's dependability.

A thematic method was then used to evaluate and synthesize the chosen documents. The resources were categorized into major analytical topics that were in line with the study's goals after an iterative reading process. These themes included the theoretical underpinnings of digital transformation and its consequences for higher education. This procedure made it possible to identify prevailing viewpoints, recurrent themes, and new gaps in the body of existing literature.

- Search Documents: Documents obtained from trusted sources include:
 - o Academic databases: Google Scholar, Scopus, Web of Science, JSTOR, ScienceDirect.
 - o Reports from the Ministry of Education and Training, UNESCO, OECD, and World Bank.
 - o Publish scientific articles, theses, and monographs both domestically and internationally.
- Documents are picked using the following criteria:
 - o Directly linked to digital transformation and higher education.
 - o Published during the last 10 years (excluding foundation documents).
 - o High dependability (clear origin, peer-reviewed, heavily cited)

Examine and combine documents: The documents are arranged according to important subjects like:

- The Digital Transformation's Theoretical Foundation
- Higher education's digital transformation policies and tactics
- How training managers, instructors, and students are affected by digital transformation
- Opportunities and obstacles in the process of digital transformation
- Determine the gaps in the research

The research suggests certain research directions by highlighting elements from the document analysis that have not been completely utilized or are inappropriate for the Vietnamese higher education system. The authoring team's conceptualization of the "Document Overview Method," which is the main methodology for this study, "An Overview of the Digital Transformation Plan for Higher Education Development in Vietnam," is depicted in Figure 1.

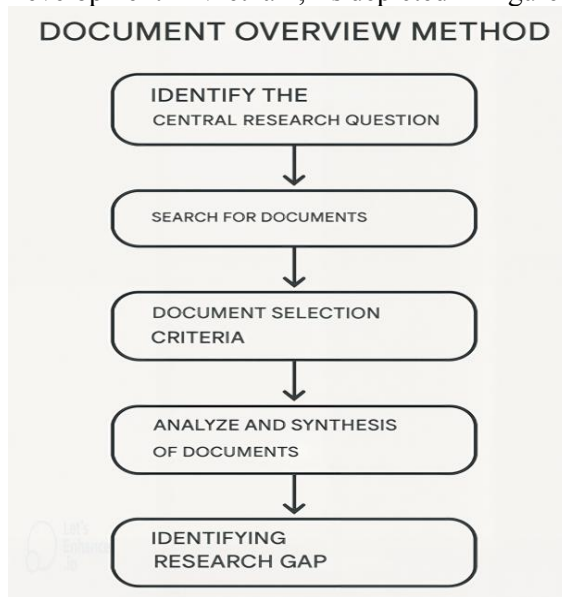


Fig. 1: Document review methodology
Source: author's analysis

Examining Vietnam's strategic orientations, policy goals, and phased roadmap for the adoption of digital transformation in higher education is the main research issue that drives this literature review. A structured review design that combined critical thematic analysis and systematic document retrieval was used to answer this topic. A focused search of reputable policy papers and academic sources

produced pertinent materials. Official policy tools, such as important government rulings (such as Decision 131/QĐ-TTg), Ministry of Education and Training papers, and peer-reviewed scholarly works discussing digital transformation in higher education, were prioritized. The selection procedure was created to guarantee contextual relevance to the Vietnamese higher education system as well as analytical rigor. The analysis went through a topic synthesis procedure after the documents were chosen. The materials under examination were analyzed critically and arranged according to the main tenets of Vietnam's agenda for digital transformation, which include the growth of open educational resources, the development of digital infrastructure, and the digital competences of academic staff and students. Dominant policy orientations, areas of convergence and divergence among sources, and underlying assumptions influencing current policies were all identified thanks to this analytical procedure. The review further identifies discrepancies between policy aims and implementation practices based on this synthesis. These gaps draw attention to areas where there is still a dearth of empirical knowledge and indicate ongoing difficulties in implementing digital transformation. Finding these gaps lays the groundwork for further investigation and highlights areas that require further study.

3 Results and Findings

3.1 Information Technology Infrastructure for Digital Transformation

Digital transformation is increasingly seen as a defining path for the advancement of higher education in the context of globalization and the Fourth Industrial Revolution. This attitude has been publicly expressed in Vietnamese national policy, most notably in Decision No. 131/QĐ-TTg (2022), which describes the Digital Transformation Program in Education and Training to 2025 with a view toward 2030. Accordingly, information technology (IT) infrastructure is identified as the "foundation" for the digital transformation process. Without a modern, synchronous, and secure digital infrastructure, it is difficult for universities to successfully implement online training models, smart management, personalized learning, or data-based scientific research, [6]. As a result, an assessment of the current

status of IT infrastructure at Vietnamese institutions is very crucial since it demonstrates the obstacles in the process of digital transformation as well as the degree of preparedness. In actuality, the most crucial layer of facilities is the network infrastructure and Internet connection. Most Vietnamese colleges have made investments in internal data centers, on-campus Wi-Fi networks, and high-speed fiber optic systems. The network connectivity quality at Vietnamese higher education institutions is still inconsistent, even with recent advances. Large colleges in Ho Chi Minh City and Hanoi are typically in a better position to implement cutting-edge connectivity standards, such as Wi-Fi 6 and more powerful network management systems, which support steady bandwidth during times of intense online learning. In contrast, a lot of local and regional institutions still deal with recurring issues like irregular coverage, network saturation, and sporadic disconnections. This discrepancy is highlighted by empirical data published by the World Bank (2021), which identifies poor network infrastructure as a significant barrier to the efficient provision of online education in Vietnam, especially during the COVID-19 pandemic. This shows that the problem of investing in network connectivity is still urgent in the process of university digital transformation, [3]

In parallel with connected networks, computing and data storage capacity are core components of IT infrastructure. Vietnamese universities are gradually shifting from traditional physical server systems to virtualization and cloud computing. Training management systems (SIS), learning management systems (LMS), e-libraries, portals, or online testing systems are increasingly deployed on virtualization platforms or public cloud services. The hybrid cloud model is applied by many schools, with the goal of both taking advantage of the flexibility of the public cloud and retaining sensitive data in the internal data center to ensure safety. However, the biggest obstacles remain long-term operating costs, cloud resource management capacity, and service provider dependency, [7]. This requires schools to build a cloud infrastructure management strategy, including contingency and cost optimization (FinOps) factors. The demand for data storage and management in the digital environment is growing rapidly. Schools not only store student records and digital learning materials, but also manage large amounts of research data, video lectures, exam data, and administration. Most are still using network storage systems

(SAN/NAS), while some pioneering schools have begun to deploy object storage solutions to serve digital learning materials and online classes. However, the disaster backup and recovery mechanism is still not synchronized. Many schools lack contingency strategies according to international standards, such as the 3-2-1 principle, and rarely rehearse system interruption scenarios. This can pose a serious risk when online exams or digital governance processes depend on the high availability of IT infrastructure, [8]. Another important highlight of digital transformation infrastructure is the digital identification system and access management. Many large universities have implemented a single sign-on solution, allowing lecturers, students, and staff to access multiple services through a unified identity.

This contributes to a better user experience while improving system manageability and overall operational safety. In addition, a number of institutions have joined the International Academic Identity Alliance, facilitating the sharing and access of global academic resources. However, according to the assessment of the Ministry of Education and Training, [9]. Most schools have not yet built a synchronous digital identification system, leading to duplication, difficulty in control, and limitations in service integration, [10]

The issue of information security has become an increasingly big concern. When universities are digitally transformed, cyber attacks expand rapidly, from online enrollment portals, online exam systems, to research data warehouses. A number of institutions have taken initial steps to strengthen cybersecurity by deploying more sophisticated protection measures, including next-generation firewall technologies, security information and event management systems, web application firewalls, and services designed to mitigate distributed denial-of-service attacks. However, in general, the capacity to ensure information security is still limited, especially in schools without technology majors. Common limitations include the lack of periodic security testing, the failure to implement multi-factor authentication, the lack of comprehensive data encryption, and the lack of focus on training to raise security awareness for staff, lecturers, and students, [11]. Another major challenge of IT infrastructure in universities is data fragmentation. Training, library, human resources, and finance management systems often operate independently, without common data standards, causing "data silos". This makes it difficult

to analyze synthetic data for decision-making, scientific research, and smart management. Some pioneering schools have built data warehouses, data lakes, and integration platforms to unify data, but this number is not much. As stated by UNESCO (2020), the lack of an overall data governance system is one of the biggest obstacles to the digital transformation of higher education in developing countries, including Vietnam, [12]

Core applications in training, research, and administration also show the decisive role of IT infrastructure. After the COVID-19 pandemic, nearly all universities in Vietnam have implemented learning management systems (LMS) such as Moodle, Canvas, or in-house solutions, and developed digital learning materials and e-lectures. Training management systems, e-libraries, online tests, and one-stop service portals have been widely adopted, laying the foundation for the digitization of processes and services. However, the level of integration and optimization between applications is limited. Many places are deployed in a local direction, leading to fragmentation and a lack of ecosystem. Building a synchronous overall architecture is still a big problem for many schools, [13]. In addition, some university campuses are testing the "smart campus" model, which applies IoT to manage access, parking, energy, and security. Although they are only at the pilot level, these models show the potential of expanding IT infrastructure to physical spaces, in order to create a more modern learning-research-living experience for students, [13]

