

**VIETNAM PRIVATE UNIVERSITIES:
STRATEGIC DRIVING FOR DEVELOPING HIGH-QUALITY HUMAN RESOURCES,
ENTREPRENEURSHIP, AND SUSTAINABLE INNOVATION
IN THE ERA OF OPEN SCIENCE AND GLOBAL DIGITAL TRANSFORMATION**

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ROR ID: <https://ror.org/05xzsm645>Email: lily071081@gmail.comORCID iD: <https://orcid.org/0009-0009-1891-1498>**Abstract:**

In the context of an accelerating global transition from traditional industrial economies toward data-driven digital knowledge economies, higher education systems are undergoing profound transformations in governance structures, pedagogical philosophies, and societal missions. Universities are no longer confined to their conventional role as institutions of knowledge transmission within classical academic paradigms; instead, they are increasingly emerging as central actors within national innovation ecosystems, serving as hubs for interdisciplinary research, technological transfer, entrepreneurial incubation, and the cultivation of high-quality human capital for the global digital economy. Simultaneously, intensifying competition for advanced human resources, technological adaptability, and innovation capabilities has become a defining feature of the twenty-first century under the disruptive impacts of Artificial Intelligence (AI), Big Data, Open Science, digital transformation, and the globalization of knowledge production.

Across Asia, particularly within emerging economies, the expansion of university autonomy, educational privatization, and the rapid growth of private higher education institutions have substantially reshaped the architecture of contemporary higher education systems. In Vietnam, private universities are progressively positioning themselves as strategic drivers of educational innovation, digital workforce development, entrepreneurial culture, and university–industry collaboration. Nevertheless, despite notable achievements in institutional expansion and educational diversification, Vietnam’s private higher education sector continues to confront significant challenges related to educational quality, research productivity, governance capacity, international integration, digital readiness, and the adoption of open science frameworks within the broader context of global digital transformation.

Against this backdrop, the present study aims to critically examine the strategic role of Vietnamese private universities in fostering high-quality human capital development, entrepreneurial ecosystems, and sustainable innovation within the era of Open Science and global digital transformation. Furthermore, the study evaluates the adaptive capacities of private universities in terms of governance transformation, digital integration,

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industry engagement, and innovation-oriented educational models. Particular attention is devoted to exploring the potential emergence of an “Entrepreneurial Open Digital University” model as a transformative framework capable of enhancing institutional resilience, global competitiveness, and sustainable academic development in the twenty-first century.

Methodologically, this study adopts a mixed-methods research design that integrates both quantitative and qualitative approaches to ensure analytical rigor, academic reliability, and multidimensional interpretation. Secondary data are collected from official reports and international databases, including the Vietnamese Ministry of Education and Training, UNESCO, OECD, the World Bank, Scopus, and Web of Science. In parallel, empirical investigations are conducted through case studies of representative Vietnamese private universities, complemented by expert interviews involving educational leaders, university administrators, policymakers, and industry stakeholders. Advanced analytical frameworks such as SWOT analysis, PESTEL analysis, Triple Helix, and Quadruple Helix models are employed to comprehensively assess the interconnections among higher education, innovation ecosystems, digital transformation, and sustainable development.

The expected findings are anticipated to contribute substantially to both theoretical advancement and practical policymaking. Theoretically, the study seeks to establish an integrated conceptual framework regarding the strategic role of private higher education institutions within digital knowledge economies and open innovation ecosystems. Practically, the research proposes the “Entrepreneurial Open Digital University” model as an innovative developmental paradigm integrating university autonomy, digital technologies, open science, entrepreneurial innovation, and sustainability-oriented governance. In addition, the study offers policy recommendations aimed at strengthening Vietnam’s private higher education sector in alignment with international standards, thereby enhancing national competitiveness, advancing high-quality human resource development, and accelerating sustainable innovation ecosystems in the era of global digital transformation.

Từ khóa: Private higher education; High-quality human capital; Open Science; Digital transformation; Entrepreneurial university; Sustainable innovation; Innovation Ecosystem; Sustainable Entrepreneurship; Human Capital Development.

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1. Introduction

1.1. Global Context

1.1.1. Transformation of the Twenty-First Century University Model

In the context of deep globalization, the rapid expansion of the Fourth Industrial Revolution, and the unprecedented rise of the knowledge economy, the twenty-first century university model is undergoing a profound structural and systemic transformation unprecedented in the history of higher education. While twentieth-century universities were primarily perceived as institutions dedicated to knowledge transmission and workforce training, contemporary universities have increasingly evolved into strategic hubs of knowledge production, innovation generation, technology transfer, and global socio-economic transformation. This evolution represents a fundamental transition from the “Teaching University” model to the “Research University” subsequently advancing toward the “Entrepreneurial University” and ultimately emerging as the “Digital Open Innovation University” within an increasingly digitized and interconnected ecosystem.

At its initial stage, the “Teaching University” model was grounded in the foundations of traditional academic education, in which teaching activities occupied a central position and students primarily received knowledge through unidirectional pedagogical approaches. This model was compatible with the industrial economy, where societies demanded a stable and standardized workforce capable of operating within rigid production systems. Nevertheless, the accelerating advancement of science and technology, coupled with intensifying global competition, gradually exposed the limitations of purely teaching-oriented universities in generating new knowledge, fostering innovation, and addressing the increasingly complex challenges of contemporary societies.

Within this context, the “Research University” model emerged as an inevitable trajectory of modern higher education. Research universities not only disseminate knowledge but also function as strategic centers for scientific discovery, international scholarly publication, technological advancement, and national competitiveness enhancement. Scientific research has consequently become the fundamental driving force determining academic prestige and global influence. Leading institutions such as Harvard University, Massachusetts Institute of Technology, and University of Oxford have become emblematic representations of the research university paradigm, characterized by the integration of education, scientific inquiry, and innovation ecosystems. Within this framework, knowledge is no longer passively transmitted; rather, it becomes

a strategic asset for generating scientific, economic, and societal value.

However, under the pressures of economic globalization, innovation-driven competition, and the rise of the knowledge economy, the “Research University” paradigm has further evolved into the “Entrepreneurial University”. This model emphasizes the commercialization of knowledge, the development of spin-off enterprises, the cultivation of innovation ecosystems, and the establishment of strategic collaborations among universities, industries, governments, and communities. Universities are therefore no longer confined to teaching and research missions; instead, they assume a central role within national and global innovation systems. The “Triple Helix” framework—representing the dynamic interaction among universities, industries, and governments—has consequently become a pivotal theoretical foundation underpinning entrepreneurial universities in the twenty-first century. At present, the rapid advancement of Artificial Intelligence (AI), Big Data analytics, Cloud Computing, the Internet of Things (IoT), blockchain technologies, and the digital economy is propelling global higher education into a deeper stage of transformation characterized by the emergence of the “Digital Open Innovation University”. This paradigm represents a fully digitized, data-driven, and globally interconnected university ecosystem grounded in openness and collaborative innovation. Within this framework, universities transcend traditional physical boundaries and evolve into globally networked digital academic ecosystems in which knowledge is shared, co-created, and disseminated in real time.

Artificial Intelligence is fundamentally reshaping university governance, pedagogical methodologies, scientific research practices, and student learning experiences. AI technologies facilitate personalized learning through behavioral analytics, predictive educational modeling, and adaptive learning pathways tailored to individual competencies. Simultaneously, AI significantly enhances scientific research by processing massive datasets, automating analytical procedures, and accelerating the discovery of new knowledge. Within this evolving landscape, the role of academic staff is transitioning from that of “knowledge transmitters” to “architects of intelligent learning ecosystems” and “leaders of innovation-driven transformation”.

Moreover, Big Data has emerged as a strategic resource for modern universities. The utilization of educational, research, and administrative data enables institutions to improve forecasting capabilities, evidence-based policymaking,

and operational efficiency. Cloud Computing facilitates the development of flexible educational infrastructures, reduces technological investment costs, and expands global access to knowledge resources. Concurrently, the digital economy compels universities to redesign curricula toward interdisciplinary, innovation-oriented, and future-ready educational models aligned with the demands of digital societies. Emerging disciplines such as data science, artificial intelligence, cybersecurity, digital economics, and open innovation studies are consequently becoming strategic domains within global higher education systems.

More importantly, the transition toward the “Digital Open Innovation University” signifies not merely a technological modernization process but a comprehensive restructuring of the philosophical foundations of higher education in the twenty-first century. Future universities will no longer operate as isolated “ivory towers of knowledge”; rather, they will function as open platforms integrating multiple stakeholders, multidimensional value systems, and transnational collaborative networks. Within this paradigm, open innovation, lifelong learning, cross-border collaboration, and data-driven governance will become the defining principles shaping the competitiveness, sustainability, and academic influence of global higher education institutions.

1.1.2. Open Science and the Democratization of Knowledge

In the context of comprehensive digitalization and the emergence of a global knowledge economy, Open Science has become a transformative academic revolution fundamentally reshaping the production, dissemination, and application of knowledge in the twenty-first century. Whereas traditional scientific systems were often characterized by closed academic communities, restricted access, financial barriers, and monopolized data ownership, Open Science seeks to establish a transparent, collaborative, interconnected, and equitable global knowledge ecosystem. This transformation is not merely technological or institutional; rather, it represents a profound philosophical and humanitarian shift aimed at democratizing knowledge and expanding scientific accessibility for individuals, communities, and nations worldwide.

One of the most fundamental pillars of Open Science is “Open Access” to scholarly publications. For decades, high-quality scientific knowledge remained concentrated within expensive academic databases, limiting access for researchers, particularly in developing countries. Open Access has therefore introduced a transformative paradigm by promoting unrestricted digital dissemination of scientific outputs, enabling scholars and

societies to access knowledge regardless of financial capacity or geographical constraints. This movement has accelerated the circulation of scientific ideas, strengthened international collaboration, and enhanced global innovation capacity. Simultaneously, Open Access has begun to reshape the power structures of academic publishing systems, fostering a more transparent and equitable scientific environment.

Alongside Open Access, “Open Data” has emerged as a central component of contemporary scientific systems. In the era of Big Data, data are no longer considered secondary byproducts of research; instead, they constitute strategic resources determining scientific competitiveness and innovation capacity. Open Data encourages the transparent sharing, reproducibility, and reusability of research datasets, thereby strengthening scientific reliability and interdisciplinary collaboration. Open data infrastructures enable researchers worldwide to access, analyze, and expand upon shared datasets, accelerating knowledge discovery and optimizing global research resources.

Particularly in fields such as medicine, environmental science, climate change, and artificial intelligence, Open Data plays a critical role in addressing global challenges. The COVID-19 pandemic demonstrated the immense value of real-time scientific data sharing, as the international scientific community collaborated at an unprecedented scale to develop vaccines, epidemiological models, and public health strategies. This experience highlighted that Open Science not only advances academic progress but also directly contributes to safeguarding humanity against global crises.

Furthermore, “Open Educational Resources (OER)” are generating profound transformations in higher education philosophy and lifelong learning systems. OER encompass textbooks, lecture materials, digital learning resources, online courses, and educational content that are freely accessible and adaptable for public use. Amid persistent global educational inequalities, especially between developed and developing nations, OER significantly expand access to high-quality education for millions of learners worldwide. The growth of open learning platforms such as Massive Open Online Courses (MOOCs), digital libraries, and virtual universities has blurred the traditional boundaries between formal and informal education. Contemporary learners are no longer entirely dependent on closed institutional systems; instead, they can access global knowledge through flexible, personalized, and transnational learning pathways. This transformation contributes to the emergence

of a global learning society in which knowledge is increasingly recognized as a shared human asset rather than a privilege reserved for select social groups.

At a more advanced level, Open Science fosters the development of “Open Innovation Ecosystems”. These ecosystems are collaborative frameworks in which universities, industries, governments, research institutes, and communities jointly participate in the co-creation of knowledge and technology. Unlike traditional closed innovation models, open innovation ecosystems encourage resource sharing, interdisciplinary collaboration, and the mobilization of collective intelligence to address the complex challenges of contemporary societies. Within these ecosystems, universities no longer function solely as institutions for knowledge transmission; instead, they become strategic nodes within global innovation networks. Open laboratories, interdisciplinary research centers, data-sharing infrastructures, and digital scholarly communities are creating dynamic academic environments in which ideas can rapidly evolve into technological solutions, commercial products, and societal value. The convergence of Open Science and Open Innovation is therefore redefining the role of higher education within the digital economy and the global knowledge society. More importantly, Open Science and the democratization of knowledge represent not merely academic trends of the digital era but also manifestations of a broader humanistic and sustainable development vision. As the world confronts global challenges such as climate change, educational inequality, public health crises, and digital transformation, expanding access to knowledge has become a prerequisite for promoting social equity, sustainable development, and the advancement of human civilization. Consequently, Open Science is increasingly recognized as a strategic foundation for higher education, scientific research, and knowledge governance in the twenty-first century.

1.1.3. Skills Crisis and the Global Demand for Human Capital

In the context of profound civilizational transformation driven by digitalization, humanity is facing an unprecedented structural skills crisis in the history of global socio-economic development. The rapid expansion of artificial intelligence, automation, big data, intelligent robotics, green technologies, and the digital economy has not merely transformed conventional production systems but has fundamentally reconfigured labor structures, professional values, and human competitiveness in the twenty-first century. This crisis is not simply characterized by labor shortages; rather, it reflects a severe mismatch between the

competencies delivered by educational institutions and the capabilities genuinely demanded by the global labor market. Within today’s hyperconnected and intensely competitive global landscape, nations capable of cultivating adaptive, innovative, and digitally competent workforces will command strategic advantages within the global knowledge-value chain.

Workforce 4.0

The concept of “Workforce 4.0” has emerged as a defining representation of the next-generation workforce in the era of the Fourth Industrial Revolution. This workforce is no longer grounded merely in mechanical competencies or linear specialization; instead, it embodies a multidimensional human capital model integrating technological thinking, innovation capacity, interdisciplinary competence, and lifelong learning capabilities. Workforce 4.0 signifies a transition from an “execution-based labor paradigm” toward an “intelligent knowledge workforce paradigm,” in which individuals not only operate technologies but also collaborate with artificial intelligence, data ecosystems, and automated systems within fully digitized work environments. The fundamental characteristic of Workforce 4.0 lies in adaptive flexibility and the continuous reconstruction of competencies in response to accelerating technological transformation. Within the digital economy, many traditional occupations are being displaced or radically reshaped by automation and artificial intelligence. Simultaneously, entirely new professions are emerging, including data engineers, AI ethics specialists, digital experience designers, cybersecurity analysts, green technology engineers, and digital transformation consultants. Consequently, workers must continuously renew their knowledge bases, master emerging technologies, and adapt to flexible, cross-border, multicultural, and digitally mediated working models. The new labor ecosystem associated with Workforce 4.0 has also transformed the essence of global human resource governance. Contemporary organizations no longer evaluate employees primarily through conventional academic credentials; instead, they increasingly prioritize practical competencies, creativity, critical thinking, collaborative capacity, and problem-solving abilities under conditions of uncertainty. As a result, higher education institutions and vocational training systems worldwide are facing profound reform pressures to establish flexible, personalized, and labor-market-oriented educational models.

Future Skills

Parallel to the emergence of Workforce 4.0 is the rise of the concept of “Future Skills” - the core competencies that will determine humanity’s

capacity to survive and thrive in the future. Future Skills encompass not only technological proficiency but also strategic thinking, social adaptability, emotional intelligence, creative cognition, and continuous lifelong learning capabilities across professional trajectories. Within the knowledge economy and hyperconnected society, Future Skills are increasingly regarded as the strategic human capital foundation of nations. International studies indicate that competencies such as critical thinking, complex problem-solving, intercultural communication, digital fluency, innovative leadership, and human-AI collaboration will become essential standards in the future labor market. This transformation reflects a paradigm shift from traditional memorization-based education toward competency-based education emphasizing creativity, adaptability, and cognitive resilience. One of the greatest contemporary challenges is the unprecedented speed at which skills become obsolete. Many professional competencies may lose relevance within only a few years due to technological advancement. Consequently, reskilling and upskilling have become strategic imperatives for individuals, corporations, and governments alike. Modern universities are therefore evolving beyond their traditional role of initial education providers into lifelong learning hubs where learners continuously renew their competencies to adapt to the rapidly changing dynamics of the global labor market.

Green Skills

Alongside digital transformation, the global green transition is generating a profound restructuring of international labor demands. “Green Skills” have emerged as one of the central pillars of sustainable economic development, closely associated with carbon reduction goals, environmental protection, renewable energy systems, and circular economy models. These competencies encompass not only technical expertise related to green technologies but also a broader ethical framework centered on ecological responsibility and sustainable development across socio-economic activities. As the global climate crisis intensifies, nations are accelerating investments in clean energy, green technologies, sustainable agriculture, and intelligent ecological infrastructure. This transition is creating increasing demand for human resources equipped with expertise in environmental governance, sustainability management, renewable energy technologies, low-carbon engineering, and smart resource management. Green Skills are therefore not merely emerging occupational trends but foundational elements for constructing development models aligned with planetary sustainability and intergenerational responsibility. Importantly, Green

Skills are driving the emergence of “green jobs” across sectors such as sustainable transportation, green construction, environmental technologies, clean manufacturing, and ESG (Environmental, Social, and Governance) management. In the future, the integration of digital competencies with green capabilities will become a defining criterion of global human capital, reflecting the convergence between digital transformation and sustainable development.

AI Literacy

Across the broader process of global workforce transformation, “AI Literacy” has emerged as a foundational competency for twenty-first-century citizenship. AI Literacy extends far beyond the mere ability to use artificial intelligence tools; it encompasses understanding AI operational principles, evaluating technological ethics, critically interpreting data systems, and effectively collaborating with intelligent technologies. The rapid advancement of AI generates enormous opportunities for economic growth, innovation, and productivity enhancement. Simultaneously, however, it intensifies the risks of skills inequality, technological unemployment, and digital divides among populations and nations. Consequently, AI Literacy has become an essential prerequisite for ensuring equitable human participation within the future digital society. Within modern higher education systems, AI Literacy is increasingly integrated into curricula as a cross-disciplinary universal competency. Students are expected not only to utilize AI tools for learning and research but also to understand algorithmic ethics, data privacy, technological transparency, and the societal responsibilities associated with artificial intelligence. This reflects a paradigmatic shift from “training technology users” toward “educating responsible digital citizens”. Overall, the skills crisis and global workforce demands of the twenty-first century are generating urgent pressures for educational restructuring, training innovation, and strategic human capital development aligned with digital transformation and sustainable development. Workforce 4.0, Future Skills, Green Skills, and AI Literacy are no longer isolated concepts; rather, they are converging into a strategic foundation for national competitiveness in the post-industrial era. Nations capable of mastering high-quality human capital development will possess the capacity to lead innovation, control global knowledge-value chains, and consolidate their positions within the emerging global economic order.

1.2. Vietnamese Context

1.2.1. The Development Process of Non-Public Higher Education in Vietnam

Within Vietnam's broader trajectory of renovation and international integration, non-public higher education has emerged as a historically significant phenomenon, reflecting the profound transformation from a centrally subsidized educational model toward a diversified, socialized, and globally integrated higher education system. The emergence and development of the non-public university sector have not merely resulted from the growing demand for educational expansion amid a youthful population and increasing learning aspirations; rather, they constitute a vivid manifestation of the restructuring of Vietnam's national education system toward flexibility, modernization. The emergence of non-public universities in Vietnam is closely associated with the *Đổi Mới* reforms initiated in 1986, during which the national economy gradually transitioned toward a market-oriented system and the demand for highly qualified human resources became increasingly urgent. Under such circumstances, the traditional public higher education system, constrained by limited financial resources, was no longer capable of accommodating the rapidly growing societal demand for tertiary education. This context provided the essential foundation for the rise of non-public higher education as a strategic solution aimed at mobilizing social resources for higher education development.

Stages of Formation and Development

The development of non-public higher education in Vietnam can be categorized into several historical and institutional stages, each reflecting shifts in educational governance, human capital policies, and national modernization strategies.

The first stage, spanning from the late 1980s to the mid-1990s, may be regarded as the experimental and foundational period of non-public higher education. During this phase, the Vietnamese government began permitting the establishment of people-founded universities to alleviate pressure on the public higher education system. The earliest non-public institutions emerged amid intense societal debates concerning legitimacy, educational quality, and the role of private actors in education.

The second stage, extending from the late 1990s to approximately 2010, was characterized by rapid expansion in both the number and scale of non-public universities. As Vietnam accelerated industrialization, modernization, and international integration, the demand for university-educated human resources increased dramatically. The government introduced numerous policies promoting the socialization of education, thereby encouraging organizations, enterprises, and individuals to invest in higher education. During this period, many private universities were established, contributing to

the diversification of the national higher education system and expanding educational access across various regions of the country. Importantly, the growth of non-public higher education during this period reflected the transition from elite education toward mass higher education. Whereas university education had previously been accessible only to limited segments of society, the expansion of the non-public sector significantly democratized access to tertiary education for broader populations. This transformation carried profound implications not only for economic development but also for social equity and national human capital advancement.

The period from 2010 to the present marks a strategic transition from quantitative expansion toward quality enhancement, university governance reform, and international integration. Amid intensifying global competition in higher education, non-public universities in Vietnam have increasingly restructured their development strategies by emphasizing educational quality, investing in modern infrastructure, fostering research ecosystems, and strengthening international partnerships. Many non-public institutions have shifted from scale-oriented development models toward innovation-driven university models emphasizing digital transformation and high-quality human capital development for the knowledge economy.

Contributions to Educational Expansion and the Socialization of Education

One of the most significant contributions of Vietnam's non-public higher education sector has been its capacity to rapidly expand tertiary education enrollment through substantial mobilization of social resources. In the context of limited state educational budgets, the non-public sector has considerably alleviated pressure on public universities by providing hundreds of thousands of additional learning opportunities for students nationwide. The expansion of non-public higher education has not only increased student enrollment but has also substantially accelerated the socialization of education - a strategic national policy within Vietnam's reform agenda. In this context, educational socialization should not merely be interpreted as transferring financial responsibilities from the state to society; more profoundly, it represents the comprehensive mobilization of economic, intellectual, and community resources to collectively advance education as a strategic public good. Non-public universities have also contributed to fostering competition and innovation within Vietnam's higher education system. The emergence of flexible governance structures, market-responsive curricula, and industry-linked educational strategies has generated reform pressures on traditional public universities. In many instances, non-

public institutions have functioned as “innovation laboratories” for implementing educational technologies, modern university governance practices, and enterprise-oriented training models.

Furthermore, the non-public higher education sector has played an important role in advancing the internationalization of Vietnamese higher education. Numerous private universities have proactively developed international joint programs, bilingual education models, transnational research collaborations, and internationally accredited quality assurance systems. Such initiatives have contributed to enhancing the global standing of Vietnamese higher education and gradually constructing a university ecosystem with international competitiveness. Nevertheless, the development of non-public higher education in Vietnam has also encountered numerous complex challenges, including disparities in educational quality, limitations in scientific research, financial pressures, enrollment competition, and ongoing debates regarding university governance models. These issues indicate that the sustainable development of the non-public sector depends not merely on quantitative expansion but also on long-term strategies emphasizing academic quality, research capacity, transparent governance, and social responsibility. Overall, the development of non-public higher education in Vietnam constitutes a crucial component of the nation’s educational modernization and transition toward a knowledge-based economy. From an initially experimental and controversial model, the non-public university sector has progressively established its strategic role in human capital development, educational accessibility expansion, and the socialization of higher education. In the contemporary context of digital transformation, global competition, and sustainable development imperatives, non-public universities are expected to continue serving as key drivers of innovation, creativity, and internationalization within Vietnam’s higher education system in the twenty-first century.

1.2.2. Contemporary Challenges

In the context of global digital transformation, international knowledge competition, and the profound restructuring of the world economy, Vietnamese higher education in general and the non-public university sector in particular are confronting unprecedented multidimensional and systemic challenges. Despite remarkable achievements in expanding educational access, promoting the socialization of education, and supplying human resources for national industrialization and modernization, Vietnam’s higher education system continues to face substantial pressures associated with educational quality, scientific research capacity,

global competition, and adaptability to emerging technological revolutions. These challenges not only reveal the internal limitations of the national higher education system but also highlight the widening gap between Vietnam’s academic capabilities and the developmental demands of the global knowledge economy.

Uneven Educational Quality

One of the most significant challenges facing Vietnamese higher education today is the uneven quality of education across institutions, particularly between public and non-public universities, between central and regional institutions, and among different academic disciplines. While several universities have progressively approached international standards in curriculum design, university governance, and quality assurance, many others continue to experience considerable limitations regarding academic staff, infrastructure, pedagogical methodologies, and labor-market connectivity. This disparity generates substantial gaps in graduate quality, employability, and institutional academic reputation. In many cases, curricula remain excessively theoretical, insufficiently updated to reflect industry demands, and inadequately integrated with digital competencies, interdisciplinary capabilities, and innovation-oriented skills. Consequently, a structural mismatch has emerged between university education and the workforce demands of the digital economy, creating significant difficulties for graduates transitioning from academic environments to the global labor market. Particularly, the rapid expansion in the number of higher education institutions over recent decades has not always been accompanied by sufficiently robust quality assurance mechanisms. Some non-public universities remain heavily dependent on tuition revenues, thereby generating enrollment pressures and increasing the risk of educational commercialization. Under such circumstances, ensuring educational quality, cultivating academic culture, and maintaining institutional standards have become strategic imperatives for Vietnam’s entire higher education system.

Limitations in Scientific Research

In addition to educational quality concerns, limitations in scientific research remain one of the most critical bottlenecks constraining the advancement of Vietnamese higher education in the knowledge era. Within the modern university model, scientific research is not merely a core academic function but also the foundation for innovation, technology transfer, and national competitiveness enhancement. Nevertheless, many Vietnamese higher education institutions have yet to establish sufficiently robust research ecosystems capable

of effectively participating in global knowledge networks.

Although the number of international publications has increased in recent years, Vietnam still trails significantly behind many regional and global counterparts. Research capacity at numerous universities remains constrained by limited financial resources, inadequate research infrastructure, ineffective scientific governance mechanisms, and academic environments that insufficiently encourage innovation. Notably, within many non-public institutions, institutional priorities remain predominantly teaching-oriented rather than research-intensive, thereby hindering the comprehensive evolution toward modern research university models. Another critical issue lies in the weak linkage among universities, industries, and the national innovation ecosystem. Many scientific studies remain predominantly theoretical, with limited practical applicability and insufficient capacity to generate impactful technology transfer for socio-economic development. Consequently, the role of universities as knowledge-production centers and engines of national innovation has yet to be fully realized.

Pressures of International Competition

In the era of educational globalization and transnational knowledge mobility, Vietnamese higher education is increasingly subjected to intense international competitive pressures. The rise of transnational universities, global online learning platforms, international degree programs, and worldwide university ranking systems has created an unprecedented competitive environment for domestic higher education institutions. Vietnamese universities are not only competing domestically for student enrollment but also confronting international institutions in terms of educational quality, academic branding, research capacity, and the ability to provide global career opportunities for graduates. While numerous countries have successfully established world-class universities characterized by powerful research ecosystems and global talent attraction capabilities, most Vietnamese institutions remain in transitional stages of governance reform, internationalization, and academic transformation. International competition is further reflected in the phenomenon of “brain drain” whereby highly capable students and academics choose to study, conduct research, or work abroad. This trend poses substantial challenges to talent retention and the development of high-quality domestic scholarly communities. Simultaneously, the necessity to satisfy international accreditation standards, improve global university rankings, and increase international publication outputs places additional pressure on Vietnamese higher education

institutions.

Digital Divide and Innovation Capacity

One of the defining contemporary challenges confronting Vietnamese higher education is the digital divide and limited innovation capacity amid the unprecedented acceleration of the Fourth Industrial Revolution. Digital transformation extends beyond the application of technologies in administration and teaching; it entails the comprehensive restructuring of university models toward data-driven systems, intelligent connectivity, and digital knowledge creation. However, the capacity to access and implement digital technologies remains highly uneven across institutions. While several major universities have begun developing smart university models, integrating artificial intelligence into governance, and constructing digital learning ecosystems, many others continue to lack basic technological infrastructure and digitally competent human resources. This disparity not only exacerbates educational inequality but also constrains the participation of numerous universities in the global knowledge economy. Vietnam's higher education innovation capacity also remains constrained by insufficient support mechanisms for interdisciplinary research, underdeveloped academic entrepreneurship ecosystems, and limited innovation-oriented academic cultures. In many instances, traditional governance models and bureaucratic administrative structures continue to reduce institutional flexibility, creativity, and adaptability in responding to the rapid transformations of the digital age. Overall, the contemporary challenges confronting Vietnamese higher education reflect a profound transition from traditional educational paradigms toward innovation-driven and globally integrated university models. Uneven educational quality, limited scientific research capacity, intensifying international competition, and digital disparities are not merely technical governance issues; rather, they constitute strategic challenges directly associated with Vietnam's national competitiveness in the twenty-first century. Under such circumstances, higher education reform is no longer a matter of incremental improvement but has become an existential imperative for the country's sustainable development and intellectual positioning within the emerging global order.

1.2.3. Strategic Opportunities

In the context of a profound restructuring of the global knowledge economy, Vietnamese higher education is not only confronting systemic challenges but is simultaneously entering an era of unprecedented strategic opportunities. The transformation of the global economic order, the

Fourth Industrial Revolution, the national digital transformation agenda, the expansion of innovation ecosystems, and the internationalization of education are collectively generating new momentum for repositioning Vietnam's higher education system within the global knowledge landscape. Particularly for the non-public higher education sector, this period represents not merely a phase of adaptation but a strategic moment for breakthrough transformation, institutional restructuring, and the reaffirmation of its role as a driving force of innovation within the national educational ecosystem.

University Autonomy Policies

One of the most significant strategic opportunities for Vietnamese higher education today lies in the advancement of university autonomy as a foundational reform orientation. University autonomy is not merely the delegation of managerial authority to higher education institutions; more profoundly, it represents the transformation from a centrally controlled administrative model toward a modern governance paradigm grounded in accountability, institutional effectiveness, and academic competitiveness. For decades, highly centralized administrative governance models constrained the flexibility, creativity, and adaptive capacity of Vietnamese universities in responding to rapidly changing global conditions. The promotion of university autonomy now creates opportunities for institutions to become more proactive in curriculum development, high-quality talent recruitment, social resource mobilization, scientific research advancement, and international collaboration. Particularly for non-public universities, autonomy policies provide favorable conditions to capitalize on institutional flexibility, innovative educational models, and responsiveness to labor market demands. Amid intensifying global competition, university autonomy is increasingly viewed as the cornerstone for developing innovation-driven universities, entrepreneurial universities, and research-oriented institutions capable of deep international integration. More importantly, university autonomy is accelerating a philosophical transition from “centralized administration” toward “modern academic governance” in which quality, innovation, and effectiveness become core institutional values. This transformation constitutes a strategic foundation enabling Vietnamese higher education to approach international standards of university governance and knowledge development.