Overall, the IT infrastructure in Vietnamese universities has reached a basic development level, sufficient to support the process of digitizing and implementing online training. However, in order to move towards higher levels of digital transformation, in which data is integrated, analyzed, and used for learning personalization, smart governance, and innovative research, standardization, modernization, and infrastructure integration are mandatory. In particular, the capacity of IT personnel in schools needs to be improved, with new specializations such as cloud administration, data science, information security, and DevOps operations. From the perspective of research, it can be affirmed that IT infrastructure is not only a contextual factor but also the main variable explaining the differences in digital transformation results between Vietnamese universities. Schools with strong network infrastructure, stable cloud platforms, good data

governance, and high information security often have a higher level of success in implementing online learning, digitizing governance, and developing smart services. Therefore, measuring the maturity of IT infrastructure and analyzing the relationship between infrastructure investment and digital transformation results will be a necessary research direction, helping to make policy recommendations and development strategies suitable for the context of Vietnamese higher education in the digital transformation period, [14]

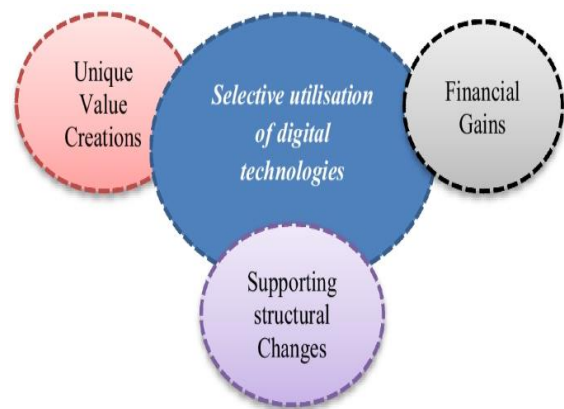


Fig. 2: The changing landscape/composition of digital transformation strategy
Sources: [15]

In addition to reflecting lessons learned from worldwide experience that are pertinent to the Vietnamese context, Figure 2 depicts a conceptual framework based on three interconnected pillars that together influence the course of digital transformation in higher education. The idea that digital transformation should be viewed as a deliberate and selected use of digital technologies rather than just the introduction of new technical tools is at the heart of this paradigm. In this way, digital technologies serve as strategic tools whose worth is determined by how well they fit institutional settings, learning objectives, and long-term viability.

The first pillar, known as "Unique Value Creation," focuses on using digital innovation to create unique learning and academic benefits. This includes applying intelligent learning management systems, growing blended and hybrid learning models, and creating tailored learning pathways—all of which improve student engagement and fortify institutional posture. The economic effects of digital transformation are discussed in the second pillar,

"Financial Gains," which emphasizes how technology can increase access to higher education, decrease operating expenses, improve managerial procedures, and increase resource efficiency. In order to demonstrate how digital technologies may assist governance change, faculty and student capacity building, and deeper integration into global academic networks, the third pillar, "Supporting Structural Change," focuses on the organizational dimension. These three pillars highlight a fundamental tenet of digital transformation in Vietnamese higher education: it is not propelled by technology per se, but rather by the thoughtful application of digital tools to generate educational value, enhance institutional effectiveness, and promote long-term, sustainable innovation.

3.2 The Digital Capacity of Lecturers and Students in Universities in Vietnam Adapts to Digital Transformation

In the process of "Digital transformation in universities in Vietnam today", the digital competence of lecturers and students is a key variable determining the ability to absorb technology, the level of pedagogical innovation, and the effectiveness of school governance. National policy documents have affirmed the requirement to develop digital competencies as a pillar of digital transformation in education, considering it as a condition to "turn the digital environment into a daily learning and working space" for each teacher and learner. Specifically, Decision 131/QĐ-TTg (25/01/2022) aims to promote the application of IT and digital transformation in education in the period of 2022–2025, with a vision to 2030, with an emphasis on fostering digital skills, teaching and learning in the digital environment, and developing digital learning materials. This document is a policy reference framework for higher education institutions to develop digital competency output standards for lecturers and students and corresponding training programs. Recent international research and reports also show that the digital capacity picture in Southeast Asia, in general, and Vietnam in particular, has progressed but is still differentiated by region, socio-economic conditions, and infrastructure. UNESCO's GEM report in collaboration with SEAMEO (2024) emphasizes that technology is "reshaping" the way education is delivered in the region, but warns that there is no "one universal formula" for all contexts; Success depends heavily on human capacity, especially teachers and learners, in

the responsible use, selection, and evaluation of educational technology. This approach suggests that, in Vietnam, digital capacity development initiatives need to be associated with the actual conditions of each facility, rather than copying the imported model, [15]

For faculty, empirical evidence in the last few years shows three striking characteristics. Firstly, the digital competence of lecturers is approached according to international reference frameworks (such as DigCompEdu), but there have been localization efforts. A study on the development of an online teaching competency framework for Vietnamese university lecturers proposes components including: digital learning design, interactive organization - online mentorship, digital assessment, digital ethics, and continuous professional development. The survey showed that many lecturers self-assessed "good" in tool operation skills, while higher-level skills, such as digital assessment design, learning analysis, and academic assurance in an online environment, were weak. Second, a number of broader surveys show that the digital competency of lecturers has a positive, statistically significant impact on student learning outcomes, through intermediary mechanisms such as the quality of digital interaction, the level of learning engagement, and the clarity of the online module structure. This reinforces the thesis that investing in fostering digital competencies for lecturers is not just "technical training" but a lever for academic quality. Third, the digital competence of lecturers is influenced by organizational factors (digital leadership, support policies, infrastructure), individuals (digital self-efficacy, experience), and professional culture; a study at universities in the North noted the role of the digital working environment, information security, safety, and career incentive mechanisms for lecturers' digital maturity, [16]

At the student level, recent quantitative surveys reflect a "fairly good" level of self-awareness of digital competencies, but there are disparities by region and by training sector. Research published in *the International Journal of Instruction* (2025) shows that students highly appreciate the ability to use digital tools for daily learning (searching, doing homework, collaborating), but the skills of "digital transformation" at the system level (data management, personal digital security, computational thinking) are still significantly different between regions; students in the North have higher scores are significant compared to other regions, while gender differences

are negligible. Supplementing this picture, a study with 2,379 economics students at three universities (2025) built a digital competency framework in the direction of combining tool skills, information and communication skills, digital safety, and problem-solving capacity; The results indicate the cumulative role of "learning through digital projects" for higher competency levels. Earlier surveys in the context of the EFL also noted that students' access to technology is quite favorable, but their skills in assessing digital information, copyright, and digital academic ethics are limited-a "blind spot" that risks persisting if not integrated into the foundational curriculum, [17]

From the perspective of "digital capacity as an ecosystem", policy reports emphasize that human resource capacity is a pillar besides digital infrastructure and content. The World Bank's ETRI Assessment Framework in Ho Chi Minh City (2023) points out that to accelerate edtech, it is necessary to "put teachers and students at the center", link capacity building with on-site guidance and support mechanisms, and design monitoring strategies for real-time feedback. This "learning goes hand in hand" approach is in line with the reality of many Vietnamese universities: when digital competencies are associated with modules, list specific output standards, and have academic advisors to accompany them, the use of digital platforms and learning outcomes increases markedly. However, gaps still exist, [18]. First, the standardization of the competency framework is still scattered. Some reference facilities, such as DigCompEdu or TPACK, build their own internal frameworks; As a result, the measurement process is heterogeneous, difficult to compare, and difficult to coordinate at the system level. The works on the online teaching competency framework for lecturers recommend switching from measuring "tool skills" to measuring "digital pedagogical competence" (learning design, digital assessment, learning analysis), accompanied by practical evidence. Second, digital inequality by region and individual conditions still affects digital competencies, especially for students. Evidence of regional disparities in digital transformation skills and digital learning habits shows the regulatory role of equipment scholarship policies, digital learning spaces, and academic support services. Third, digital safety and ethics are also a weakness: many student and faculty surveys show that the level of understanding of privacy, digital identity management, content copyright, and online fraud

prevention is not commensurate with the level of digitization of academic activities, while this is a condition for protecting academic integrity in the environment, [19]

In terms of development, a feasible digital competency roadmap for the Vietnamese landscape could include four layers of integration. (i) Digital competency output standards at the program level: schools establish minimum standards for graduates (e.g., personal data management, professional collaboration tools, digital safety -ethics, basic computational thinking) and continuous career development standards for lecturers (open learning material design, learning analysis, online authentication assessment). (ii) Multi-source measurement tools: combining standardized self-assessments, case exercises, digital competency records (e-portfolio) with evidence, and data using platforms (learning analytics) to assess practical competencies instead of self-assessment competencies. (iii) Supervised practice environment: deployment of "digital pedagogical studios", shared data/AI labs, and modules based on interdisciplinary digital projects; These designs both help "learn by doing" and create proof outputs. (iv) Governance and encouragement: including digital competencies in the criteria of emulation -academic appointment; establish a community of practice (CoP) to spread innovation, and at the same time ensure technical and pedagogical support resources to stand side by side with faculties/departments. These recommendations resonate with the national policy orientation and the World Bank's ETRI/EdTech framework on placing "human capacity" at the center of the edtech strategy, [20].

A notable research implication is the need to shift the focus of measurement from "tool skills" to "the ability to create academic value with technology". SEM or ENA models applied to policy and survey data can clarify the mechanism of impact of lecturer digital competencies on learning outcomes, through intermediate variables such as module design quality, student engagement, and fairness in assessment. At the same time, longitudinal monitoring of student courses with project-based digital competency interventions can show a sustainable effect on academic achievement and employability. Recent policy analyses using the ENA technique on the digital transformation document of Vietnamese universities also show a close link between "capacity investment" and "implementation efficiency", reinforcing the

thesis of the central position of people in digital transformation. In the context of the digital transformation of Vietnamese universities, the digital capacity of lecturers and students is both a necessary condition (to effectively operate the digital system) and a sufficient condition (to transform technology into academic value). Evidence from policies (Decision 131/QĐ-TTg), international reports (UNESCO/SEAMEO, World Bank) and from domestic empirical surveys show that tool skills have spread relatively widely, but the high-level pedagogical capacity of lecturers and the data -safety -problem-solving capacity of students are still "bottlenecks". Therefore, the digital competency development program needs to be designed as a continuous learning ecosystem, linking output standards, measuring evidence, practicing in real contexts, and a framework to encourage career development; Only then will digital transformation move from "deploying technology" to "improving the quality of higher education" in a sustainable way, [20]

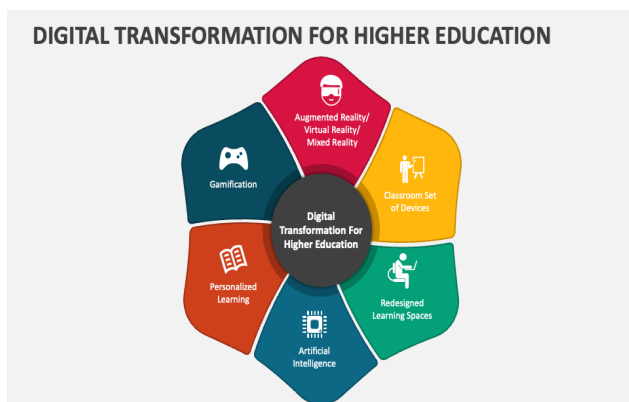


Fig. 3: Components of digital transformation in higher education
Source: [21]

A graphic depiction of the main tenets of the digital transformation of higher education is shown in Figure 3. The elements depicted in the figure exhibit a strong alignment with Vietnam's current strategic objectives, especially those stated in Decision No. 131/QĐ-TTg, when analyzed in relation to the theme "An Overview of the Digital Transformation Plan for Higher Education Developments in Vietnam." A conceptual model of the digital transformation ecosystem in higher education, as it applies to the Vietnamese context, is shown in Figure 3. It consists of six interconnected components. Instead of being discrete parts, these components are arranged to show

how pedagogical change, enabling infrastructure, and technological innovation interact.

The two main technical forces driving change at the center of the concept are artificial intelligence (AI) and augmented, virtual, and mixed reality (AR/VR/MR). Instead of being seen as ends in and of themselves, these technologies are positioned as tools for change. While AR/VR/MR technologies broaden the scope of teaching and research through virtual laboratories and immersive learning environments, helping to alleviate limitations related to physical space and resources, AI is linked to the development of intelligent learning systems and the optimization of institutional governance. The paradigm emphasizes two pedagogical and learner-experience dimensions—gamification and individualized learning—that build upon this technology basis. These components show how Vietnam's digital transformation plan is moving toward learner-centered teaching methods. AI-based solutions and data analytics are used in personalized learning to modify teaching methods to meet the unique demands and learning paths of each student. By adding interactive and motivating elements that improve student engagement and learning persistence, gamification, on the other hand, places an emphasis on pedagogical innovation. The model's environmental and infrastructure layer is made up of the other components, which include redesigned learning areas and ecosystems of classroom-based devices. When taken as a whole, they represent a shift away from conventional classroom setups and toward adaptable, hybrid, and technologically advanced learning settings. This approach is in accordance with national policy aims that place a strong emphasis on funding digital infrastructure, such as server systems, teaching aids, and fast internet, in order to facilitate blended and online learning. All things considered, Figure 3 shows how these six components work together to create a cohesive environment for digital transformation. The model emphasizes how technology alone is not driving digital transformation in Vietnamese higher education; rather, pedagogical innovation, technological capabilities, and infrastructure support are strategically aligned to improve educational quality, institutional efficiency, and global competitiveness.

3.3 Data Management and System Connection in Universities in Vietnam

In the context of "Digital transformation in universities in Vietnam today", data management and

system connectivity have emerged as soft infrastructure that determines the capacity to implement data-driven governance, training, and research models. At the policy level, Vietnam's new legal standards directly shape the "rules of the game" for schools. Decision 131/QĐ-TTg (25/01/2022) clearly states the goal of making teaching and learning in the digital environment a daily activity, and at the same time requires governance innovation based on digital technology and data (Prime Minister of Vietnam, 2022). At the level of digital state, Decree 47/2020/ND-CP regulates the management, connection, and sharing of data of state agencies, emphasizing the mechanism for opening data and the obligation to update periodically, creating a framework for interconnection between systems, including public higher education (Government of Vietnam, 2020). More recently, the National Data Strategy to 2030 (Decision 142/QĐ-TTg, 02/02/2024) focuses on data sharing and coordination infrastructure and the goal of online processing of 100% of administrative procedures, leading to the requirement of synchronizing integrated architecture and data standards in ministries, sectors, and localities (Ministry of Information and Communications, 2024). At the same time, Decree 13/2023/ND-CP on personal data protection has laid a comprehensive legal foundation for data processing activities of learners and public employees; by June 2025, the National Assembly has passed the Law on Personal Data Protection, effective from January 1, 2026, forecasting to tighten risk management, cross-border data transfer and accountability, [21]. These policy milestones shape the "track" for universities to build a data architecture -integration in accordance with the law and national interconnection, [22]

At the technical architecture level, the core problem is to move from "data island" to "data ecosystem" through the integration of academic management platforms (SIS/EMIS), learning management (LMS), enterprise resource management (ERP, finance -accounting), human resource management (HRM), etc digital library and repository of learning materials/research source code (IR/CRIS). International experience in higher education recommends an integration model based on open standards and an intermediary layer (API gateway/ESB), the application of Single Sign-On (SSO) under SAML or OpenID Connect, and metadata standards to ensure consistent data lifecycle governance, [23]. In the learning application layer,

1EdTech's standards, such as Learning Tools Interoperability (LTI 1.3) and OneRoster 1.1, enable secure connections between the LMS and content/assignment tools and synchronize class-learner-grade categories, reducing manual manipulation and increasing data reliability, [24]. Compliance with these standards is especially important when Vietnamese schools use a variety of commercial and open source applications and expand international cooperation, which requires cross-border integration.

At the level of integration with digital government, public universities are directly influenced by the national data sharing and coordination platform (NGSP/NDXP) and local platform (LGSP) according to the architecture of Vietnam's e-Government. Since 2020, 22 ministries, 63 provinces and cities have operated LGSP connected to NDXP to interconnect data; The new orientation is to expand national/regional data centers and centralized sharing platforms, [25]. From a regulatory perspective, administrative and non-academic information systems within educational institutions—including enrollment management, diploma issuance, tuition payment, and online public services—are expected to operate in accordance with the data sharing and utilization mechanisms set out in Decree 47. This alignment is intended to streamline reporting processes, ensure consistency in digital identifiers, and support the standardization of training management data. In addition, it makes it possible for citizen digital IDs, digital signatures, and electronic records to be used more widely throughout the entire student-alumni life cycle, which helps the policy goal of having all administrative operations done online by 2030.[26]

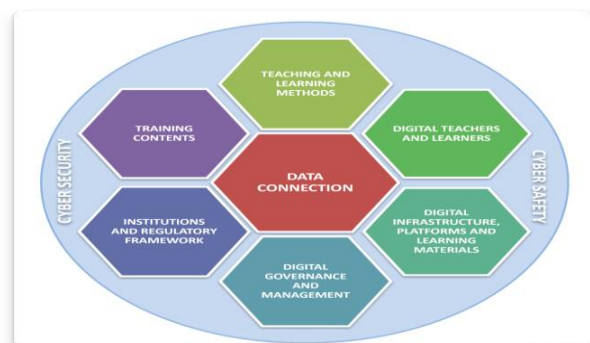


Fig. 4. Key trends shaping the digital transformation of vocational education in Vietnam toward 2030.