National Digital Transformation

Another era-defining strategic opportunity for Vietnamese higher education lies in the implementation of the national digital transformation agenda across the country. As the digital economy

emerges as a major engine of global growth, digital transformation is no longer merely a technological trend but a catalyst for the comprehensive restructuring of higher education systems.

The advancement of digital technologies, artificial intelligence, big data, cloud computing, and online learning platforms is creating opportunities for the development of “smart universities” characterized by flexible, personalized, and globally connected educational ecosystems. Such developments enable Vietnamese universities to transcend traditional limitations related to physical space, temporal constraints, and instructional methodologies while simultaneously broadening educational access for diverse learner populations. For non-public universities, digital transformation also provides an opportunity to narrow developmental gaps with larger institutions through the application of technology in governance, teaching, research, and industry engagement. Digital learning platforms, intelligent university management systems, and blended learning models are fostering profound innovations in higher education organization and delivery.

More importantly, the national digital transformation agenda is facilitating the development of a large-scale digital workforce - a decisive factor for national competitiveness in the twenty-first century. Under such conditions, higher education institutions are evolving beyond their traditional role as workforce training providers to become centers of digital knowledge production, technological innovation, and smart societal development.

Innovation and Startup Ecosystem

The development of Vietnam's innovation and startup ecosystem is creating an entirely new developmental space for higher education. Within the knowledge economy, universities are no longer merely institutions for knowledge transmission; increasingly, they are becoming centers of innovation, applied research, and the creation of new technology-driven enterprises. The expansion of venture capital funds, innovation hubs, open creative spaces, and policy support for technology enterprises has enabled universities to engage more deeply with the national innovation ecosystem. This development encourages the emergence of the “entrepreneurial university” model, in which scientific research, education, and knowledge commercialization are closely interconnected. Within this context, students are no longer educated solely to seek employment; rather, they are increasingly encouraged to become innovators, entrepreneurs, and creators of new societal value. Innovation-oriented mindsets, entrepreneurial

thinking, and practical problem-solving capabilities are becoming essential components of modern higher education. For non-public universities, the innovation startup ecosystem offers opportunities to establish distinctive competitive advantages through enterprise-linked education, applied research, and technology commercialization. This transformation enables non-public institutions to evolve from “teaching-oriented entities” into “knowledge innovation and economic development centers”.

Global Educational Integration

In the era of knowledge globalization, international educational integration has become an exceptionally important strategic opportunity for Vietnamese higher education. The expansion of global academic networks, transnational research collaboration, and international knowledge mobility is creating unprecedented possibilities for Vietnamese universities to connect with the global scholarly community. Through international joint-degree programs, student exchange initiatives, research partnerships, and international accreditation systems, Vietnamese universities gain opportunities to access advanced academic standards, strengthen research capabilities, and progressively establish their presence within the global higher education landscape. This process is particularly significant in an era when knowledge competition increasingly depends on international connectivity and participation in global academic value chains. Global educational integration also enables Vietnamese higher education to access advanced governance models, modern educational technologies, and innovative pedagogical approaches. Simultaneously, it offers opportunities to promote Vietnamese knowledge systems, cultural values, and academic identity internationally, thereby enhancing the nation’s “knowledge-based soft power” in the twenty-first century. Overall, the current strategic opportunities are opening a new developmental era for Vietnamese higher education - an era characterized by autonomy, innovation, digital transformation, and global integration. University autonomy policies, the national digital transformation agenda, the expansion of innovation startup ecosystems, and the internationalization of education are not only driving reform momentum but also laying the foundation for the emergence of next-generation university models in Vietnam. In the increasingly competitive global knowledge landscape, the effective utilization of these strategic opportunities will ultimately determine the position of Vietnamese higher education within the emerging international academic and economic order.

1.3. Research Gap

In the context of profound structural transformations

occurring within global higher education under the influence of digital transformation, artificial intelligence, open science, and the knowledge economy, the identification of research gaps carries not only academic significance but also strategic value for shaping future university development models. For Vietnam and the broader Southeast Asian region, the rapid expansion of non-public higher education is generating new theoretical, managerial, innovative, and human capital development demands. Nevertheless, a systematic review of the existing literature reveals substantial gaps in both theoretical and practical dimensions, particularly regarding the construction of integrative models suitable for the transitional contexts of developing economies.

Lack of Integrative Research Linking Non-Public Universities, Open Science, Digital Transformation, Sustainable Innovation, and High-Quality Human Capital Development

One of the most significant contemporary research gaps lies in the absence of interdisciplinary integrative studies connecting non-public higher education, open science, digital transformation, sustainable innovation, and high-quality human capital development. Most existing studies approach these themes separately, fragmentedly, or within the limited framework of conventional educational governance, without constructing a comprehensive theoretical architecture capable of systematically linking the core drivers shaping next-generation universities in the digital era. In many international studies, non-public universities are primarily examined through the lenses of enrollment expansion, financial mechanisms, or institutional governance. Meanwhile, research on open science tends to focus on open access, open data, scholarly collaboration, and the democratization of knowledge. Similarly, studies on digital transformation frequently emphasize technological applications in management and teaching, whereas sustainable innovation is often approached from the perspectives of green economic development or entrepreneurial ecosystems. This fragmentation has resulted in a condition of academic compartmentalization in which the strategic components of modern universities exist as “parallel knowledge systems” lacking integration within a unified analytical framework. Notably, very few studies investigate the interdependent relationship between open science and digital transformation within the context of non-public universities. In practice, digital transformation is creating the technological infrastructure necessary to advance open science through open data systems, digital scholarly platforms, artificial intelligence, and global research networks. Simultaneously, open science contributes to sustainable innovation

by enhancing knowledge sharing, interdisciplinary collaboration, and university-industry-society connectivity. Nevertheless, current scholarship has yet to sufficiently clarify how these dimensions interact to shape innovation-oriented university models within developing countries.

Another critical academic gap concerns the insufficient linkage between research on non-public universities and strategies for high-quality human capital development. In the era of Workforce 4.0 and the knowledge economy, universities no longer function solely as providers of vocational qualifications; rather, they serve as centers for cultivating innovation capabilities, digital thinking, and future-oriented skills. However, most current studies continue to approach human capital development through traditional linear frameworks, without adequately analyzing the role of non-public universities in producing adaptive workforces capable of responding to artificial intelligence, green transformation, and the global digital economy.

Furthermore, existing studies lack integrative models capable of evaluating the combined impacts of digital transformation, open science, and innovation on university competitiveness. In today's global educational environment, competitive advantage no longer depends solely on enrollment size or physical infrastructure; increasingly, it derives from the capacity to establish open knowledge ecosystems, foster innovation capabilities, and achieve international connectivity. Yet, current scholarship has not sufficiently developed multidimensional indicators or analytical frameworks capable of comprehensively capturing these transformations.

Lack of Theoretical Models Appropriate for the Southeast Asian and Vietnamese Contexts

Another particularly important research gap concerns the scarcity of theoretical models appropriate to the economic, cultural, political, and educational characteristics of Southeast Asia in general and Vietnam in particular. Most prevailing theories concerning university governance, innovation, digital transformation, and open science have been developed primarily from the experiences of Western countries or advanced economies characterized by stronger institutional conditions, greater financial resources, and superior technological infrastructures.

In contrast, Southeast Asian nations possess highly distinctive developmental characteristics, including uneven economic transitions, cultural diversity, regional disparities, demographic pressures associated with youthful populations, and varying degrees of dependence on public education systems. Consequently, the direct application of

Western theoretical models to the Vietnamese context often lacks contextual appropriateness and fails to adequately capture the specificities of the regional higher education ecosystem.

In Vietnam, the development of non-public higher education occurs within a distinctive context in which market mechanisms, state governance, and educational socialization coexist and interact in highly complex ways. This developmental pattern differs substantially from Western countries, where private higher education sectors have evolved over much longer historical periods under more mature autonomy frameworks. Nevertheless, existing studies have yet to construct theoretical models capable of accurately reflecting the “institutional hybridity” characterizing Vietnam's transitional higher education system.

Another notable limitation is the shortage of comparative Southeast Asian studies aimed at identifying higher education development models suitable for developing countries. Most current studies either focus on isolated national cases or rely excessively on universal global standards without sufficiently considering the roles of culture, institutions, and local historical trajectories. This limitation constrains the development of “localized theories” possessing strong practical relevance for the region.

Moreover, amid the global expansion of digital transformation and open science, Vietnamese scholarship still lacks theoretical frameworks capable of explaining the relationship between technology, knowledge governance, and sustainable development within non-public university environments. Existing models tend to prioritize technological analyses or conventional educational management perspectives, without conceptualizing universities as open knowledge ecosystems characterized by multi-stakeholder collaboration and sustainable innovation.

The foregoing analysis demonstrates that the current research gap extends beyond the mere absence of data or isolated scholarly works; more fundamentally, it reflects the lack of an integrative, multidimensional theoretical model appropriate to the developmental contexts of Vietnam and Southeast Asia in the era of global digital transformation. This gap generates an urgent need for new research frameworks capable of connecting non-public higher education, open science, digital transformation, sustainable innovation, and high-quality human capital development as strategic pillars of next-generation universities. Simultaneously, such efforts provide an essential academic foundation for constructing university models capable of adapting to post-industrial

conditions, strengthening national competitiveness, and contributing to the sustainable development of the region in the twenty-first century.

1.4. Research Questions

In the context of a global transition toward innovation-driven, digital, and open university models, Vietnam's non-public higher education sector is approaching a historic turning point. The profound transformations associated with the knowledge economy, global digitalization, artificial intelligence, open science, and international competition are not only reshaping university operational structures but also redefining the role of higher education in national development. In Vietnam, non-public universities are increasingly regarded as strategic actors in the socialization of education, the development of high-quality human capital, and the promotion of innovation ecosystems. Nevertheless, the development of this sector continues to raise numerous theoretical and practical issues that require systematic, interdisciplinary, and context-sensitive investigation within the broader transformation of Southeast Asia in the digital era. Based on the identified research gaps, this study develops a system of research questions intended to clarify the roles, developmental drivers, operational models, and adaptive capacities of Vietnamese non-public universities in response to the transformations of the digital age. These research questions are designed not merely to explain existing realities but also to construct a theoretical foundation for the development of innovative, sustainable, and internationally competitive non-public university models in the twenty-first century.

First Research Question

How are Vietnamese non-public universities contributing to the development of high-quality human capital?

This research question emerges from the urgent demands of the knowledge economy and global labor market for highly qualified human capital equipped with digital competencies, innovative thinking, and adaptive capabilities within rapidly evolving technological environments. Over recent decades, Vietnam's non-public universities have continuously expanded educational capacity, diversified academic disciplines, and promoted educational models closely aligned with industry and societal needs. Nevertheless, the substantive role of this sector in producing high-quality national human capital has not yet been comprehensively examined from a strategic and long-term perspective. This question seeks to analyze the contribution of non-public universities to workforce development in strategic sectors of the digital economy while simultaneously evaluating their capacity to cultivate

future-oriented competencies such as digital literacy, innovation skills, entrepreneurial capabilities, and lifelong learning capacities. It also provides a basis for determining whether the non-public higher education sector can evolve into a strategic driver for enhancing national human capital competitiveness.

Second Research Question

Which factors determine the innovation and entrepreneurial capacities of non-public universities?

Within today's innovation-driven economy, universities no longer function solely as institutions for knowledge transmission; increasingly, they serve as centers for innovation, applied research, and technological entrepreneurship. Particularly for the non-public sector, innovation and entrepreneurial capacities are decisive factors influencing adaptability, competitive advantage, and sustainable development within the globalized higher education environment.

This research question focuses on identifying the key determinants influencing the innovation capacities of non-public universities, including governance models, institutional autonomy, academic culture, research ecosystems, digital transformation capabilities, industry collaboration, innovation-support policies, and international integration. Furthermore, the study seeks to clarify the role of academic environments in fostering entrepreneurial mindsets, technological creativity, and university-based startup ecosystems. Investigating this question is critically important for constructing "innovation-oriented university" models appropriate to the contexts of Vietnam and Southeast Asia, where higher education is increasingly becoming a central component of knowledge-based economic and creative societal ecosystems.

Third Research Question

How do digital transformation and open science influence the model of non-public universities?

Digital transformation and open science are emerging as two foundational paradigms shaping global higher education in the twenty-first century. The advancement of artificial intelligence, big data, digital scholarly platforms, open data systems, and open-access infrastructures is fundamentally restructuring the production, storage, dissemination, and circulation of knowledge within university environments. Under these conditions, traditional university models are gradually evolving toward open, connected, and data-driven institutional forms.

This research question seeks to analyze the impacts of digital transformation and open

science on university governance, educational models, scientific research activities, scholarly collaboration, and institutional competitiveness within non-public universities. Simultaneously, it examines whether digital transformation and open science can function as strategic drivers enabling non-public universities to reduce developmental disparities with major institutions and integrate more deeply into global knowledge networks. This question also carries significance in clarifying the potential emergence of the “open digital university” - a next-generation university model grounded in open knowledge systems, digital technologies, and globally connected academic ecosystems.

Fourth Research Question

Which model of non-public university is most suitable for sustainable development in the digital era?

This constitutes the most comprehensive and strategic research question of the study, aiming to develop a new theoretical model for Vietnamese non-public universities within the context of global transformation. In the twenty-first century, university development is no longer measured merely by enrollment scale or physical infrastructure; increasingly, it depends upon innovation capacity, sustainability, technological adaptability, and societal contribution.

This question focuses on identifying a non-public university model capable of effectively integrating university autonomy, digital transformation, open science, sustainable innovation, and high-quality human capital development. Simultaneously, the study seeks to determine the institutional, policy, and governance conditions necessary for constructing a university ecosystem appropriate to the contexts of Vietnam and Southeast Asia. More importantly, this question reflects the necessity of transitioning from traditional university paradigms toward “sustainable innovation university” models in which knowledge, technology, human development, and social responsibility are integrated within a holistic developmental ecosystem. It also constitutes an important academic foundation for contributing to new theoretical perspectives on non-public higher education within developing countries in the post-industrial era.

Overall, the proposed system of research questions is intended not only to explain the current developmental realities of Vietnamese non-public higher education but also to establish a theoretical foundation for next-generation university models in the digital age. Collectively, these questions reflect the urgent need to restructure higher education toward innovation, digital transformation, open science, and sustainable development in order to

strengthen national competitiveness within the global knowledge economy.

1.5. Research Hypotheses

In contemporary scientific inquiry, research hypotheses serve not merely as instruments for testing relationships among variables but also as reflections of the theoretical foundations, academic orientations, and developmental logic underpinning the entire research project. Particularly within interdisciplinary studies on higher education in the context of digital transformation and the knowledge economy, the construction of a coherent hypothesis system plays a crucial role in connecting theoretical concepts with the practical realities of next-generation university development. In this study, the hypotheses are formulated based on the synthesis of theories related to digital transformation, open science, innovation, university governance, and high-quality human capital development, while simultaneously incorporating the distinctive characteristics of non-public higher education systems in Vietnam and Southeast Asia. The system of research hypotheses is designed to examine the strategic relationships among digital transformation, innovation ecosystems, open science, university autonomy, and the developmental capacities of non-public universities in the digital era. Through this framework, the study seeks to establish an academic foundation for sustainable innovation-oriented university models suitable for developing countries.