Source: [29]

Figure 4 illustrates a six-pillar digital transformation ecosystem model, with “Data Connection” positioned at its core. The model demonstrates a strong correspondence with the strategic directions outlined in the “Digital Transformation Plan for Higher Education Development in Vietnam.” The central element-Data Connection-reflects Vietnam’s fundamental objective of establishing a national database for higher education, ensuring interoperability and synchronization among universities and state management agencies. Surrounding this core, the six pillars define the key domains of action. The pillars “Institutions and Regulatory Framework” and “Digital Governance and Management” directly correspond to Vietnam’s ongoing efforts to strengthen the legal and institutional foundations for digital transformation (as stated in Decision No. 131/QĐ-TTg) and to promote the development of smart universities (e-University). The pillar “Digital Infrastructure, Platforms, and Learning Materials” provides the physical and technological foundation, aligning with national initiatives to develop Learning Management Systems (LMS) and establish shared open digital learning repositories. The pillars “Digital Teachers and Learners” and “Teaching and Learning Methods” represent the pedagogical and human aspects. Regarding Figure 4, these characteristics highlight the increasing focus on enhancing digital competencies for both students and instructors, as well as the use of cutting-edge teaching techniques, especially blended learning. With learners and teaching methods at the center of digital change, these orientations show a move away from technology-centered deployment and toward pedagogical reform. The “Training Contents” component at the curriculum level emphasizes how crucial it is to digitize and continuously update curricula in order to be responsive to changing labor market demands in the context of the digital economy.

The addition of “Cyber Security” and “Cyber Safety” at the outermost level of the structure shown in Figure 4 acts as a systemic safety measure for the whole ecosystem of digital transformation. In order to ensure the long-term sustainability and resilience of digital transformation in higher education, this layer highlights that data protection, system security, and digital safety are not ancillary issues but rather

essential prerequisites. These interconnected dimensions reflect the priority areas stated in Vietnam's national digital strategy and show how vocational and higher education institutions are supposed to coordinate curriculum reform, technological infrastructure, and pedagogical innovation within a logical transformation pathway in the context of Vietnamese higher education.

However, the intrinsic capacity of data management of schools is the decisive variable. Recent studies on the digitalization of higher education in Vietnam note strong policy dynamics but also point to challenges in data standards, data quality, and system fragmentation, which stem from project-based investment, lack of a transparent governance framework, etc, and the capacity of data personnel is still thin. In practice, many universities apply the “warehouse first, governance later” model, leading to a large data warehouse (data warehouse/lake), but the original data is not synchronized, lacking “master data” about learners, modules, programs, and lecturers; thereby limiting learning analytics and real-time executive reporting. The recommendation of the international higher education community is “governance-by-design”: clearly define the role of Data Owner -Data Steward -Data Custodian by data domain (enrollment, academics, finance, research), issue a data dictionary and classify data (sensitive/private) labeling, etc. apply role-based access control (RBAC/ABAC) and data quality processes (profiling, lineage, issue management) right from the source, [27], [28]. Regarding legal and ethical compliance, Decree 13/2023 requires the principles of lawful processing, minimization, purpose of identification, retention for a limited time, and security at all stages of personal data processing; at the same time, set up a data processing impact assessment (DPIA) mechanism for some cases, in which the university environment regularly processes sensitive data (health, disability, circumstances) for learning support [29]. The Personal Data Protection Law, passed in 2025, expands the obligations, clarifies the role of data protection officers (similar to DPOs), sanctions for violations, and regulations on cross-border data transfers, forcing international cooperation cases to evaluate suppliers and contracts under the new framework. In addition, the National Data Strategy emphasizes open data responsibly, connected to the goal of developing the digital economy and open science; this encourages

universities to publish research/education datasets under open licenses, and to comply with anonymization/pseudonymization and privacy governance, [29]

From the perspective of system design, a possible roadmap for Vietnamese schools is to prioritize the standardization of core data domains (student, course, program, staff, finance) and identify the "system of record" for each domain; deploying an API management integration layer that combines a queue/event streaming mechanism for near real-time synchronization; Apply an appropriate academic data model (e.g., an internationally standard schema for course descriptions, or a CRIS schema for research) and a data catalog to manage metadata - data origination (lineage). In the classroom, implement LTI 1.3/OAuth2 to integrate content and assessment tools with LMS; use OneRoster to sync class portfolios - enroll from SIS; build an ETL/ELT pipeline to feed into the data warehouse for BI/analytics and early warning of learning risks, [30]. At the security layer, in addition to data classification and encryption at rest/in transit, it is necessary to integrate compliance monitoring (audit), privileged access management (PAM), and supplier risk assessment process (HECVAT) before purchasing a cloud solution for training/research. When connecting to the LGSP/NDXP platform for public services, the university needs to map the digital student-citizen identification, standardize the record data field, and apply digital signatures/timestamps to preserve the legal value of diplomas and electronic transcripts according to the interconnection framework of Decree 47, [31]

Governance aspect -organizational change determines technical efficiency. International research and reviews in Vietnam have both suggested that data only brings value when it converges: common strategy, interdepartmental processes, and human capacity, [32]. Accordingly, schools should establish a data governance committee in conjunction with the IT council/digital transformation committee, set KPIs on data quality, publish an enterprise data handbook, and train a data career pathway for full-time staff - from data management, analysis, to educational data science. In terms of resources, it is necessary to gradually shift from distributed infrastructure projects to "platformization" in the direction of internal services (PaaS), prioritizing reusable components (identification, object storage, event queues, ETL, monitoring). In the Vietnamese higher education

context, the current situation suggests that Vietnamese universities are operating within a relatively favorable policy environment, with clear incentives and legal frameworks that support the advancement of data governance and system connectivity. Practical factors including data standardization, the availability of skilled human resources for data management, and institutional capability for managing organizational transformation provide more significant challenges than regulatory purpose. A comprehensive strategy that incorporates adherence to new data-related laws, open integration standards, and the use of data governance principles in line with global norms advocated by institutions like UNESCO and EDUCAUSE is needed to address these issues. With this strategy, digital transformation in higher education would be able to go beyond fulfilling administrative reporting requirements to the creation of strong analytical skills, evidence-based decision-making, and more individualized learning opportunities for students. Figure 5 presents a process model that delineates three developmental stages, providing a valuable theoretical framework for analyzing the "Digital Transformation Plan for Higher Education Development in Vietnam." The first stage, Digitization, is defined as the conversion from analog or physical formats to digital form, encompassing the steps of "Information Digitization" and "Information Organization."

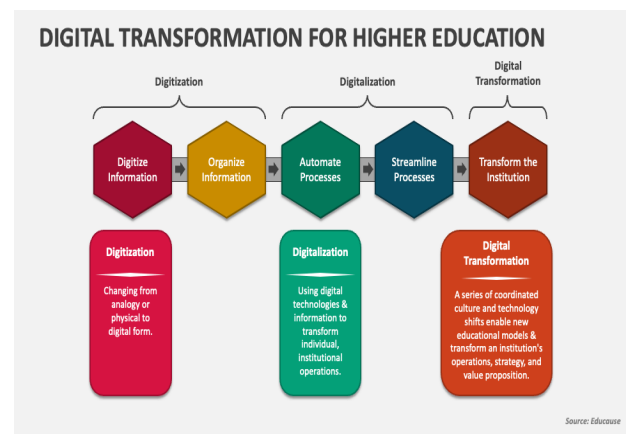


Fig. 5: Data management and system connection in the university
Source: [36]

In the Vietnamese context, this stage corresponds to foundational tasks such as the development of digital learning repositories, electronic libraries, and the digitization of student and faculty records. The

second stage, Digitalization, refers to the use of digital technologies to transform individual and organizational operations, achieved through “Process Automation” and “Process Streamlining.” This stage reflects the ongoing efforts of Vietnamese universities to deploy Learning Management Systems (LMS) and implement smart university (e-University) models to enhance administrative efficiency and optimize institutional operations. Above all, the last phase-digital transformation-indicates a comprehensive reorganization of the institution and serves as the planned culmination of Vietnam's national policy. In order to create new educational models and radically reorient institutional operations, strategic priorities, and fundamental academic values, this stage entails a concerted process of technological integration and cultural change rather than just the adoption of digital technologies. This viewpoint emphasizes that rather than concentrating only on document digitalization or process automation, Vietnam's approach aims to accomplish a comprehensive and strategic change.

3.4 Legal and Policy Framework in Digital Transformation in Universities

In the last decade, the legal and policy framework has become the guiding pillar for the digital transformation process in Vietnam's higher education system, providing both incentives and legal constraints for training institutions to plan, invest, and implement digitalization initiatives. At the national level, Decision No. 131/QĐ-TTg (2022) on “Strengthening the application of IT and digital transformation in education and training” plays a guiding role, defining goals, tasks and solutions for the period 2022–2025 with a vision to 2030; This document not only promotes the popularization of online teaching-learning platforms and digital governance, but also sets requirements for digital capacity development for lecturers, students, and management teams in schools, [33]. On that basis, a series of specialized legal documents and decrees have built a more detailed normative order, clarifying obligations on data management, information sharing, and privacy protection - core issues as universities move from manual processes to digital ecosystems. An important element in the policy architecture is the legal framework for state data sharing, which Decree 47/2020/ND-CP on management, connection, and sharing of digital data between state agencies has created a foundation for public educational institutions to connect with the e-Government system. Reduce

duplication of reports and facilitate data exploitation for governance and analysis (Government of Vietnam, 2020). When universities integrate registration data, academic affairs, degrees, and research records into interconnected platforms, this Decree plays a guiding role in connection techniques, data standards, and data provision responsibilities, and requires agencies to establish a connection mechanism. Opening up opportunities for academic data to serve strategic management, policy making, and interdisciplinary research, [34]

Figure 6 illustrates a learner-centric learning ecosystem model, a key orientation within the “Digital Transformation Plan for Higher Education Development in Vietnam.” At the core of this model is the learner (student), who-through the use of digital technology (computer)-acts as the central interface to actively access, integrate, and construct knowledge from diverse sources. These learning resources extend beyond traditional academic components that have now been digitalized, such as the “Lecturer,” “Class,” and “Library”.

The concept of *class* now encompasses virtual or blended learning environments, while *library* refers to digital repositories and open educational resources. Importantly, the model highlights the expansion and “openness” of the learning environment, reflecting the growing permeability between formal and non-formal sources of knowledge.

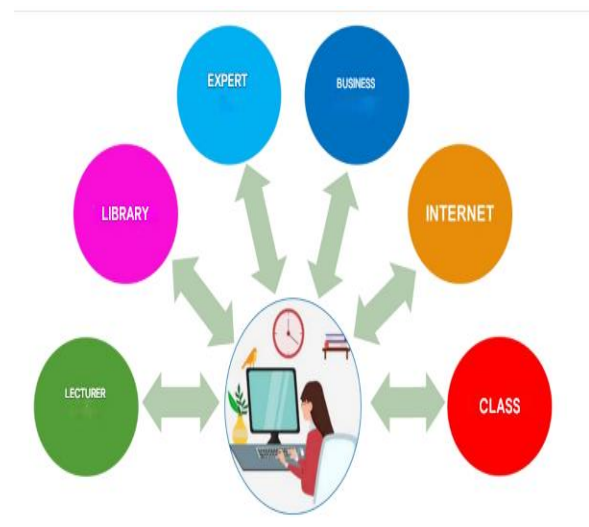


Fig. 6: Legal framework for digital transformation in universities

Source: Overview of the author collective

The inclusion of "experts" and "businesses" as essential elements of the ecosystem demonstrates Vietnam's strategic focus on bolstering relationships between academia and business, bringing educational offerings closer to the real-world demands of the labor market. According to this concept, the Internet serves as a fundamental infrastructure that increases opportunities for digital learning and permits widespread access to global knowledge networks. In a broader sense, the model depicts a shift from traditional, instructor-centered instruction to more adaptable and customized learning environments where students take on increasing responsibility for directing and determining their own educational paths. In light of the continuous digital transformation, this change aligns with Vietnam's goal to create a learner-centered, digitally integrated higher education system. Simultaneously, the development of data sharing and connection creates serious worries about personal data security. In response, Decree No. 13/2023 on personal data protection, along with the Law on Personal Data Protection enacted in 2025, imposed more stringent legal requirements for the collection, processing, storage, and transfer of personal data about students, academic staff, and university employees. These regulatory developments require higher education institutions to reassess their data governance arrangements, conduct data protection impact assessments for systems that handle sensitive information (such as health records, enrollment data, or assessment results), and designate institutional roles responsible for data protection. They also require explicit contractual terms when working with cloud service providers or third-party digital platforms.

The emergence of this legal framework highlights a central tension inherent in digital transformation: the simultaneous need to promote data openness and sharing as a driver of innovation, while safeguarding individual rights and information security. Beyond sector-specific regulations, Vietnam's national data strategy (Decision No. 142/QĐ-TTg, 2024) articulates a long-term vision for data governance that emphasizes the development of data infrastructure, the standardization of data domains, and the establishment of interoperable, cross-sectoral data-sharing platforms. These orientations directly shape how universities are expected to position and manage academic data within the broader national information ecology. For a university to design a data warehouse, metadata standards, and APIs to integrate with a national sharing platform is not only a technical story,

but also a policy obligation to ensure legal compatibility, security, and accountability. However, there are many significant gaps between policy ambitions and implementation practices. Reports and field studies show that large educational institutions in urban areas have relatively better technical capacity, resources and internal policies to meet the new requirements; In contrast, schools in low-resource areas often face difficulties in standardizing data, upgrading governance systems, and complying with data protection regulations, leading to risks in terms of safety, data quality, and interoperability, [35]. This fragmentation highlights the need for targeted government support measures - such as technical assistance funds, national data framework standards for higher education, and data governance competency training programs for IT and school management teams, [36]

In terms of internal governance, the legal framework promotes schools to form a clear data governance mechanism: delineating Data Owner, Data Steward, and Data Custodian; promulgating policies on data classification, retention, version, and quality standards; and applying technical tools such as data catalog, lineage, and SIEM to ensure transparency and auditability. These requirements are not only legal compliance but also improve evidence-based decision-making capacity in schools, a prerequisite for digital transformation to go deep instead of just digitizing old processes (EDUCAUSE; Government of Vietnam documents). An important policy consequence is the increase in liability when working with technology providers. The Data Protection Law and related decrees set strict conditions for data transfer abroad, cloud service contract management, and require that schools have a vendor risk assessment mechanism. This is a big change for schools that are familiar with the model of renting solutions in a relatively free way; now they must ensure that the contract has provisions on security, troubleshooting, and data compliance support (DLA Piper; Tilleke & Gibbins analyses),[37]

The current legislative and policy framework in Vietnam provides a thorough and more cohesive basis for promoting the digital transformation of higher education. This framework includes a long-term national strategy for data governance, a gradually consolidated regime for protecting personal data, regulatory tools controlling data connectivity and interoperability, and high-level strategic orientations on digital transformation in education. These policy

tools give universities in Vietnamese higher education guidance and regulatory support to achieve digital transformation in a more methodical and legally sound way. However, to turn this legal framework into a real driving force, universities need to implement synchronously: building governance-by-design, investing in human and technological capacity, adjusting technology contracts accordingly, and coordinating with regulatory agencies to ensure technical support and resources for weak units. In terms of research, the relationship between legal compliance, internal data governance capacity, and digital transformation efficiency in universities is a topic that needs to be analyzed in depth, using empirical data and appropriate analytical models to propose regulatory policies, prioritize resources, and implementation roadmaps in accordance with the diverse realities of Vietnam's university system, [38]

3.5 Financial Resources and Governance Models to Meet the Needs of Digital Transformation in Universities

In the context that digital transformation is being placed at the strategic focus of Vietnam's education sector, financial resources and governance models have become the two pillars that determine the implementation, scale, and sustainability of digitalization initiatives in universities. An overview of resources and governance should be placed in a causal relationship with national policies (e.g., Decision 131/QD-TTg), the state of university autonomy, and international recommendations on how to finance, share digital services, and mobilize public-private resources (World Bank, 2020; Prime Minister of Vietnam, 2022). At the macro level, many recommendations say that the State cannot (and should not) subsidize all digital transformation costs for all establishments; instead, it is necessary to combine targeted public investment, mechanisms to encourage private capital, and the development of shared platforms to effectively leverage scale and specialization, [39]

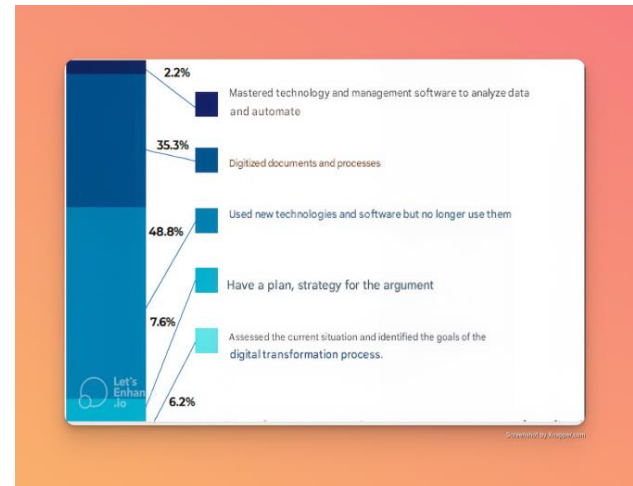


Fig. 7: Projected investment levels supporting digital transformation in universities.

Source: [21]

Figure 7 offers an empirically grounded perspective on the current challenges and levels of maturity associated with digital transformation in higher education, providing insight that is directly relevant to the implementation of Vietnam's Digital Transformation Plan for Higher Education Development. Rather than merely illustrating investment figures, the data highlight a clear disparity between the strategic ambitions articulated in national policy and the practical realities of implementation at the institutional level. The data reveal that only a very small proportion (2.2%) of institutions have reached the highest maturity level, namely "Mastering technology and management software for data analytics and automation." This represents the ultimate goal of the plan in Vietnam, aiming to develop data-driven Smart Universities. A substantial portion (35.3%) remains at the stage of "Digitizing documents and processes." This corresponds to the foundational digitization phase (as analyzed in the process diagrams), rather than comprehensive digital transformation. Most concerning, 48.8% of organizations have "adopted new technologies and software but subsequently discontinued their use." This underscores the greatest risk facing Vietnamese universities: the potential failure of technology investments. Without accompanying changes in organizational culture, systematic digital competency training for faculty, and appropriate pedagogical strategies, tools such as AI or AR/VR are likely to be abandoned, resulting in significant resource wastage.