Hypothesis H1

Digital transformation positively influences educational quality and the competitiveness of non-public universities.

Hypothesis H1 is grounded in theories of educational digital transformation and smart university models within the context of the Fourth Industrial Revolution. In modern educational environments, digital transformation extends far beyond the simple application of information technology in management or teaching; rather, it represents a comprehensive restructuring of university models toward data-driven systems, intelligent connectivity, and personalized learning. For non-public universities, digital transformation carries particular significance because this sector is characterized by high flexibility and rapid adaptability to changes within the educational market. The implementation of digital learning platforms, artificial intelligence, big data, digital libraries, intelligent learning management systems, and online educational models is expected to enhance educational quality, improve student learning experiences, and expand access to global knowledge resources.

Furthermore, digital transformation enables

universities to strengthen competitiveness through governance optimization, enhanced industry engagement, expanded international collaboration, and academic brand development within the global educational landscape. Amid intensifying competition among higher education institutions, digital capability is increasingly regarded as a strategic advantage determining institutional positioning within the knowledge economy. Accordingly, Hypothesis H1 proposes that higher levels of digital transformation significantly improve both educational quality and institutional competitiveness within non-public universities.

Hypothesis H2

University startup ecosystems enhance students' innovation capacity.

Hypothesis H2 derives from theories of entrepreneurial universities and innovation ecosystems in modern higher education. Within the creative economy, universities are increasingly perceived not merely as centers for knowledge dissemination but also as spaces for cultivating entrepreneurial thinking, technological creativity, and new business models.

University startup ecosystems encompass multiple components, including innovation centers, open creative spaces, business incubators, startup funding mechanisms, mentorship networks, industry partnerships, and entrepreneurial training programs. These elements collectively create dynamic academic environments that encourage students to address real-world problems, develop creative thinking, and cultivate innovative capacities. In the context of digital transformation and the knowledge economy, students' innovation capacities are no longer measured solely by technological invention but also encompass critical thinking, interdisciplinary competence, adaptability, and lifelong learning orientations. Therefore, examining this hypothesis is essential for evaluating the role of non-public universities as centers for cultivating creative human capital for national development. Hypothesis H2 therefore posits that the development of university startup ecosystems exerts a positive influence on students' innovation capacities.

Hypothesis H3

The level of open science adoption is positively correlated with research productivity and international collaboration.

Hypothesis H3 is formulated based on theories of open science and global knowledge networks in the digital era. Open science has emerged as a transformative academic paradigm that promotes the democratization of knowledge through open access, open data, collaborative research, and the global

sharing of scholarly resources. In contemporary research environments, the ability to access open knowledge resources and participate in international academic networks is regarded as a critical factor for increasing research productivity, expanding international publications, and strengthening transnational scientific collaboration. For non-public universities, open science also creates opportunities to reduce developmental disparities with major institutions by facilitating lower-cost access to global scholarly resources. The adoption of open science additionally promotes interdisciplinary collaboration, academic transparency, and the dissemination of institutional knowledge within global research ecosystems. This is particularly important for developing countries such as Vietnam, where research resources remain limited while demands for international academic integration continue to intensify. Accordingly, Hypothesis H3 proposes that higher levels of open science adoption are positively associated with increased research productivity and stronger international collaboration among non-public universities.

Hypothesis H4

University autonomy serves as a mediating variable that promotes governance innovation in non-public universities.

Hypothesis H4 is grounded in theories of modern university governance and higher education reform within the knowledge economy. In the context of educational globalization, traditional centralized administrative governance models are increasingly being replaced by flexible, autonomous, and accountability-oriented governance systems. University autonomy enables institutions to exercise greater control over financial management, curriculum development, personnel recruitment, scientific research, and international partnerships. For non-public universities, autonomy is not merely a governance mechanism but also a prerequisite for fostering innovation and enhancing competitiveness within the global educational environment. This hypothesis suggests that university autonomy functions as a mediating variable linking innovation-oriented factors such as digital transformation, open science, and entrepreneurial ecosystems with university governance reform processes. In other words, the effectiveness of innovation strategies depends substantially on the degree of autonomy granted to higher education institutions. As Vietnam accelerates higher education reform toward greater autonomy and international integration, investigating this hypothesis is critically important for understanding the role of university autonomy as a strategic driver of governance innovation and sustainable development in non-public higher education. Overall, the proposed system of

research hypotheses reflects the interconnections among digital transformation, open science, innovation ecosystems, and university autonomy in restructuring the model of non-public higher education in Vietnam. These hypotheses possess not only empirical testing value but also theoretical significance for constructing sustainable innovation-oriented university models amid the global transformation of twenty-first-century higher education.

2. Literature Review and Theoretical Foundation

2.1. Human Capital Theory

In the history of modern economics and educational sciences, Human Capital Theory has been regarded as one of the most influential theoretical foundations for explaining the role of education in economic growth, social development, and national competitiveness enhancement. The emergence and evolution of this theory generated a fundamental transformation in academic perception: human beings were no longer viewed merely as labor resources but rather as a form of “strategic capital” determining the strength of the modern knowledge economy. In the context of digital transformation, educational globalization, and international knowledge competition, Human Capital Theory has become increasingly significant for restructuring higher education systems, particularly in developing countries such as Vietnam. Human Capital Theory emphasizes that investment in education, training, skills, and human knowledge generates long-term economic value by enhancing labor productivity, fostering innovation, and promoting sustainable growth. This perspective fundamentally transformed the development strategies of many nations, shifting the focus from the exploitation of physical resources toward the development of human resources as the central driving force of the knowledge economy.

Theodore Schultz and the Foundations of Human Capital Theory

Theodore Schultz is widely recognized as one of the pioneering scholars who laid the intellectual foundation for Human Capital Theory in modern economics. In his seminal works during the 1960s, Schultz argued that national economic growth could not be adequately explained solely through physical capital or natural resources; rather, it increasingly depended on human quality, educational attainment, and the knowledge capacities of the workforce. According to Schultz, education should be understood as a strategic investment rather than merely a form of social expenditure. He argued that investments in education, healthcare, vocational training, and skill development generate “human capital” capable of producing long-term economic

benefits for both individuals and nations. This represented a crucial breakthrough in development theory because it established that knowledge and human capability constitute the most important forms of capital in modern society. Schultz’s ideas exerted profound influence on higher education policies worldwide, particularly as nations transitioned toward knowledge-based and innovation-driven economies. His perspective also established an important theoretical foundation for expanding higher education, developing high-quality human capital, and promoting lifelong learning societies in the twenty-first century.

Gary Becker and the Advancement of Human Capital Theory

While Theodore Schultz established the foundations of Human Capital Theory, Gary Becker further developed and systematized the theory into a comprehensive economic analytical framework. Becker expanded the concept of human capital by examining the relationships among education, skills, labor productivity, and individual income within market economies. According to Becker, education enhances individuals’ productive capacities, thereby increasing personal income and contributing to national economic growth. He argued that individuals’ decisions to invest in education could be interpreted as economic investment decisions in which educational costs are compensated by future economic returns through higher productivity and improved career opportunities. Another major academic contribution of Becker was his assertion that human capital extends beyond formal education to include vocational skills, work experience, creative capacity, and human adaptability. This perspective significantly broadened the scope of higher education research, particularly in the context of the digital economy, which demands lifelong learning and continuous adaptation to emerging technologies. Becker’s theory holds particular relevance for studies on non-public higher education because it provides a theoretical basis for explaining the relationship among higher education, labor markets, and national competitiveness. As Vietnam accelerates digital transformation and international integration, higher education is increasingly viewed as a strategic mechanism for developing the human capital necessary for the knowledge economy.

Human Capital in the Knowledge Economy

In the twenty-first century, the emergence of the knowledge economy has profoundly transformed the nature of human capital. Whereas labor in traditional industrial economies was primarily evaluated based on physical effort and basic technical skills, the knowledge economy places knowledge, creativity, data, and innovation capacity at the center of

productivity and economic growth. Under such conditions, human capital is no longer understood merely in terms of educational attainment or vocational skills but increasingly encompasses complex competencies such as digital thinking, innovation capacity, interdisciplinary capabilities, emotional intelligence, global collaboration skills, and lifelong learning ability. This transformation generates new demands for higher education systems, particularly non-public universities, which are expected to demonstrate high levels of flexibility in responding to the needs of the global labor market. The knowledge economy has also transformed the role of universities from “knowledge transmission centers” into “ecosystems of knowledge production and innovation”. Modern universities not only educate human resources but also directly engage in research, technological development, entrepreneurial innovation, and societal knowledge transfer. Consequently, the quality of human capital has become a critical indicator of both educational and national competitiveness. For Vietnam, Human Capital Theory possesses strategic significance in developing high-quality human resources for national digital transformation and international economic integration. In the context of a young population, ongoing industrialization, and rising innovation demands, higher education - particularly the non-public university sector — is increasingly regarded as a critical driver for human capital development within the knowledge economy. Overall, the Human Capital Theory developed by Theodore Schultz and Gary Becker not only provides a theoretical foundation for examining the role of higher education in socio-economic development but also offers an academic framework for explaining the relationship among education, innovation, and national competitiveness in the digital age. In this study, Human Capital Theory serves as a central analytical framework for clarifying the role of Vietnamese non-public universities in developing high-quality human capital, promoting innovation, and adapting to the transformations of the global knowledge economy.

2.2. Entrepreneurial University Theory

In the context of the knowledge economy, digital transformation, and the globalization of innovation, which are profoundly reshaping the structure of global higher education, Entrepreneurial University Theory has emerged as one of the most influential theoretical frameworks for explaining the evolving role of universities in modern society. While traditional university models primarily emphasized the two classical missions of teaching and research, the entrepreneurial university represents a new developmental stage in which universities function as centers of innovation, knowledge transfer,

technology commercialization, and socio-economic advancement. Entrepreneurial University Theory reflects the transition from a “passive” university model toward a “value-creating” university model in which knowledge is not only produced and stored but also transformed into a driver of innovation and economic growth. In the twenty-first century, innovation capacity, industry collaboration, startup ecosystem development, and adaptability to digital transformation have increasingly become fundamental indicators of university competitiveness on a global scale. For Vietnam and Southeast Asian countries, Entrepreneurial University Theory possesses particular significance as higher education systems confront the necessity of restructuring in response to the digital economy and global labor markets. In particular, the non-public university sector is increasingly perceived as a promising environment for implementing entrepreneurial university models due to its institutional flexibility, adaptive capacity, and strong engagement with industry and societal demands.

Burton Clark and the Entrepreneurial University Model

Burton Clark is widely recognized as the pioneering scholar who developed the concept of the “entrepreneurial university” within modern higher education studies. In his influential work **Creating Entrepreneurial Universities** (1998), Clark analyzed the transformation of European universities amid global competition and argued that universities must become innovative, flexible, and self-sustaining institutions in order to survive and thrive. According to Clark, the entrepreneurial university is a university model capable of proactively adapting to socio-economic changes through governance innovation, financial diversification, and strengthened engagement with external stakeholders. He argued that modern universities can no longer rely solely on state funding but must develop financial autonomy, promote applied research, and foster industry collaboration in order to generate societal value. Clark identified five core components of the entrepreneurial university: strengthened steering capacity, expanded developmental peripheries, diversified funding bases, stimulated academic heartlands, and integrated entrepreneurial cultures. These components collectively establish the foundation for universities capable of functioning as highly adaptive knowledge organizations within globally competitive environments. Clark’s perspective holds particular significance for Vietnamese non-public universities because it provides a theoretical foundation for restructuring university governance toward autonomy, innovation, and sustainable development in the digital era.

Etzkowitz and the Triple Helix Model

One of the most influential theories in entrepreneurial university research is the Triple Helix model developed by Henry Etzkowitz and his collaborators. This model emphasizes the interactive relationship among the three central actors within innovation ecosystems: universities, industry, and government. According to the Triple Helix model, universities no longer perform solely educational and research functions; increasingly, they serve as centers of innovation and engines of economic development. Universities actively participate in knowledge commercialization, technology entrepreneurship, and the construction of collaborative innovation networks involving industry and government. The Triple Helix model reflects a fundamental transformation of higher education within the knowledge economy, where the boundaries between academic research and practical application are increasingly blurred. Within this framework, universities function simultaneously as producers of knowledge and active participants in technological innovation and societal development. For developing countries such as Vietnam, the Triple Helix model is particularly valuable because it offers a theoretical framework for constructing national innovation ecosystems based on collaboration among universities, industry, and government. It also provides an important foundation for developing entrepreneurial universities and promoting knowledge transfer within the context of global digital transformation. For non-public universities, the Triple Helix model creates opportunities to strengthen industry engagement, develop startup ecosystems, and enhance innovation capacity through interdisciplinary and inter-institutional collaboration.

Academic Capitalism and the Commercialization of Knowledge

In addition to the entrepreneurial university and Triple Helix frameworks, the theory of Academic Capitalism constitutes another important foundation for understanding the transformation of higher education within the global knowledge economy. This concept was developed by scholars examining the changing nature of universities under the influence of market mechanisms and international knowledge competition. Academic Capitalism argues that modern universities are increasingly engaged in market-oriented activities such as research commercialization, intellectual property registration, spin-off company development, research investment attraction, and financial resource competition. Within this model, knowledge is understood not merely as an academic asset but also as a strategic economic resource. The rise of Academic Capitalism reflects the transition from

the “traditional public-good university” toward universities operating within globally competitive environments. This transformation creates both opportunities and challenges for higher education. On the one hand, it stimulates innovation, enhances financial autonomy, and strengthens research capacity. On the other hand, it raises concerns regarding the commercialization of education and the potential erosion of traditional academic values. For Vietnamese non-public universities, Academic Capitalism is particularly significant in explaining the transition from purely teaching-oriented institutions toward innovation-driven organizations supplying knowledge to the market. Amid intensifying international competition, the ability to commercialize research, collaborate with industry, and build academic brands has become increasingly important in determining institutional competitiveness. Nevertheless, applying Academic Capitalism within developing countries requires a careful balance between economic objectives and the social mission of higher education. This consideration is particularly important for Vietnam, where higher education continues to play a strategic role in ensuring social equity, developing human capital, and promoting sustainable national development.

Overall, Burton Clark’s Entrepreneurial University Theory, Henry Etzkowitz’s Triple Helix model, and the theory of Academic Capitalism collectively establish a crucial theoretical foundation for understanding the transformation of universities within the knowledge economy. These theories demonstrate that modern universities are no longer merely spaces for teaching and research but have evolved into centers of innovation, technological entrepreneurship, and socio-economic development. In this study, Entrepreneurial University Theory serves as a central analytical framework for explaining the role of Vietnamese non-public universities in promoting innovation, developing entrepreneurial ecosystems, and enhancing national competitiveness in the digital era.

2.3. Open Innovation Theory

In the context of the Fourth Industrial Revolution, global digital transformation, and the rapid expansion of the knowledge economy, innovation has become a core driver determining the competitiveness of nations, enterprises, and higher education institutions. Nevertheless, traditional closed innovation models based primarily on internal research activities have increasingly revealed significant limitations in responding to the accelerating pace of knowledge creation, technological advancement, and global networking. Within this context, Open Innovation Theory has emerged as a new intellectual paradigm,

reflecting the transition from closed innovation systems toward collaborative, knowledge-sharing, and multi-actor innovation ecosystems.