In terms of public resources, the reality shows that the majority of public schools in Vietnam still depend

on the state budget for recurrent expenses, while capital investments (CAPEX) for IT infrastructure and digital platforms are often limited or scattered on a short-term projects. The World Bank's report (2020) proposes to increase the proportion of public expenditure on higher education and recommends strategic investments to build a shared e-learning platform and a digital learning repository serving multiple schools at the same time; This both helps save unit costs and supports schools in disadvantaged areas to access technology, [40]. At the national level, Decision 131 creates a policy framework, but still requires a specific financial allocation mechanism, standardization, and monitoring of investment efficiency to avoid resource fragmentation and waste of public investment. At the same time, the funding model based on tuition fees and autonomous revenues is increasingly encouraged in the policy of autonomous universities. Financial autonomy allows some schools to proactively allocate budgets to digital transformation - for example, prioritizing network upgrades, academic management systems (SIS), LMS, or hiring cloud services when the load needs to be increased. However, this mechanism also leads to inequality between "have" and "without" schools: branded schools attract many students who pay high tuition fees and cooperate with businesses that easily mobilize resources for large-scale investment, while many regional public schools and small schools are unlikely to be able to rely on tuition fees to fund digital colleges. Leading to the risk of digital distance in the system, [41]

To overcome this problem, the shared services model and inter-school platform are emphasized as a cost-effective strategy. The recommendations of the Vietnam Mobility Readiness Study and international studies suggest developing shared "platforms as a service" for multiple schools - for example, national learning repositories, centralized e-learning platforms, or cloud security and backup services provided on a lease-to-use basis - that reduce the barrier to entry for small and standard facilities digital service quality, [35] This model is also a practical premise for implementing public-private partnership (PPP) projects in the field of digital education, when the state plays the role of enabler and businesses provide technology/operational skills. The PPP model and cooperation mechanism with technology enterprises need to be carefully designed to balance public and private interests. Recent practice in Vietnam shows that PPP policies are promoted more broadly, creating

legal conditions for businesses to invest in digital infrastructure and smart services-this can open up more channels for capital mobilization for university e-commerce (Vietnam Investment Review, 2025). However, PPP contracts must include data protection clauses, service quality assurance, and long-term cost control mechanisms; Especially in the context of an increasingly tightening legal framework for the protection of personal data, the university has a responsibility to assess supplier risk and ensure compliance, [36]. In terms of internal governance models, digital transformation requires a shift from discrete project management to platform governance with clear decision-making mechanisms, budget decentralization, and indicators to measure investment efficiency. Schools with success in digital transformation often apply a cross-functional steering committee model chaired by senior leaders, with the core being the Digital Transformation Office or IT Department which is responsible for strategic planning, project coordination, and tracking KPIs such as process digitization rate, etc service recovery time, LMS utilization rate, and cost savings rate across shared platforms (Readiness reports; EDUCAUSE recommendations). At the same time, applying product-based funding - allocating budgets according to the digital product/service lifecycle - helps the school maintain the operating investment (OPEX) needed for continuous operation, maintenance, and upgrades. Human resources and operating costs are also key components. Digital transformation is not only the purchase of hardware/software but also requires continuous investment in IT teams, data experts, cybersecurity, and training programs for lecturers in digital education. Therefore, the budget for digital transformation needs to include both CAPEX for infrastructure and OPEX for human resources, managed services, and digital content maintenance. Some schools implement a hybrid model: in-house core strategic personnel combined with outsourcing partners to deploy intensive modules, both reducing recruitment costs and transferring skills to internal teams, [42]

In terms of fiscal transparency, universities need to develop accounting mechanisms and clear digital expenditure reports to evaluate investment efficiency (cost-benefit) and inform the decision to continue expanding or restructuring costs. At the national level, earmarked funds for inter-school platform initiatives-e.g., national e-learning development funds-can ease the burden on weak schools. At the same time, policies

to encourage donations, business cooperation, and land-for-infrastructure are also feasible financial tools in the context of Vietnam, if they are managed transparently and supervised. Financial resources and governance models to meet the needs of digital transformation in Vietnamese universities need to take into account: (1) public-private coordination mechanisms and sharing platforms to optimize costs; (2) the funding structure combined with the target state budget, the autonomy of universities and enterprises; (3) a platform governance model with clear decentralization, KPIs to measure efficiency and a budget allocation mechanism according to digital products/services; (4) a CAPEX–OPEX balanced investment plan, including human and maintenance costs; and (5) state support policies to reduce inequality between schools. The next study should quantify the relationship between financial resources, governance models, and digital transformation outcomes (e.g., LMS usage, improved learning outcomes, and administrative cost savings) to provide evidence for the design of funding policies and governance mechanisms that are appropriate to the diverse context of Vietnam's university system, [43]

4 Discussion

The fourth industrial revolution and globalization have made digital transformation in higher education an unavoidable trend. This process in Vietnam not only illustrates how the educational system has been mobilized for international integration, but it also highlights how urgently training, scientific research, university governance, and community service must all be improved. Recent events at Vietnamese colleges demonstrate how both real advancements and unresolved structural limitations influence digital change. This viewpoint is especially crucial since digital transformation involves more profound changes in institutional culture, governance structures, organizational attitudes, and the distribution of resources for sustainable development than just the introduction of new technologies.

One of the most prominent problems in this larger context is the disparity in readiness throughout institutions of higher learning. Divergent trajectories across universities as they interact with national digitalization objectives are the result of notable inequalities in readiness for digital transformation

caused by differences in governance methods, infrastructure, and human capacity. In order to get closer to the "smart university" model, several large universities in Hanoi and Ho Chi Minh City—particularly those in the engineering and economics fields—have integrated online learning platforms, centralized data infrastructure, and smart university governance systems. However, many schools in provinces or small-scale training institutions still face difficulties in investing in information technology infrastructure, a lack of human resources with digital skills, as well as limited financial resources to maintain digital transformation activities, [44]. This clearly reflects the differentiation in Vietnam's higher education system, which has existed before but is being multiplied under the impact of digital transformation. In addition to the infrastructure factor, the digital capacity of lecturers and students is also an aspect worth discussing. Although there have been many efforts to foster information technology skills for lecturers, the reality shows that there is still a huge gap between industry groups and generations. Young lecturers often easily adapt to digital teaching tools, while a part of older lecturers face many barriers in using digital platforms and innovating pedagogical methods. For students, although most of them are familiar with digital technology in daily life, the application of technology to learning and scientific research is still limited, mainly stopping at the level of information exploitation, but not developing digital creativity capacity, [45]. This poses an urgent requirement to build a comprehensive digital competency framework for both lecturers and students, associated with international standards such as the European Union's DigCompEdu, to ensure integration and competitiveness in the global environment, [46].

The organizational model and operation of digital transformation in universities is a topic that requires extensive discussion from a management standpoint. At the moment, most schools are still tackling digital transformation as standalone initiatives, concentrating on implementing various online portals or training management software packages. This strategy, however, lacks general integration, which results in dispersed data, disjointed systems, and challenges in generating value from artificial intelligence (AI) or big data analysis (big data). More recent research indicates that successful digital transformation in higher education requires more than just standalone technology projects. Rather, it necessitates the

formulation of a long-term strategic vision, the creation of an integrated information and data architecture, and the adoption of flexible and institutionally independent governance structures. Additionally highlighted as essential prerequisites for maintaining digital transformation over time are transparency and the methodical application of data to decision-making, [47]. In addition to increasing management effectiveness, this method improves the caliber of strategic decision-making and reaffirms institutions' place in the larger national higher education system, [48].

From a policy perspective, Vietnam has established a relatively comprehensive framework to advance digital transformation in higher education through the issuance of a series of key regulatory and strategic documents. Among these, Decision No. 131/QĐ-TTg (2022) stands out as a central policy instrument, formally approving the Digital Transformation Program in education and training to 2025 with a longer-term orientation toward 2030. This document emphasizes the development of online learning management systems, open learning banks, and industry data infrastructure, considering this as the foundation for the formation of a digital learning society. However, the gap between policy and practice is still significant, especially in synchronous implementation at the level of educational institutions. Many universities do not have specific mechanisms to take advantage of resources from national programs, while lacking initiative in mobilizing socialized capital or public-private cooperation to develop digital infrastructure. It is the dependence on the top-down orientation that makes the digital transformation process at many schools slow and has not reached its full potential, [49]

Another point of discussion is the relationship between digital transformation and university autonomy. Autonomy creates conditions for schools to be flexible in choosing technology solutions, financial models, and strategies for developing digital human resources. However, the lack of synchronization in governance capacity, along with limitations in monitoring and evaluation mechanisms, also makes many schools confused in determining investment priorities and ensuring the sustainability of digital transformation projects, [50]. This leads to the consequence that some schools deploy modern technology solutions but do not fully exploit their functions, or cannot maintain them after the initial time, when there is a lack of supporting resources.

Therefore, the discussion of digital transformation in Vietnamese universities is inseparable from improving management capacity, especially digital leadership capacity at the school, faculty, and department levels. In the long term, digital transformation at Vietnamese universities is not only aimed at digitizing the management or teaching and learning process, but also aims to change the education model in the direction of openness, flexibility, and association with social needs. The trend of blended learning, personalized learning, and data-driven training is gradually becoming a reality in many advanced universities around the world (OECD, 2021). Vietnam, in the process of integration, needs to take advantage of this global trend to innovate training methods, and, at the same time, affirm the position of higher education in the knowledge economy. However, to do that, it is necessary to have close coordination between the State, universities, and the technology business sector to create a unified digital ecosystem and support each other in infrastructure development, human resources, and policies, [51]

An overview of digital transformation in universities in Vietnam shows that this is a complex, multi-dimensional process, including both opportunities and challenges. Universities have achieved some initial results in deploying technology infrastructure and developing online learning models, but there are still many limitations related to digital capacity, data governance, financial models, and policy synchronization. Digital transformation cannot succeed if it only stops at purchasing equipment or applying discrete digital tools, but requires a comprehensive, human-centric strategy, based on a transparent legal foundation and closely linked to the requirements of sustainable development. Vietnam is at an important threshold to decide whether higher education can take advantage of digital transformation as a real innovation driver, or stop at superficial technical improvements, [52]

5 Conclusion

In order to achieve the strategic objectives of the national economy, higher education contributes to the development of superior human resources for society. Universities must play a leading role in digital transformation, helping to successfully implement the National Digital Transformation Strategy, fulfilling the requirements of training human resources for

digital government, etc., digital economy, and digital society. These tasks include training human resources, implementing scientific research and technology transfer, and fostering international cooperation. Digital transformation in higher education in the modern Vietnamese setting should be viewed as a strategic imperative within the larger agenda of fundamental and comprehensive educational reform, rather than just an unavoidable development trend. Universities must adapt more quickly to changes in knowledge production, technical advancements, and the labor market's need for top-notch human resources as a result of the combined pressures of globalization and the digital age. These factors make it imperative to improve data management methods, boost academic staff and students' digital capabilities, and fortify contemporary IT infrastructure. Establishing a suitable legal framework and governance model that can guarantee the coordinated, consistent, and sustainable implementation of digital transformation efforts is equally crucial.

One of the important results of the digital transformation process is the formation of a digital education ecosystem in universities. This ecosystem not only includes online learning platforms, learning management systems (LMS), and digital libraries, but also extends to big data analysis tools, artificial intelligence (AI), and cloud computing to support decision-making. Assessing the quality of training and scientific research. This process has been fundamentally changing the management model, teaching methods, and learning methods of students.

The adoption of digital technologies in university administration and instruction has accelerated due in part to the COVID-19 epidemic, laying the groundwork for a longer-term digital transformation. However, the results obtained thus far fall short of the potential and expectations. Uneven digital capacity throughout institutions, a lack of coherence in the regulatory framework guiding digital transformation, a lack of financial and human resources, and limitations in technology infrastructure are the main causes of ongoing difficulties. Inequality in access to digital education is becoming more likely, especially given the disparity between big institutions in cities and schools in rural areas. Furthermore, some instructors and students still have a low level of digital competency, and the current setups for data management and information security are still inadequate, which could lead to operational problems. These limitations imply that digital transformation in

Vietnamese higher education must be viewed as a concerted national effort rather than just an institutional initiative. The Ministry of Education and Training, other ministries and agencies, local governments, and the private sector must all work closely together to implement such a strategy. According to this viewpoint, a few enabling conditions are very important. These include the creation of long-term funding sources, the encouragement of public-private investment models, the creation of thorough frameworks for academic staff and students' digital competency, and the standardization of IT infrastructure throughout the higher education system. In order to support the growth of a knowledge-based economy and a digital society, more focus should be made on enhancing universities' capacities for research, innovation, and the commercialization of technical outputs.

When taken as a whole, the digital revolution in Vietnamese higher education offers both enormous potential and formidable obstacles. On the one hand, it provides avenues to improve the caliber of training, increase learning opportunities, encourage more fair access to information, and better match educational offerings with the demands of socioeconomic development. However, achieving these advantages calls for a thorough, well-thought-out, and long-term approach to digital transformation—one that prioritizes people, views technology as an enabling tool, and acknowledges knowledge as the main motivator. Only under these circumstances can higher education contribute significantly to sustainable development in the digital age and take the lead in the country's digital transformation process.

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References:

- [1] S. V. Tulunova and L. N. Ruliene, "China's Technological Revolution in Universities," *Alma mater. Vestnik Vyshey Shkoly*, no. 11, 2022, doi: 10.20339/am.11-22.074.
- [2] X. Jiang, Y. Jiang, and C. Ye, "Modeling and Simulation Analysis of Digital Standardization Transformation Teaching Organization and Management System," *Advances in Education, Humanities and Social Science Research*, vol. 1, no. 3, 2023, doi: 10.56028/aehtsr.3.1.174.

- [3] Y. Stukalina, "Towards Innovative Education: Developing Digital Learning Strategy in a Modern University," in *Lecture Notes in Networks and Systems*, 2021.
- [4] A. Omar, W. Altohami, and M. Afzaal, "Assessment of the Governance Quality of the Departments of English in Saudi Universities: Implications for Sustainable Development," *World Journal of English Language*, vol. 12, no. 8, 2022.
- [5] S. H. Mian, B. Salah, W. Ameen, K. Moiduddin, and H. Alkhalefah, "Adapting universities for sustainability education in industry 4.0: Channel of challenges and opportunities," *Sustainability (Switzerland)*, vol. 12, no. 15, 2020, doi: 10.3390/su12156100.
- [6] H. Masatoshi, "Educational reform for middle-income trap under digitalization: Culprits, challenges, and strategies in the Philippines," *SocioEconomic Challenges*, vol. 7, no. 3, 2023, doi: 10.61093/sec.7(3).200-218.2023.
- [7] C. J. Fernandez, R. Ramesh, and A. S. R. Manivannan, "Synchronous learning and asynchronous learning during COVID-19 pandemic: a case study in India," *Asian Association of Open Universities Journal*, vol. 17, no. 1, 2022, doi: 10.1108/AAOUJ-02-2021-0027.
- [8] S. K. Softic, M. Odak, and J. L. Lazic, "Digital transformation - New Approaches and Challenges in Education," in *2022 45th Jubilee International Convention on Information, Communication and Electronic Technology, MIPRO 2022 - Proceedings*, 2022, doi: 10.23919/MIPRO55190.2022.9803435.
- [9] G. F. Gabdrakhmanova, "The University and City Images for Migration of Nonresident Students: a Regional Case," *Vysshee Obrazovanie v Rossii*, vol. 32, no. 6, 2023.
- [10] O. A. Gironkina, N. A. Medvedeva, and E. E. Sokolova, "The Role of Digital Technologies in Distance Learning," *Open Education*, vol. 27, no. 1, 2023, doi: 10.21686/1818-4243-2023-1-4-16.
- [11] G. C. M. Moyano and M. D. R. M. Spinelli, "The use of mobile devices as an educational strategy at university" (El uso de dispositivos móviles como estrategia educativa en la universidad, *RIED-Revista Iberoamericana de Educacion a Distancia*, vol. 23, no. 1, 2020, doi: 10.5944/ried.23.1.25065.
- [12] J. B. Geroche and X. Yang, "The organizational change process during COVID-19 pandemic in a public university: The case of Kasetsart University, Thailand," *International research journal of science, technology, education, and management (Online)*, vol. 2, no. 3, 2022.
- [13] T. Sobchenko, N. Tkachova, and A. Tkachov, "Formation of Information and Digital Competence of Future Teachers in The Educational Environment of Pedagogical Universities," *Scientific Bulletin of Uzhhorod University. Series: «Pedagogy. Social Work»*, no. 2(51), 2022, doi: 10.24144/2524-0609.2022.51.145-148.
- [14] J. A. Moreira, C. S. Nunes, and D. Casanova, "Digital Competence of Higher Education Teachers at a Distance Learning University in Portugal," *Computers*, vol. 12, no. 9, 2023, doi: 10.3390/computers12090169.
- [15] L. Olivier, "Multimodal Composition Pedagogy in Higher Education: A Paradigm Shift," *Per Linguam*, vol. 37, no. 2, 2022, doi: 10.5785/37-2-996.
- [16] A. Sani, S. F. Mat Noor, and H. Mohamed, "E-Learning Framework of TVET Practical Skills Courses," *Online Journal for TVET Practitioners*, vol. 8, no. 2, 2023, doi: 10.30880/ojtp.2023.08.02.001.
- [17] I. Verbovskyi and A. Melnyk, "Modern Trends in the Training of Future Computer Science Teachers in the Conditions of Digital Transformation of Education," *Zhytomyr Ivan Franko state university journal. Pedagogical sciences*, no. 1(112), 2023, doi: 10.35433/pedagogy.1(112).2023.5-28.
- [18] R. B. P. Maluche, J. M. Molano, and L. A. O. Castro, "Strategy-structure relationship in organizational and business model innovation from digital transformation in the context of COVID-19" (Relación estrategia-estructura en la innovación