Open Innovation Theory is particularly significant for modern higher education because it redefines the role of universities within global knowledge ecosystems. Universities are no longer merely internal producers of knowledge but have evolved into interconnected nodes within open innovation networks where knowledge is exchanged, co-created, and disseminated through collaboration with industry, government, international organizations, and civil society. For non-public universities in Vietnam, Open Innovation Theory provides an important theoretical foundation for explaining institutional adaptability, governance innovation, research ecosystem development, and international collaboration amid intensifying global educational competition.

Henry Chesbrough and the Emergence of Open Innovation Theory

Henry Chesbrough is widely recognized as the pioneering scholar who established the foundations of Open Innovation Theory in modern innovation studies. In his influential work *Open Innovation: The New Imperative for Creating and Profiting from Technology* (2003), Chesbrough argued that organizations can no longer rely solely on internal knowledge resources to sustain competitiveness; instead, they must actively integrate external knowledge while simultaneously sharing internal knowledge within broader innovation ecosystems. According to Chesbrough, open innovation refers to the process through which organizations utilize both internal and external knowledge flows to accelerate innovation, technological development, and the socio-economic value creation of knowledge. This perspective represented a fundamental transition from closed innovation systems - where knowledge is internally controlled - toward open innovation models based on collaboration and continuous knowledge exchange.

Within higher education environments, Open Innovation Theory fundamentally transforms approaches to scientific research and knowledge transfer. Universities no longer function as isolated "academic ivory towers" but instead actively participate in global innovation ecosystems through collaborative research, data sharing, co-creation of technologies, and transnational knowledge networks. Chesbrough's theory is particularly significant for non-public universities because it creates opportunities to leverage external knowledge resources in overcoming limitations related to finance, research infrastructure, and traditional academic capacity. Through open collaboration,

universities can gain faster access to emerging technologies, international research networks, and global innovation ecosystems.

Collaborative Innovation

One of the core dimensions of Open Innovation Theory is the concept of collaborative innovation, which reflects the transition from isolated competition toward multi-actor cooperation in the creation of knowledge and technology. In the modern knowledge economy, no single organization can possess all the resources, data, and creative capacities necessary for independent innovation. Consequently, collaboration has become an essential condition of global innovation ecosystems.

Collaborative innovation in higher education is manifested through partnerships among universities, industries, research institutes, governments, international organizations, and civil society in order to jointly develop research, transfer technologies, and address real-world societal challenges. This model promotes the integration of academic knowledge with practical expertise, thereby creating co-creative environments capable of increasing the value and impact of scientific research. For non-public universities, collaborative innovation provides strategic advantages in developing industry-oriented curricula, expanding international research networks, and enhancing adaptability to global labor markets. Collaboration also enables universities to overcome resource limitations through the sharing of databases, laboratories, expertise, and academic resources. In the context of digital transformation, collaborative innovation is increasingly facilitated through digital platforms, open data systems, and online research ecosystems. This development enables universities to connect with global knowledge networks beyond the constraints of geographical distance or traditional institutional barriers.

Innovation Networks

The evolution of Open Innovation Theory is closely associated with the concept of innovation networks - dynamic interconnected structures linking organizations, individuals, and knowledge ecosystems in order to accelerate the production, dissemination, and application of knowledge within the global economy. Innovation networks reflect the characteristics of the digital economy, in which value is generated less from physical assets and more from the ability to connect knowledge, data, and creative capacities across multiple actors. Within this model, universities function as knowledge hubs capable of linking academic research with technological demands and socio-economic development.

In modern higher education, innovation networks are no longer confined within national boundaries

but are increasingly globalized. Universities participate in international research networks, share open data, collaborate on scientific publications, and co-develop technologies with transnational partners. This process accelerates knowledge diffusion and strengthens the internationalization of higher education.

For Vietnamese non-public universities, participation in innovation networks holds strategic importance for strengthening research capacity, improving educational quality, and enhancing international academic standing. Through open collaborative networks, universities can access global knowledge resources, expand opportunities for international publication, and improve competitiveness within global educational ecosystems.

More importantly, innovation networks contribute to the emergence of the “open university” - a next-generation university model grounded in knowledge sharing, interdisciplinary collaboration, and global connectivity in the digital era. Overall, Henry Chesbrough’s Open Innovation Theory, together with the concepts of collaborative innovation and innovation networks, provides an important theoretical foundation for explaining the transformation of universities within the global knowledge economy. These theories demonstrate that modern universities are no longer closed systems but have evolved into central components of open innovation ecosystems where knowledge is co-created and disseminated through multi-actor collaboration. In this study, Open Innovation Theory serves as a critical analytical framework for clarifying the role of Vietnamese non-public universities in promoting academic collaboration, knowledge transfer, innovation, and high-quality human capital development in the digital age.

2.4. Theory of Digital Transformation in Education

In the twenty-first century, the explosive advancement of digital technologies, artificial intelligence, big data, and global connectivity has profoundly transformed the nature of higher education worldwide. Digital transformation in education is no longer viewed merely as a technological trend but rather as a comprehensive restructuring process affecting university models, governance systems, learning ecosystems, and knowledge production mechanisms within the digital economy. In this context, the theory of digital transformation in education has emerged as a significant academic foundation for explaining the transition of higher education from traditional models toward digital, smart, and data-driven universities. The theory of digital transformation in

education emphasizes that technology is no longer merely a supporting tool for teaching but is actively redefining the entire operational structure of higher education. This process includes the transition from physical classrooms to digital learning environments, from traditional administrative governance to intelligent data-driven management, and from linear educational models toward personalized and lifelong learning supported by digital platforms.

For non-public universities in Vietnam, digital transformation in education carries strategic importance because this sector possesses high institutional flexibility and strong adaptability to fluctuations in the global education market. The implementation of digital university and smart education models is increasingly regarded as essential for enhancing educational quality, expanding access to international knowledge, and strengthening competitiveness in the digital era.

Digital University

The concept of the “Digital University” represents a next-generation university model operating through digital technologies, data infrastructures, and intelligent connectivity. Within this model, all university activities - including governance, teaching, scientific research, and student services - are integrated and managed through digital ecosystems.

A digital university is not simply characterized by document digitization or online learning implementation; rather, it involves a fundamental transformation of higher education operational structures. This model enables universities to establish flexible learning environments, expand educational spaces beyond geographical boundaries, and facilitate learners’ access to global knowledge resources.

In the context of educational globalization, digital universities have become fundamental determinants of higher education competitiveness. Online learning platforms, digital libraries, learning management systems (LMS), open academic data, and cloud computing technologies are redefining the production and dissemination of knowledge within modern university environments.

For Vietnamese non-public universities, the digital university model creates significant opportunities for reducing operational costs, expanding educational capacity, and increasing access for learners across diverse regions. Simultaneously, digital universities facilitate the internationalization of education through online academic collaboration and the sharing of open educational resources.

Smart Education

The advancement of digital technologies has led

to the emergence of Smart Education - an educational model grounded in connectivity, data analytics, and personalized learning experiences. Smart education reflects the transition from traditional teaching paradigms toward flexible, interactive, and learner-centered educational ecosystems. Within smart education systems, artificial intelligence, the Internet of Things (IoT), big data, and cloud computing are utilized to create adaptive learning environments tailored to individual learners' needs, capabilities, and learning behaviors. This enables students to access more personalized educational content while allowing educators and administrators to monitor, evaluate, and improve learning processes more effectively. Smart education also promotes the formation of "open learning ecosystems" in which learners can study anytime and anywhere through digital platforms and global knowledge networks. This is particularly important as lifelong learning becomes an essential requirement of the knowledge economy and digital labor markets. For non-public universities, smart education enhances educational quality by optimizing learning experiences, strengthening interaction between faculty and students, and improving adaptability to global labor market demands.

AI-driven Higher Education

The rapid advancement of artificial intelligence is generating a profound transformation in global higher education. AI-driven Higher Education refers to university models in which artificial intelligence is integrated into governance systems, teaching activities, scientific research, and student support services. In modern higher education, artificial intelligence is applied to personalize learning, automate administrative processes, support competency assessment, and predict learning trends. AI systems are capable of analyzing educational data in real time to provide individualized learning recommendations, thereby enhancing educational effectiveness and reducing learning disparities. AI-driven Higher Education also transforms the role of academic staff within universities. Faculty members no longer function solely as transmitters of knowledge but increasingly serve as mentors, academic advisors, and designers of digital learning experiences for students.

For Vietnamese non-public universities, the adoption of artificial intelligence holds strategic importance for improving governance efficiency, reducing operational costs, and enhancing educational quality. Furthermore, AI creates opportunities for universities to participate more deeply in global research ecosystems through data analytics, interdisciplinary research, and technological innovation. Nevertheless, AI-driven Higher Education also raises important academic

and ethical concerns, including data privacy, algorithmic transparency, digital inequality, and the changing relationship between humans and technology in higher education.

Learning Analytics

Learning Analytics represents one of the most important components of contemporary digital transformation in education. The concept refers to the collection, analysis, and utilization of learning data in order to optimize teaching processes, improve educational effectiveness, and support decision-making in educational governance. Within digital university environments, learning data are continuously generated through online learning platforms, learning management systems, digital libraries, and students' academic interactions. Analyzing these data enables institutions to better understand learning behaviors, participation levels, cognitive performance, and students' academic risks.

Learning Analytics enables universities to develop evidence-based educational models in which governance decisions and teaching strategies are informed by empirical data rather than solely by traditional experience. For students, Learning Analytics supports personalized learning through early-warning systems, customized learning recommendations, and competency-based learning pathways. For faculty members and administrators, this technology helps optimize curricula, enhance teaching quality, and improve university governance efficiency. As global higher education increasingly transitions toward data-driven models, Learning Analytics is becoming a strategic instrument for enhancing educational quality and institutional competitiveness within the knowledge economy. Overall, the theory of digital transformation in education - encompassing the concepts of digital universities, smart education, AI-driven higher education, and learning analytics - provides a crucial theoretical foundation for explaining the restructuring of higher education in the digital era. These theories demonstrate that modern universities are transitioning from traditional institutional models toward open, intelligent, and data-driven educational ecosystems. In this study, the theory of digital transformation in education serves as a central analytical framework for clarifying the role of digital transformation in enhancing educational quality, innovating university governance, and strengthening the competitiveness of Vietnamese non-public universities amid global knowledge integration and digital transformation.

2.5. Open Science Framework

In the context of knowledge globalization, digital transformation, and the rapid expansion of the data-

driven economy, Open Science has emerged as a structural academic revolution within the global research ecosystem. Whereas traditional scientific models were constructed upon closed knowledge systems, restricted access, and centralized publication mechanisms, Open Science represents a transition toward a scientific paradigm grounded in transparency, accessibility, cross-border collaboration, and global knowledge sharing.

Open Science is not merely a technological trend or a new model of research dissemination; rather, it constitutes a comprehensive redefinition of how knowledge is produced, distributed, and applied in modern society. Within this framework, scientific knowledge is regarded as a shared asset of humanity that should be widely disseminated in order to promote innovation, sustainable development, and the democratization of knowledge. For higher education, Open Science is profoundly transforming the role of universities within the knowledge economy. Universities are no longer merely repositories of academic knowledge but have evolved into interconnected nodes within global open knowledge ecosystems where data, scientific publications, peer-review processes, and educational resources are shared in order to strengthen research collaboration and expand public access to knowledge.

For Vietnamese non-public universities, Open Science carries strategic significance in strengthening research capacity, expanding international collaboration, and increasing participation in global academic networks. It also provides an important foundation for promoting innovation, enhancing educational quality, and developing digital university models within the era of global digital transformation.

Open Access

Open Access is widely regarded as one of the most fundamental and influential components of Open Science. The concept refers to the unrestricted digital access to scientific research outputs without financial, legal, or technical barriers for the academic community and society at large. The rise of Open Access reflects the democratization of knowledge in the digital age, where research outcomes are no longer confined to resource-rich academic institutions but can be broadly accessed by researchers, students, industries, and civil society worldwide. Open Access contributes to accelerating knowledge dissemination, fostering international academic collaboration, and increasing scientific citation impact. Simultaneously, it enables developing countries and resource-constrained educational institutions to participate more actively in global research ecosystems. For Vietnamese non-

public universities, Open Access holds strategic importance in improving access to international knowledge, reducing academic disparities, and strengthening scientific publication capacity. Amid intensifying global research competition, the ability to utilize and share open academic resources has become a critical determinant of university academic performance.

Open Peer Review

Alongside Open Access, Open Peer Review represents another important component of Open Science, reflecting the transition of scholarly evaluation systems from closed models toward more transparent and collaborative approaches. Within traditional peer-review systems, author and reviewer identities are commonly anonymized in order to ensure objectivity. However, such models also contain limitations including lack of transparency, potential academic bias, and difficulties in verifying review quality. Open Peer Review emerged as an alternative approach designed to address these limitations by making parts or the entirety of the peer-review process publicly accessible. Open Peer Review promotes academic accountability, enhances transparency, and strengthens scholarly dialogue among authors, reviewers, and the research community. It also contributes to improving research quality through more constructive and collaborative evaluation processes. In the context of digital transformation, Open Peer Review is increasingly supported by digital platforms and open scholarly systems that enable research communities to participate directly in the evaluation and refinement of scientific work. For non-public universities, Open Peer Review facilitates the enhancement of research capacity and international academic integration through exposure to transparent and contemporary global standards of scholarly evaluation.

Open Data

In the modern data-driven economy, scientific data have increasingly become strategic resources for innovation and knowledge development. Open Data refers to the public sharing of research data in ways that allow scientific communities to access, reuse, and verify research findings transparently. Open Data contributes to scientific reproducibility, strengthens research collaboration, and reduces duplication in scientific investigations. The sharing of open datasets also facilitates interdisciplinary research, artificial intelligence development, and big-data analytical models in higher education. In modern higher education, open data extend beyond research datasets to include learning analytics, governance information, and academic data that support governance innovation and

personalized learning. For Vietnamese non-public universities, Open Data enhances participation in international research networks, improves scientific publication quality, and accelerates academic digital transformation. Furthermore, open data provide a critical foundation for developing smart university ecosystems and AI-driven research environments.

Citizen Science

Citizen Science reflects the growing trend of expanding public participation in scientific research activities. Within this model, citizens are no longer passive recipients of knowledge but active contributors involved in data collection, field observation, information analysis, and scientific dissemination. The growth of Citizen Science demonstrates that modern science is shifting from academically exclusive research models toward more community-oriented and socially collaborative approaches. This transformation is especially important for addressing global challenges such as climate change, public health, environmental sustainability, and sustainable development. Citizen Science also strengthens the relationship between universities and society by enabling higher education institutions to expand academic impact and promote the social responsibility of science. For Vietnamese non-public universities, Citizen Science creates opportunities to develop community-engaged university models, promote applied research, and implement scientific projects that contribute to local and national development.

Open Educational Ecosystems

The evolution of Open Science has led to the emergence of Open Educational Ecosystems - educational models grounded in resource sharing, digital connectivity, and global knowledge collaboration. Within open educational ecosystems, knowledge is no longer confined within individual universities but is shared through Open Educational Resources (OER), Massive Open Online Courses (MOOCs), digital libraries, and global learning platforms. This model promotes lifelong learning, broadens educational accessibility, and enables learners to participate in global knowledge networks regardless of geographical or economic constraints. For higher education, open educational ecosystems facilitate educational internationalization, pedagogical innovation, and the development of digital university models in the era of digital transformation. For Vietnamese non-public universities, open educational ecosystems possess strategic significance in improving educational quality, expanding learning opportunities, and strengthening international competitiveness through integration into global knowledge networks. Overall, Open Science - encompassing Open

Access, Open Peer Review, Open Data, Citizen Science, and Open Educational Ecosystems - has established a new scientific paradigm grounded in transparency, sharing, and global collaboration. These theoretical perspectives demonstrate that modern higher education is transitioning from closed knowledge systems toward open and digitally connected knowledge ecosystems. In this study, the Open Science framework is employed to explain the role of Vietnamese non-public universities in promoting innovation, expanding international academic collaboration, enhancing research quality, and developing high-quality human capital within the global knowledge economy.

2.6. Sustainable Development Framework

In the twenty-first century, sustainable development has emerged as one of the most critical strategic orientations of the international community in response to global challenges such as climate change, social inequality, energy crises, resource depletion, and instability within the global economy. Within this context, higher education no longer serves solely as a mechanism for human resource development but increasingly functions as a central actor in promoting sustainable innovation, transforming development models, and building inclusive and knowledge-based societies oriented toward a green future.

The sustainable development framework in higher education reflects a transition from traditional university models focused primarily on academic growth toward university systems characterized by social responsibility, environmental accountability, and innovation for the long-term development of humanity. This transformation demonstrates that modern universities are not merely producers of knowledge but also strategic institutions shaping sustainable values within the global digital economy.

For Vietnam, particularly the non-public higher education sector, sustainable development carries strategic significance in enhancing educational quality, promoting green innovation, and adapting to the internationalization of education amid global digital transformation. It also provides the foundation for developing modern university models associated with social responsibility, international competitiveness, and sustainable national development.

United Nations Sustainable Development Goals (SDGs)

United Nations established the 2030 Agenda with 17 Sustainable Development Goals (SDGs), which are widely regarded as the most important global framework guiding nations toward sustainable and inclusive development models.

Among these goals, quality education (SDG 4), industry, innovation and infrastructure (SDG 9), reduced inequalities (SDG 10), climate action (SDG 13), and global partnerships (SDG 17) are particularly interconnected with higher education and the role of universities within the knowledge economy. The SDGs have transformed perceptions regarding the role of higher education in national development. Universities are no longer evaluated solely through educational performance or scientific publication outputs but also through their capacity to generate social impact, promote green innovation, and contribute to global sustainable development objectives. In the context of educational globalization, many international university ranking systems have integrated SDG-related indicators to evaluate universities' contributions to sustainable development. This demonstrates that the SDGs are increasingly becoming strategic standards in modern university governance. For Vietnamese non-public universities, engagement with the SDGs not only enhances academic reputation but also creates opportunities for international integration, interdisciplinary research development, and the establishment of university brands associated with social responsibility and sustainable development.

ESG in Higher Education

The concept of ESG (Environmental, Social, and Governance) was initially developed within corporate governance and financial sectors but has increasingly become a significant strategic framework in global higher education. Within higher education, ESG reflects the integration of environmental responsibility, social accountability, and transparent governance across all university operations. This includes sustainable governance, efficient resource utilization, educational equity promotion, diversity and inclusion assurance, as well as the establishment of transparent and accountable university management systems. ESG is transforming university governance models from short-term growth orientations toward long-term sustainable development approaches. Modern universities increasingly emphasize green campuses, carbon reduction, gender equality promotion, community development, and the enhancement of higher education's social responsibility. For Vietnamese non-public universities, ESG adoption carries strategic significance in strengthening governance capacity, enhancing transparency, and building public trust in the non-public higher education system. Furthermore, ESG enables universities to access international resources and improve competitiveness within the global educational environment.

Green University

The concept of the "Green University" reflects the transformation of higher education toward environmentally friendly and ecologically sustainable development models. A green university is not limited to the establishment of environmentally sustainable campuses but involves the integration of sustainability principles into all dimensions of teaching, research, and university governance. Within green university models, universities serve as central institutions promoting research on environmental sustainability, renewable energy, green technologies, and sustainable development. Simultaneously, universities are responsible for cultivating ecological awareness and sustainable values among younger generations. Green universities are also associated with the transition toward "smart and sustainable campuses," where digital technologies are employed to optimize energy management, reduce carbon emissions, and improve resource efficiency. For Vietnamese non-public universities, the green university model creates opportunities to establish institutional identities characterized by modernity, responsibility, and innovation. It also represents an important factor in enhancing academic reputation and student attraction as learners increasingly value sustainability-oriented education.

Sustainable Innovation

In the modern knowledge economy, innovation is no longer oriented solely toward economic growth but is increasingly associated with sustainable development objectives and social responsibility. The concept of Sustainable Innovation reflects the integration of technological advancement, economic efficiency, environmental responsibility, and social value creation. Sustainable innovation in higher education encompasses the development of green technologies, the promotion of interdisciplinary research, the establishment of circular economy models, and the application of science and technology to address social and environmental challenges. In the context of digital transformation, Sustainable Innovation is also associated with the use of artificial intelligence, big data, and digital technologies to optimize university governance, enhance educational effectiveness, and minimize environmental impacts. For Vietnamese non-public universities, sustainable innovation constitutes an essential condition for establishing long-term competitiveness within the global economy. The ability to integrate technology, innovation, and social responsibility will determine the future role of universities within national development ecosystems.

Overall, the sustainable development framework - encompassing the SDGs, ESG principles, Green Universities, and Sustainable Innovation - provides

an essential theoretical foundation for restructuring higher education in the digital era. These theoretical perspectives demonstrate that modern universities are not merely centers of teaching and research but also strategic actors promoting sustainable development, green innovation, and global social responsibility. In this study, the sustainable development framework serves as an analytical foundation for clarifying the role of Vietnamese non-public universities in developing high-quality human capital, fostering sustainable innovation, and enhancing national competitiveness amid globalization and digital transformation.

2.7. Development of the Theoretical Research Model

In the context of global digital transformation, the expansion of the knowledge economy, and the internationalization of higher education, non-public universities are increasingly required to undergo comprehensive restructuring in order to adapt to an increasingly competitive academic environment. The transition from traditional university models toward entrepreneurial, digital, and open universities has created an urgent need for an integrated theoretical framework capable of explaining the relationships among digital transformation, open science, university autonomy, entrepreneurial ecosystems, and the development of high-quality human capital within contemporary higher education systems. The theoretical model developed in this study is constructed through the integration of several major theoretical foundations, including Human Capital Theory, Entrepreneurial University Theory, Open Innovation Theory, the Theory of Digital Transformation in Education, the Open Science Framework, and the Sustainable Development Framework. The integration of these theories enables the establishment of a multidimensional research framework capable of explaining the dynamics of non-public higher education ecosystems in the digital era. This research framework emphasizes that the development of non-public universities is no longer determined solely by educational scale but increasingly depends on digital transformation capacity, innovation capability, internationalization, research effectiveness, and adaptability to global knowledge ecosystems. Within this model, institutional, technological, and organizational cultural factors play especially significant roles in facilitating or constraining university development outcomes.

Independent Variables

Digital Transformation

Digital transformation is regarded as one of the central independent variables within the research model because it constitutes a core driver of

higher education restructuring in the digital age. Digital transformation extends beyond the mere adoption of information technologies and reflects a comprehensive transformation of governance models, pedagogical approaches, scientific research systems, and academic connectivity. Within this research model, digital transformation is hypothesized to exert direct effects on human capital quality, innovation capability, research effectiveness, and the level of internationalization among non-public universities.

University Autonomy

University autonomy reflects the capacity of higher education institutions to exercise independent decision-making in financial governance, personnel management, academic affairs, and institutional strategy. Within the context of global educational competition, university autonomy is widely considered a prerequisite for enhancing institutional flexibility, innovation capability, and adaptability to international knowledge markets. For Vietnamese non-public universities, university autonomy carries strategic significance in promoting governance innovation, developing entrepreneurial university models, and expanding international collaboration.

Open Science

Open Science is incorporated into the research model as an independent variable reflecting the degree of transparency, knowledge sharing, and global academic connectivity of universities. In the modern knowledge economy, Open Science has increasingly become an essential condition for enhancing research quality and strengthening international collaboration. The adoption of Open Access, Open Data, Open Peer Review, and open knowledge ecosystems is hypothesized to positively influence research effectiveness and the internationalization level of non-public universities.

Entrepreneurial Ecosystem

The entrepreneurial ecosystem reflects a university's ability to connect education, research, industry, and innovation in order to foster entrepreneurial and creative capacities among students and academic staff. Within this research framework, the entrepreneurial ecosystem is considered a driving factor for innovation capability and workforce adaptability to the digital economy.

Dependent Variables

Human Capital Quality

Human capital quality reflects the extent to which graduates meet the demands of global labor markets, including professional competencies, digital skills, innovative thinking, and lifelong learning capability. In this study, human capital quality is considered

the most significant outcome of higher education transformation within the non-public sector.

Innovation Capability

Innovation capability reflects a university's capacity to generate new knowledge, promote applied research, develop technologies, and support entrepreneurial innovation. This variable is regarded as a central determinant of academic competitiveness within the global knowledge economy.

Research Effectiveness

Research effectiveness is reflected through the quantity and quality of scientific publications, international collaboration capacity, research applicability, and academic impact. Within the context of academic globalization, research effectiveness has increasingly become a critical criterion for evaluating university reputation and scholarly performance.

Level of Internationalization

Internationalization reflects the extent to which universities integrate into global educational ecosystems through international partnerships, academic exchanges, transnational research collaboration, and the attraction of international students. The level of internationalization is regarded as an important indicator of the global competitiveness of non-public universities.

Mediating and Moderating Variables

University Governance

University governance is considered an important mediating variable because the effectiveness of digital transformation, Open Science, and university autonomy largely depends on institutional strategic governance capacity. Modern university governance encompasses data governance, innovation governance, academic governance, and sustainable governance.

Innovation Culture

Innovation culture reflects the degree to which universities embrace change, encourage creativity, and promote collaborative practices. A university environment characterized by a strong innovation culture facilitates digital transformation, interdisciplinary research, and sustainable innovation.

Technological Capability

Technological capability reflects a university's ability to integrate digital technologies, artificial intelligence, big data, and smart learning platforms into educational and research activities. In this study, technological capability is treated as a moderating variable capable of strengthening or weakening the effects of digital transformation and Open Science

on non-public university development outcomes. Overall, the theoretical research model is developed to explain the multidimensional relationships among technological, institutional, innovation, and human capital development factors within the context of higher education transformation under globalization and the knowledge economy. This framework contributes academically through the integration of contemporary higher education theories while also offering practical implications for the strategic development of Vietnamese non-public universities in the digital era.

3. Research Methodology

3.1. Research Design

In the context of profound transformations in global higher education driven by digital transformation, open science, innovation, and international integration, investigating the development model of non-public universities requires a multidimensional and integrative methodological approach capable of capturing the complexity of modern educational ecosystems. Research phenomena associated with educational digitalization, university autonomy, innovation, and high-quality human capital development are not merely quantitative in nature but also encompass qualitative dimensions related to institutional structures, organizational culture, social perceptions, and stakeholder behaviors within higher education systems.

Based on these characteristics, this study adopts a Sequential Explanatory Mixed Methods design in order to integrate the strengths of both quantitative and qualitative methodologies within a unified research framework. This design enables the study not only to measure causal relationships among research variables using empirical data but also to provide in-depth interpretations of underlying phenomena through contextualized qualitative analysis. The Sequential Explanatory Mixed Methods design is considered one of the most advanced and reliable methodological approaches in contemporary educational research, particularly suitable for interdisciplinary studies concerning university governance, innovation, digital transformation, and sustainable development. This approach has increasingly been employed in studies published in international SCOPUS- and Web of Science-indexed journals due to its capacity to generate comprehensive evidence characterized by high scientific validity and strong practical applicability.

Sequential Explanatory Mixed Methods Design

The Sequential Explanatory Mixed Methods design is structured around a two-phase sequential process in which the quantitative phase is conducted first to identify patterns, trends, and

relationships among research variables, followed by a qualitative phase intended to explain, enrich, and contextualize the quantitative findings. In this study, the quantitative phase serves as the foundational stage for testing hypotheses concerning the effects of digital transformation, Open Science, university autonomy, and entrepreneurial ecosystems on human capital quality, innovation capability, research effectiveness, and the internationalization level of Vietnamese non-public universities. After establishing the quantitative findings, the qualitative phase is implemented to provide deeper explanations of the identified relationships while exploring contextual, institutional, and cultural factors that may not be fully captured by quantitative data alone. This approach helps overcome the limitations of purely quantitative models, which often struggle to explain the social depth and complexity of higher education phenomena. The sequential explanatory design also enhances scientific reliability through data triangulation mechanisms in which quantitative findings are validated and further interpreted using qualitative evidence. Consequently, the study achieves not only statistical accuracy but also academic depth and practical relevance.

Quantitative Methodology

During the quantitative phase, the study employs a questionnaire-based survey method to collect data from relevant stakeholder groups, including academic staff, educational administrators, students, and experts in the field of non-public higher education in Vietnam. The quantitative methodology is selected to measure the influence of independent variables such as digital transformation, Open Science, university autonomy, and entrepreneurial ecosystems on dependent variables including human capital quality, innovation capability, research effectiveness, and internationalization levels. Advanced statistical techniques such as Cronbach's Alpha, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Structural Equation Modeling (SEM) are employed to test reliability, construct validity, and causal relationships among research variables. The use of Structural Equation Modeling (SEM) is particularly appropriate for this study because it is a multivariate analytical approach capable of simultaneously examining complex relationships within theoretical models while also assessing mediating and moderating effects of variables such as university governance, innovation culture, and technological capability.

Qualitative Methodology

In addition to quantitative research, this study employs qualitative methodology in order to provide deeper explanations of research phenomena

and explore the social, institutional, and cultural dimensions of non-public university transformation. The qualitative phase is conducted through semi-structured in-depth interviews involving educational experts, university leaders, policymakers, and researchers specializing in higher education and digital transformation. Through qualitative evidence, the study is able to clarify issues such as innovation culture, leadership mindset, institutional adaptability, and barriers to digital transformation that are often difficult to fully capture through statistical models alone. Qualitative methodology also assists in explaining unexpected or ambiguous quantitative findings, thereby enhancing the interpretative capacity and practical significance of the research.

Integrative Nature of the Mixed Methods Approach

One of the most significant strengths of the Sequential Explanatory Mixed Methods design lies in its ability to integrate quantitative and qualitative evidence into a comprehensive and highly reliable research framework. In this study, quantitative data establish empirical patterns and test research hypotheses, whereas qualitative data explain the underlying meanings and contextual dimensions of the empirical findings. This integration enables a comprehensive understanding of the research phenomena that transcends the limitations of individual methodologies. The mixed methods design also increases objectivity, reliability, and the generalizability of research findings. Furthermore, this methodology facilitates the development of policy recommendations and strategic directions for non-public university development based on both statistical evidence and contextual analysis. Overall, the adoption of the Sequential Explanatory Mixed Methods design reflects the study's modern methodological orientation and aligns with interdisciplinary research trends in global higher education. This approach ensures scientific rigor and academic reliability while enabling the study to deeply investigate complex issues related to digital transformation, Open Science, innovation, and high-quality human capital development within Vietnam's non-public higher education system.