- organizacional y de modelo de negocio a partir de la transformación digital en el contexto de la COVID-19), *Cuadernos de Administracion*, vol. 35, 2022, doi: 10.11144/JAVERIANA.CAO35.REEIOM.
- [19] E. Choi, "A Paradigm Shift in Beauty Education in Response to the Digital Transformation Era -Based on Analysis of Trends in the Cosmetics and Beauty Industry," *Journal of the Korean Society of Cosmetology*, vol. 28, no. 4, 2022.
- [20] M. S. Dyachenko and A. G. Leonov, "Digital footprint in education as a driver of professional growth in the digital age," *E-Management*, vol. 5, no. 4, 2022..
- [21] M. Coffin Murray, J. Pérez, and J. Fluker, "Digital Literacy in the Core: The Emerging Higher Education Landscape," *Issues in Informing Science and Information Technology*, vol. 19, 2022, doi: 10.28945/4957.
- [22] M. YAVUZ and S. KARAMAN, "Components of Digital Transformation and Digital Transformation in Higher Education: Conceptual Framework Proposal," *Yuzunci Yil Universitesi Egitim Fakultesi Dergisi*, 2023, doi: 10.33711/yyuefd.1332639.
- [23] D. R. Serrano, A. I. Fraguas-Sánchez, E. González-Burgos, P. Martín, C. Llorente, and A. Lalatsa, "Women as Industry 4.0. entrepreneurs: unlocking the potential of entrepreneurship in Higher Education in STEM-related fields," *J Innov Entrep*, vol. 12, no. 1, 2023, doi: 10.1186/s13731-023-00346-4.
- [24] E. Pavlova, "Enhancing the Organisational Culture related to Cyber Security during the University Digital Transformation," *Information & Security: An International Journal*, vol. 46, no. 3, 2020, doi: 10.11610/isij.4617.
- [25] N. Vukčević, N. Abramović, and N. Perović, "Research of the level of digital competencies of students of the University 'Adriatic' Bar," *SHS Web of Conferences*, vol. 111, 2021, doi: 10.1051/shsconf/202111101008.
- [26] M. Pérez-Sanagustín *et al.*, "A Competency Framework for Teaching and Learning Innovation Centers for the 21st Century: Anticipating the Post-COVID-19 Age," *Electronics (Switzerland)*, vol. 11, no. 3, 2022, doi: 10.3390/electronics11030413.
- [27] J. B. G. Tilak and A. G. Kumar, "Policy Changes in Global Higher Education: What Lessons Do We Learn from the COVID-19 Pandemic?," *Higher Education Policy*, vol. 35, no. 3, 2022, doi: 10.1057/s41307-022-00266-0.
- [28] A. Omar and A. Almaghthawi, "Towards an integrated model of data governance and integration for the implementation of digital transformation processes in the Saudi Universities," *International Journal of Advanced Computer Science and Applications*, vol. 11, no. 8, 2020, doi: 10.14569/IJACSA.2020.0110873.
- [29] S. E. A. Hilal, *Vietnam: TVET in Vietnam - Situation assessment and inputs for the legal reform process*. 2020. Access: <https://www.adb.org/sites/default/files/institutional-document/551001/viet-nam-tvet-sector-assessment.pdf>
- [30] I. Kulish, "Problems of digitalization in institutions of higher education," *Nowoczesne Systemy Zarządzania*, vol. 18, no. 3, pp. 85–98, Sep. 2023, doi: 10.37055/NSZ/183869.
- [31] I. Shyshenko and I. Kharchenko, "Theoretical Aspects of Digital Transformation of Professional Training of Future Specialists," *Scientific Bulletin of Uzhhorod University. Series: «Pedagogy. Social Work»*, no. 2(49), pp. 241–244, Dec. 2021, doi: 10.24144/2524-0609.2021.49.241-244.
- [32] Y. Pasmor and M. Kulyk, "Information technologies and resources of open science: bibliometric, scientometric vision," *Law and innovations*, no. 3 (31), pp. 24–33, Oct. 2020, doi: 10.37772/2518-1718-2020-3(31)-4.
- [33] D. T. K. Oanh, D. T. D. Hien, H. T. P. Thao, M. A. Tho, D. T. M. Trang, and H. Anh, "Development of an online teaching competence framework for University lecturers in Vietnam," *Taylor & Francis*, vol. 10, no. 2, p. 2264034, 2023, doi: 10.1080/2331186X.2023.2264034.
- [34] W. P. Zhou, S. H. Yang, N. Mu, and W. Y. Jian, "Analysis of variation trend in health

- workforce equity allocation in China,” *Beijing da xue xue bao. Yi xue ban - Journal of Peking University. Health sciences*, vol. 54, no. 3, pp. 477–482, Jun. 2022, doi: 10.19723/J.ISSN.1671-167X.2022.03.012.
- [35] P. Gasbarri, D. Accardo, S. Meschini, L. C. Tagliabue, G. M. Di Giuda, and T. D. Connections, “Optimized Data Connection for a Bim-Gis Based University Asset Management System,” in *Proceedings of the European Conference on Computing in Construction*, 2023, doi: 10.35490/EC3.2023.242.
- [36] Fernández, Antonio, et al. "Digital transformation initiatives in higher education institutions: A multivocal literature review." *Education and information technologies* 28.10 (2023): 12351-12382.
- [37] Quy, V.K.; Thanh, B.T.; Chehri, A.; Linh, D.M.; Tuan, D.A. AI and Digital Transformation in Higher Education: Vision and Approach of a Specific University in Vietnam. *Sustainability* **2023**, *15*, 11093. <https://doi.org/10.3390/su151411093>
- [38] X. Jiang, Y. Jiang, and C. Ye, “Modeling and Simulation Analysis of Digital Standardization Transformation Teaching Organization and Management System,” *Advances in Education, Humanities and Social Science Research*, vol. 1, no. 3, p. 174, Feb. 2023, doi: 10.56028/AEHSSR.3.1.174.
- [39] H. Nguyen, B. Dang, Y. Hong, and A. Nguyen, “Digital transformation in Vietnamese higher education: An epistemic network analysis of policy documents,” *Journal of International Cooperation in Education*, vol. 26, no. 1, 2024, doi: 10.1108/JICE-03-2024-0010.
- [40] M. Modise and O. Zawacki-Richter, “Professional development of academics for the implementation of online learning in African open and distance teaching institutions,” *International Journal of E-Learning & Distance Education / Revue internationale du e-learning et la formation à distance*, vol. 37, no. 2, Feb. 2023, doi: 10.55667/IJEDE.2022.V37.I2.1256.
- [41] Q. T. T. Pham, H. T. Tran, and V. P. Nguyen, “Semiotics of algorithmic law in Vietnam: Decoding the digital transformation of legal texts and practices,” *Springer*, 2025, doi: 10.1007/S00146-025-02440-5.
- [42] S. H. Mian, B. Salah, W. Ameen, K. Moiduddin, and H. Alkhalefah, “Adapting universities for sustainability education in industry 4.0: Channel of challenges and opportunities,” *Sustainability (Switzerland)*, vol. 12, no. 15, Aug. 2020, doi: 10.3390/SU12156100.
- [43] GSO, *General Statistics Office of Vietnam*, 2024, 1st ed., vol. 4. Ha Noi: Statistical publisher, 2024.
- [44] G. Haugsbakk, “Special issue: 30 years of ICT and learning in education -major changes and challenges,” *Seminar.net*, vol. 16, no. 2, Dec. 2020, doi: 10.7577/SEMINAR.4043.
- [45] S. Liang, Y. Zhang, M. Ma, J. He, and S. He, “Construction of Ideological and Political Mixed Teaching in Higher Education under the Digital Transformation,” *Int J Innov Educ Res*, vol. 11, no. 8, pp. 15–20, Aug. 2023, doi: 10.31686/IJIER.VOL11.ISS8.4123.
- [46] T. M. Kostyrko, “Resources And Services of The University Library in the Conditions Of Digital Transformations,” *Library Mercury*, no. 1(27), pp. 105–113, Jun. 2022, doi: 10.18524/2707-3335.2022.1(27).256413.
- [47] H. Masatoshi, “Educational reform for middle-income trap under digitalization: Culprits, challenges, and strategies in the Philippines,” *SocioEconomic Challenges*, vol. 7, no. 3, pp. 200–218, Sep. 2023, doi: 10.61093/SEC.7(3).200-218.2023.
- [48] M. M. Saudi and R. Talib, “USIM’s Smart University Blueprint: Advances and Challenges,” *Journal of Sustainability Perspectives*, vol. 3, no. 2, pp. 176–184, Oct. 2023, doi: 10.14710/JSP.2023.20476.
- [49] M. N.-V. J. of S. P. and Management and undefined 2023, “Impacts of digital transformation on manufacture in Vietnam,” *js.vnu.edu.vn*, vol. 39, no. 2, pp. 34–45, 2023, doi: 10.25073/2588-1116/vnupam.4375.

- [50] A. Omar, W. Altohami, and M. Afzaal, “Assessment of the Governance Quality of the Departments of English in Saudi Universities: Implications for Sustainable Development,” *World Journal of English Language*, vol. 12, no. 8, pp. 443–449, Dec. 2022.
- [51] T. Nguyen, T. Le-Anh, Q. Nguyen, ... H. Q. R. in M., and undefined 2023, “Factors affecting on intellectual capital, service innovation, and digital transformation of financial industry in Vietnam,” *Springer*, pp. 525–535, 2024, doi: 10.1007/978-981-99-8472-5_48.
- [52] A. Subaeva and F. Avhadiev, “Training of Personnel for Agriculture in the Digital Economy,” *Vestnik of Kazan State Agrarian University*, vol. 16, no. 2, pp. 133–137, Aug. 2021, doi: 10.12737/2073-0462-2021-133-137.

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