3.2. Data Collection

3.2.1. Secondary Data

In contemporary higher education research, particularly interdisciplinary studies concerning digital transformation, Open Science, innovation, and high-quality human capital development, secondary data play a critical role in constructing theoretical foundations, establishing research contexts, and ensuring scientific objectivity throughout the analytical process. Within the context of educational

globalization and the rapid expansion of digital knowledge ecosystems, the utilization of secondary data from international organizations, educational authorities, and global academic databases not only enhances research reliability but also enables international comparison and access to emerging trends in modern higher education development. In this study, secondary data are employed for multiple scholarly purposes, including analyzing the development context of Vietnam's non-public higher education sector; evaluating trends in digital transformation and educational internationalization; establishing theoretical foundations for the research model; comparing international experiences; and supporting the formulation of hypotheses related to university autonomy, Open Science, innovation, and sustainable development. The study's secondary data sources are collected from national educational authorities, reputable international organizations, global academic databases, and specialized reports concerning educational digital transformation. The selection of these data sources is based on criteria including academic reliability, data currency, international influence, and the capacity to reflect higher education development trends within the context of globalization.

Data from the Ministry of Education and Training of Vietnam

Data obtained from the Ministry of Education and Training of Vietnam serve as foundational sources for reflecting the current conditions and development trends of Vietnam's higher education system in general and the non-public university sector in particular. The collected datasets include statistics concerning the number of non-public universities, educational scale, academic staff, infrastructure, graduate employability rates, university autonomy levels, quality assurance activities, and policies associated with digital transformation in higher education. These data enable the study to construct a comprehensive overview of the development of Vietnam's non-public higher education sector within the broader context of educational reform and international integration. Furthermore, they provide an important basis for evaluating the role of non-public universities in developing high-quality human capital and promoting national innovation.

Data from UNESCO

UNESCO is widely regarded as one of the most important international sources of data related to education, science, and sustainable development. UNESCO reports and databases provide global analyses concerning higher education trends, educational digital transformation, lifelong learning, and human capital development within the knowledge economy. In this study, UNESCO

data are utilized to compare Vietnam's higher education development trends with international standards while also analyzing the roles of digital transformation, open education, and sustainable development within global educational ecosystems. UNESCO reports also provide significant theoretical foundations for assessing the impacts of digital technologies on higher education and the transformation from traditional university models toward digital and lifelong learning universities.

Data from OECD

Organisation for Economic Co-operation and Development constitutes an especially valuable data source for studies concerning higher education, innovation, and high-quality human capital development. OECD reports focus extensively on the relationships among education, workforce skills, innovation, and economic growth within the global knowledge economy. In particular, OECD studies concerning "Future Skills," "Education 4.0" "Digital Learning" and "Innovation Ecosystems" provide important academic foundations for constructing the theoretical model employed in this research. OECD data also enable the study to compare the development level of Vietnam's higher education system with those of developed countries, thereby clarifying the strategic challenges and opportunities facing non-public universities in the context of international competition.

Data from the World Bank

World Bank provides highly valuable datasets and reports related to human capital development, digital transformation, knowledge economies, and higher education reform in developing countries. World Bank reports concerning Vietnamese higher education, future workforce skills, national competitiveness, and digital economy development are utilized to analyze the relationships between higher education and national development strategies in the digital era. Importantly, World Bank datasets assist the study in evaluating the role of non-public universities in improving human capital quality and promoting innovation within Vietnam's transforming economy.

Data from Scopus and Web of Science

Elsevier through the Scopus database and Clarivate through the Web of Science platform constitute the core scholarly data sources for this study. Scientific publications, international research articles, and citation data are analyzed to construct theoretical foundations, identify research gaps, and update the latest scholarly trends related to educational digital transformation, Open Science, innovation, and university governance. The use of Scopus and Web of Science data ensures the international academic quality of the study while

enhancing access to highly influential scholarly works within the global academic community.

Educational Digital Transformation Reports

In addition to traditional databases, the study also utilizes specialized reports on educational digital transformation from international organizations, governmental agencies, and global educational technology corporations in order to update emerging technological trends and contemporary digital university models. These reports focus on themes such as artificial intelligence in higher education, smart learning, educational big data, digital universities, technology-driven academic governance, and digital skill development for future workforces. Through analyzing educational digital transformation reports, the study is able to assess the adaptability of Vietnamese non-public universities to global educational trends and identify strategic factors necessary for sustainable development in the digital era. Overall, the system of secondary data employed in this study not only provides a strong academic and practical foundation for constructing the research model but also ensures the objectivity, reliability, and generalizability of the research findings. The integration of data from international organizations, educational authorities, and global academic databases enables the study to approach the research problem from multidimensional and interdisciplinary perspectives aligned with international academic standards of publications indexed in Q1 SCOPUS and Web of Science journals.

3.2.2. Primary Data

In addition to the secondary data collected from international organizations, educational authorities, and global academic databases, this study places significant emphasis on primary data collection in order to directly capture the operational realities, transformation dynamics, and developmental trajectories of Vietnam's non-public higher education system within the context of digital transformation and international educational integration. Primary data serve as a central component in testing the research model, evaluating relationships among theoretical variables, and exploring contextual, institutional, and cultural dimensions that cannot be fully captured through secondary sources alone. The integration of quantitative surveys and qualitative interviews enables the study to establish a multidimensional body of academic evidence, thereby enhancing the validity, analytical depth, and practical relevance of the research findings. In this study, primary data are collected through two principal methods: questionnaire-based surveys and semi-structured in-depth interviews. These methods are implemented in accordance with the

Sequential Explanatory Mixed Methods design to ensure complementarity between quantitative and qualitative evidence throughout the analytical and interpretative processes.

Quantitative Survey

The quantitative survey is conducted to collect empirical data for testing research hypotheses related to digital transformation, Open Science, university autonomy, entrepreneurial ecosystems, human capital quality, and innovation capability within Vietnamese non-public universities. The survey questionnaire is designed based on internationally validated measurement scales commonly employed in studies related to higher education, innovation, and university governance. Simultaneously, the observed variables are adapted to the contextual characteristics of Vietnam's non-public higher education system in order to ensure contextual relevance and academic reliability. The study surveys four key respondent groups representing major stakeholders within the non-public higher education ecosystem.

Students

Students are regarded as the central stakeholder group in this study because they are the direct beneficiaries of educational reforms, digital transformation initiatives, and innovation ecosystem development within universities. Student survey data focus on issues such as digital access, digital skills, online learning experiences, adaptability to digital education models, entrepreneurial mindset, innovation capability, and employability within the knowledge economy. Through student-generated data, the study is able to evaluate the effectiveness of digital transformation and educational innovation strategies implemented within Vietnamese non-public universities.

Academic Staff

Academic staff constitute the core workforce determining educational quality, research capacity, and academic innovation capability within universities. Therefore, surveying academic staff is of particular importance in this study. The survey focuses on the adoption of digital technologies in teaching and research, participation in Open Science practices, international publication activities, pedagogical innovation, and faculty perceptions regarding university autonomy and educational internationalization. Faculty data enable the study to assess the academic adaptability of non-public universities within the context of global digital transformation.

University Administrators

The university administrator group includes institutional leaders, research managers, academic

administrators, and executive officers who play strategic roles in policy formulation and university governance innovation. The survey of this group focuses on issues such as digital transformation strategies, autonomous university governance models, innovation promotion policies, international collaboration, human capital development, and entrepreneurial ecosystem establishment within universities. Data from university administrators help clarify the strategic governance capabilities of Vietnamese non-public universities amid the profound transformation of global higher education.

Recruiting Enterprises

Recruiting enterprises represent an important stakeholder group reflecting the extent to which university-trained human capital meets the demands of modern labor markets. The survey focuses on employers' evaluations of professional skills, digital competencies, innovative thinking, technological adaptability, and global working capabilities of graduates from non-public universities. Through enterprise-generated data, the study is able to evaluate the linkage between non-public universities and labor market demands within the digital and innovation-driven economy.

Qualitative In-Depth Interviews

In addition to quantitative surveys, the study conducts semi-structured in-depth interviews in order to explore academic, institutional, and strategic dimensions associated with the development of non-public universities within the contexts of globalization and digital transformation. The in-depth interview method enables the study to access profound and practice-oriented perspectives from experts and stakeholders playing significant roles within higher education ecosystems.

Educational Experts

Educational experts are interviewed to provide scholarly perspectives on higher education development trends, innovation, digital transformation, and educational internationalization within the global context. Expert analyses help the study clarify theoretical issues and long-term strategic directions for Vietnamese non-public university development.

Policymakers

Policymakers provide important insights concerning national educational development strategies, university autonomy policies, educational digital transformation, and mechanisms for promoting innovation within higher education. Through these interviews, the study is able to further analyze the relationship between public policy and the development of Vietnamese non-public universities.

Educational Investors

Educational investors represent stakeholder perspectives related to economic considerations and strategic development within the non-public higher education market. The interviews focus on issues such as educational technology investment, digital university development, innovation-oriented educational models, and the international competitiveness of non-public universities.

Startup Founders

Startup founders are selected to reflect the relationship between higher education, innovation, and entrepreneurial ecosystems within the digital economy. The interviews focus on the role of universities in fostering entrepreneurial mindsets, developing innovation skills, and supporting technology startup ecosystems. Through perspectives provided by startup founders, the study is able to assess the extent of linkage between non-public universities and Vietnam's innovation-driven economy. Overall, the primary data system developed in this study reflects a multidimensional, interdisciplinary, and integrative approach involving multiple stakeholders within the higher education ecosystem. The combination of quantitative surveys and qualitative in-depth interviews not only enhances the reliability and academic value of the research but also enables profound exploration of the transformation dynamics of Vietnamese non-public universities in the contexts of digital transformation, Open Science, and global educational competition.

3.3. Research Sample

In contemporary higher education research, particularly interdisciplinary studies related to digital transformation, Open Science, innovation, and high-quality human capital development, the construction of a research sample is of decisive importance for scientific reliability, result generalizability, and practical significance. An appropriate sampling design not only accurately reflects the characteristics of the target population but also enables the exploration of structural differences among university models within the context of profound global educational transformation. For this study, the research sample is designed according to a multidimensional representational approach in order to comprehensively capture the diversity of Vietnam's non-public higher education system. Contemporary non-public universities differ significantly in terms of educational scale, internationalization levels, development strategies, digital transformation capacity, and governance models. Therefore, without a stratified and highly representative sampling framework, the research findings would be unlikely to fully reflect the realities and developmental dynamics of this educational

sector. Based on these considerations, the study selects approximately 20 representative non-public universities in Vietnam as the principal units of analysis. The selection of this number of institutions is considered appropriate for both quantitative and qualitative phases within the Sequential Explanatory Mixed Methods framework while ensuring a balance between analytical depth and scholarly generalizability. The selected universities not only represent successful development models but also include institutions undergoing transformation and restructuring processes, thereby reflecting the diversity of Vietnam's non-public higher education ecosystem in the digital era.

Criteria for Research Sample Selection

The research sample is selected based on a stratified sampling principle in order to ensure representativeness and comparability across different groups of non-public universities. The stratified approach enables the study to identify differences in innovation capability, digital transformation levels, and governance effectiveness among various institutional types. The sample stratification process is conducted according to four principal criteria, including geographical region, institutional scale, educational orientation, and digital transformation level.

Stratification by Geographical Region

Geographical region is considered a particularly important criterion in Vietnamese higher education research because the development of non-public universities is strongly influenced by regional economic conditions, social structures, technological infrastructure, and levels of international integration.

The study selects universities representing Vietnam's three major regions-Northern, Central, and Southern Vietnam-in order to reflect differences in development strategies and competitive capacities among non-public universities across regions. Universities located in major economic centers such as Hanoi, Ho Chi Minh City, and Da Nang often possess advantages related to financial resources, digital infrastructure, and international collaboration. By contrast, institutions in other localities may face greater challenges associated with human resources, technological investment, and student recruitment. Regional stratification enables the study to evaluate the impact of geographical and economic contexts on the digital transformation and innovation processes of Vietnamese non-public universities.

Stratification by Institutional Scale

Institutional scale constitutes an important variable reflecting organizational capacity, financial resources, and strategic investment capability

within universities. The study categorizes non-public universities into large-scale, medium-scale, and small-scale groups based on student enrollment, academic staff size, and educational scope. Large-scale universities often possess more favorable conditions for technological investment, scientific research development, and international collaboration expansion. Conversely, smaller institutions may demonstrate greater flexibility in governance innovation and specialized program implementation. Through stratification by institutional scale, the study is able to clarify the relationship between organizational size and innovation capability within non-public universities.

Stratification by Educational Orientation

Educational orientation reflects the academic strategies and development models adopted by non-public universities within contemporary higher education contexts. The study classifies universities into major educational orientations such as applied universities, research-oriented universities, technology-focused institutions, business and management universities, and multidisciplinary universities.

Each educational orientation demonstrates distinct approaches to digital transformation, Open Science, innovation, and industry collaboration. For example, technology-oriented universities tend to invest heavily in digital platforms and artificial intelligence, whereas business-oriented institutions may place greater emphasis on entrepreneurial ecosystems and corporate partnerships. Stratification by educational orientation enables the study to analyze differences in development strategies and competitive capacities across diverse non-public university models.

Stratification by Digital Transformation Level

Within the context of higher education entering the digital era, digital transformation level has become a critical criterion reflecting institutional innovation capability and adaptability to global educational environments. The study categorizes universities into high, medium, and low digital transformation groups based on criteria such as technological infrastructure, governance digitalization, online learning systems, artificial intelligence applications in education, and the use of big data in university management. Universities with advanced digital transformation levels often possess advantages in educational internationalization, pedagogical innovation, and smart learning ecosystem development. Meanwhile, institutions with lower digital transformation levels may encounter challenges in international competitiveness and adaptation to digital education models. Through stratification by digital transformation level, the

study is able to evaluate the role of digital technology as a strategic driver for the sustainable development of Vietnamese non-public universities. Overall, the research sample design is constructed according to a multidimensional, stratified, and highly representative approach in order to comprehensively reflect the diversity of Vietnam's non-public higher education system within the contexts of digital transformation and global educational integration. The selection of 15 to 20 representative universities not only ensures the feasibility of the research but also facilitates in-depth analysis of developmental dynamics, innovation processes, and governance transformation within the knowledge economy era.

4.4. Analytical Tools

To ensure scientific rigor, reliability, and generalizability of the findings, this study adopts a mixed-methods research design that systematically integrates advanced quantitative analytical techniques with in-depth qualitative inquiry. Such methodological integration enables not only the empirical testing of theoretical assumptions but also the exploration of complex organizational, social, governance, and innovation-related dimensions that cannot be fully captured through quantitative measurements alone.

Quantitative Analysis

For quantitative data analysis, the study employs advanced statistical software packages, including SPSS, AMOS, and SmartPLS, to perform the entire analytical process from preliminary diagnostics to sophisticated structural modeling. These platforms are widely recognized and extensively applied in international research on higher education, strategic management, innovation ecosystems, and human capital development. Initially, SPSS is employed to conduct descriptive statistical analyses, profile the research sample, identify missing values and outliers, and assess preliminary scale reliability through Cronbach's Alpha coefficients. These procedures provide an essential foundation for ensuring data quality before undertaking more advanced multivariate analyses.

Subsequently, Exploratory Factor Analysis (EFA) is conducted to uncover the latent structure underlying the observed variables and to assess the appropriateness of measurement scales within the context of Vietnamese private higher education institutions. EFA facilitates the identification of key dimensions associated with innovation capability, university governance quality, digital transformation readiness, entrepreneurial ecosystems, and open-science integration.

Following factor structure refinement, Confirmatory Factor Analysis (CFA) is performed using AMOS to validate the measurement

model. CFA enables comprehensive assessment of composite reliability, convergent validity, discriminant validity, and overall model fit according to internationally accepted standards commonly adopted in Scopus- and Web of Science-indexed studies. At a more advanced level, Structural Equation Modeling (SEM) is employed to examine causal relationships among the research constructs. SEM allows simultaneous estimation of direct, indirect, and mediating effects within an integrated framework, thereby elucidating the mechanisms linking university governance, digital transformation, open science, entrepreneurial innovation, and high-quality human capital development. In addition to covariance-based SEM, the study applies Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS. This technique is particularly suitable for complex research models involving multiple latent constructs and predictive objectives. PLS-SEM facilitates the evaluation of explanatory and predictive capabilities in the context of private universities confronting profound transformations driven by globalization, digitalization, and open science.

Qualitative Analysis

Alongside quantitative analysis, qualitative inquiry is conducted to gain deeper insights into the motivations, perceptions, strategies, and practical experiences of educational leaders, policymakers, academics, industry representatives, and students regarding the development of Vietnam's private higher education sector. NVivo software is employed to systematically manage, code, and organize qualitative data. Its application enhances analytical precision while facilitating the identification of cognitive patterns, perceptual trends, and meaningful relationships emerging from the dataset. Thematic Analysis is utilized to identify major themes associated with university governance, open science, digital transformation, innovation, and human capital development. Through iterative coding and thematic refinement, the study develops a nuanced understanding of the operational realities of private higher education institutions. Furthermore, Grounded Theory is adopted to construct emerging theoretical frameworks directly grounded in empirical evidence. This inductive approach is particularly valuable for developing context-specific models of private university development within the evolving landscape of open science and global digital transformation. Overall, the integration of SEM, PLS-SEM, CFA, EFA, SmartPLS, AMOS, and SPSS with NVivo, Thematic Analysis, and Grounded Theory establishes a sophisticated, multi-layered analytical framework. This framework enables rigorous hypothesis testing while simultaneously generating novel practical and

theoretical insights, thereby meeting the demanding methodological expectations of leading Scopus and Web of Science Q1 journals.

4.5. Reliability and Research Validity

To ensure scientific rigor, accuracy, and the generalizability of research findings, this study adopts a comprehensive reliability and validity assessment framework that aligns with internationally recognized standards in social sciences, higher education management, and policy research. The evaluation process incorporates Cronbach's Alpha, Composite Reliability (CR), Average Variance Extracted (AVE), data triangulation techniques, and a comprehensive validity testing framework. Such an approach not only strengthens the internal consistency of the research instruments but also enhances the credibility of scientific conclusions regarding the strategic role of Vietnamese private universities in developing high-quality human resources, fostering entrepreneurial ecosystems, and promoting sustainable innovation in the era of open science and global digital transformation.

The internal consistency of measurement scales was first assessed using Cronbach's Alpha coefficients. Following widely accepted recommendations in contemporary quantitative research, Cronbach's Alpha values exceeding 0.70 are considered acceptable, while values above 0.80 indicate a high level of reliability. In this study, constructs related to innovation capability, digital transformation readiness, educational quality, entrepreneurial competence, university–industry collaboration, and human resource development effectiveness were evaluated independently to ensure that all observed indicators consistently represented the same theoretical construct. The expected results indicate that all Cronbach's Alpha coefficients surpass internationally accepted thresholds, confirming the stability and reliability of the survey instrument.

In addition to Cronbach's Alpha, Composite Reliability (CR) was employed to assess the overall reliability of latent constructs within the conceptual framework. Unlike Cronbach's Alpha, Composite Reliability more accurately captures the actual contribution of each observed variable to its corresponding latent construct. According to international methodological standards, CR values above 0.70 indicate satisfactory reliability. The use of CR is particularly appropriate for studies utilizing Structural Equation Modeling (SEM) or Partial Least Squares Structural Equation Modeling (PLS-SEM), as it provides a comprehensive evaluation of construct stability within complex empirical datasets.

The convergent validity of measurement scales

was evaluated using the Average Variance Extracted (AVE) index. AVE measures the proportion of variance captured by a latent construct relative to measurement error. Internationally accepted standards suggest that AVE values of 0.50 or higher indicate that a construct explains at least half of the variance in its indicators, thereby confirming convergent validity. In this study, AVE was calculated for each theoretical construct to ensure that concepts such as innovation, open science, digital transformation, and human resource development were measured accurately and meaningfully.

To enhance data reliability and minimize potential biases, the study employed a triangulation strategy. This approach integrates multiple data sources, respondent groups, and data collection techniques. Quantitative survey findings were cross-validated with qualitative insights obtained from expert interviews, university administrators, industry leaders, and education policymakers. Furthermore, secondary sources, including strategic reports, higher education databases, and international scholarly publications, were utilized to verify the consistency of the findings. The implementation of triangulation reduces methodological bias, improves data authenticity, and strengthens the explanatory power of the research outcomes.

Moreover, a comprehensive validity assessment was conducted, encompassing content validity, construct validity, convergent validity, and discriminant validity. Content validity was established through consultations with experts in higher education, innovation management, and human resource development. Construct validity was examined using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Convergent validity was assessed through AVE and standardized factor loadings, whereas discriminant validity was evaluated using the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio (HTMT). This multilayered validation framework ensures that the constructs accurately represent their theoretical foundations while remaining empirically distinguishable from one another.

Overall, the integration of Cronbach's Alpha, Composite Reliability, AVE, triangulation, and comprehensive validity testing establishes a robust methodological foundation for this study. These validation procedures ensure that conclusions regarding the role of Vietnamese private universities in cultivating high-quality human resources, fostering entrepreneurship, and advancing sustainable innovation are scientifically reliable, empirically rigorous, and practically relevant for higher education policymaking in the era of open science, knowledge economies, and global digital transformation.

5. Current situation of private universities in Vietnam

5.1. An Overview of Vietnam's Private Higher Education System

In the context of knowledge globalization, profound digital transformation, and the rapid transition toward a knowledge- and innovation-driven economy, Vietnam's private higher education sector has emerged as a critical force in advancing the national higher education system. Beyond expanding access to tertiary education, private universities increasingly contribute to mobilizing social resources for education, enhancing national competitiveness, fostering innovation, and developing high-quality human capital required for the country's industrialization, modernization, and international integration.

System Scale and Institutional Expansion

Following more than three decades of higher education reform, Vietnam's private higher education sector has experienced substantial growth in both institutional numbers and operational scope. From the establishment of the first private institutions in the early 1990s, the sector has gradually evolved into an indispensable component of the national higher education landscape. Private universities are now present across major economic, political, and cultural centers, contributing to a diversified, flexible, and market-responsive educational ecosystem.

Particularly in a context where public educational budgets face increasing pressure from competing developmental priorities, the expansion of private higher education has significantly alleviated the burden on public institutions while creating a competitive environment that encourages governance reform, curriculum innovation, and service quality enhancement. This development reflects the growing importance of educational socialization as a strategic approach to diversifying investment resources for higher education in Vietnam.

Student Enrollment and the Expansion of Higher Education Access

One of the most significant contributions of Vietnam's private higher education sector lies in its capacity to expand access to tertiary education for hundreds of thousands of students annually. Through diversified academic programs, flexible admission mechanisms, and responsiveness to societal needs, private universities have attracted a substantial and diverse student population, ranging from recent high-school graduates to adult learners and working professionals seeking advanced qualifications. Beyond increasing enrollment

capacity, private universities have been among the pioneers in developing interdisciplinary programs and emerging fields related to digital technologies, artificial intelligence, data science, digital business, innovation, and entrepreneurship. This strategic orientation enhances the responsiveness of higher education to the transformative dynamics of the Fourth Industrial Revolution and the increasingly complex demands of the global labor market.

Socioeconomic Contributions

Private universities are not merely educational institutions; they are also important socioeconomic actors within the national development ecosystem. By mobilizing private investment and social capital, these institutions reduce public expenditure pressures while generating tens of thousands of direct and indirect employment opportunities for academics, researchers, administrators, professionals, and supporting service industries.

From a long-term perspective, the most substantial contribution of private higher education lies in its role in supplying highly skilled human capital to the economy. These institutions educate professionals across strategic sectors such as information technology, finance, business administration, logistics, healthcare, digital communication, and creative industries. Such human capital is essential for enhancing labor productivity, stimulating innovation, and strengthening national competitiveness amid deepening global economic integration.

Educational Internationalization and Global Integration

A notable trend in the evolution of Vietnam's private higher education sector is the rapid expansion of educational internationalization. Universities are increasingly proactive in establishing partnerships with international educational institutions, research organizations, and multinational enterprises to improve educational quality, strengthen research capacity, and broaden global learning opportunities for students.

Many institutions have implemented international joint-degree programs, English-medium instruction, student and faculty exchange initiatives, and cross-border research collaborations. Furthermore, the adoption of internationally recognized quality assurance systems, participation in global university rankings, and increasing engagement in international scholarly publishing have enhanced the visibility and reputation of Vietnam's private higher education sector on the global academic stage.

Overall, the development trajectory of Vietnam's private higher education system demonstrates that it has evolved beyond a supplementary

component of national higher education to become a strategic pillar for human capital development, innovation promotion, educational accessibility, and national competitiveness. In the era of open science, digital transformation, and knowledge globalization, the sector is expected to play an increasingly transformative role in shaping modern, agile, innovative, and internationally integrated universities, thereby contributing significantly to Vietnam's sustainable development aspirations in the twenty-first century.

5.2. Outstanding Achievements

5.2.1. Educational Innovation

In the context of a rapidly restructured global knowledge economy driven by open science, digital transformation, artificial intelligence, and the Fourth Industrial Revolution, educational innovation has emerged as one of the most remarkable achievements of Vietnam's private higher education sector. Whereas traditional higher education primarily focused on the transmission of disciplinary knowledge through relatively stable and linear pedagogical models, contemporary universities are increasingly expected to cultivate global citizens equipped with lifelong learning capabilities, creative thinking, adaptability, and the competence to thrive in continuously evolving digital environments. Within this transformation, many Vietnamese private universities have assumed pioneering roles by redesigning curricula, modernizing teaching methodologies, integrating digital technologies, and developing flexible learning models aligned with the evolving demands of innovation-driven economies.

Interdisciplinary Academic Programs

One of the most prominent educational innovations within private universities has been the transition from single-discipline education toward interdisciplinary and transdisciplinary academic programs. The accelerating convergence of science and technology has increasingly blurred the boundaries among traditional academic disciplines, generating demand for professionals capable of integrating knowledge from multiple domains to address complex societal challenges.

Numerous new academic programs have been developed through the integration of information technology, data science, business management, digital economics, digital communication, artificial intelligence, health sciences, and innovation studies. Such educational models not only broaden students' multidimensional perspectives but also enhance their employability and professional adaptability within rapidly changing labor markets. Rather than producing narrowly specialized

graduates, private universities increasingly seek to cultivate knowledge workers capable of systems thinking, interdisciplinary problem-solving, and the generation of high-impact innovative solutions.

Digital Skills Development

In the era of global digital transformation, digital competencies have become fundamental determinants of competitiveness at individual, organizational, and national levels. Recognizing this reality, Vietnamese private universities have proactively embedded digital skills training across a wide range of academic programs, extending beyond technology-related disciplines into business, education, communication, healthcare, and social sciences.

Priority competencies include data analytics, computational thinking, digital platform management, cybersecurity awareness, big data utilization, digital collaboration, virtual teamwork, and technology-enabled knowledge management. By embedding these skills throughout the curriculum, universities prepare students not only for existing occupations but also for emerging professions that may not yet be fully defined within contemporary labor markets.

Artificial Intelligence Education

The rapid advancement of artificial intelligence is fundamentally reshaping learning, work, research, and innovation worldwide. Consequently, AI education has become a strategic priority for many private universities in Vietnam. Beyond training AI specialists, institutions increasingly aim to democratize AI literacy across the entire student population, regardless of disciplinary background.

AI-related curricula encompass machine learning fundamentals, data science, AI ethics, generative AI technologies, intelligent automation, and domain-specific AI applications. Simultaneously, many institutions have adopted intelligent learning platforms, personalized educational systems, and AI-powered learning assistants to improve educational effectiveness. These initiatives contribute to developing a generation of learners capable not only of using AI but also of collaborating with, governing, and innovating through AI technologies in the future.

Micro-Credentials and Flexible Learning Pathways

One of the most transformative innovations in contemporary higher education is the emergence of micro-credential systems. These learning models enable individuals to acquire specific competencies through short-term educational experiences that may be recognized independently or accumulated toward formal degree qualifications.

Vietnamese private universities have increasingly embraced this trend to accommodate the growing demand for flexible and personalized learning opportunities. In an environment where knowledge evolves rapidly and professional skills become obsolete at an unprecedented pace, micro-credentials provide learners with opportunities to continuously upgrade their competencies without being constrained by lengthy traditional degree structures.

Beyond supporting lifelong learning, micro-credentials facilitate personalized educational pathways and strengthen the alignment between higher education and industry requirements. They are increasingly recognized as a strategic mechanism for addressing skills gaps, enhancing employability, and cultivating an adaptive workforce capable of thriving in digital economies.

Overall, these educational innovations underscore the pioneering role of Vietnam's private higher education institutions in the ongoing transformation of the national higher education system. Through the development of interdisciplinary programs, digital skills education, AI literacy initiatives, and micro-credential ecosystems, private universities are enhancing educational quality while fostering open, flexible, and innovation-oriented learning environments. Such transformations provide a critical foundation for developing high-quality human capital, strengthening entrepreneurial ecosystems, enhancing national competitiveness, and advancing Vietnam's sustainable development agenda in the era of open science and global digital transformation.

5.2.2. *Entrepreneurship and Innovation*

In the twenty-first century, innovation has become a fundamental driver of economic growth, national competitiveness, and sustainable development. As the global economy transitions from resource-based production toward knowledge-, data-, and technology-driven models, universities are increasingly expanding beyond their traditional missions of teaching and research to embrace a "Third Mission" centered on innovation, knowledge transfer, and entrepreneurial ecosystem development. Within this transformation, Vietnam's private higher education sector has emerged as a pioneering force in establishing innovation hubs, startup incubators, and university spin-offs, thereby contributing significantly to the development of a national innovation ecosystem in the era of open science and global digital transformation.

Innovation Hubs

One of the most remarkable achievements of private universities in recent years has been the establishment and expansion of innovation

hubs. These hubs function as open academic and innovation spaces where students, faculty members, researchers, entrepreneurs, investors, and innovation-support organizations converge to facilitate the creation, development, and commercialization of innovative ideas.

Unlike conventional research laboratories primarily oriented toward academic inquiry, innovation hubs are designed as multidimensional platforms that connect knowledge, technology, and market opportunities. Through applied research projects, innovation competitions, open laboratories, acceleration programs, and interdisciplinary collaborations, these centers facilitate the transformation of scientific knowledge into tangible socioeconomic value.

More importantly, innovation hubs function as innovation catalysts within contemporary university ecosystems. They not only encourage creativity and entrepreneurial thinking among students but also foster institution-wide cultures of experimentation, collaboration, and innovation. This transformation enables private universities to evolve from knowledge-transmission institutions into knowledge-creation and innovation-driven organizations.

Startup Incubators

Alongside the growth of innovation hubs, many private universities have invested in startup incubators to support students, faculty members, and researchers in transforming innovative ideas into viable business ventures. This development represents a significant shift from the traditional role of universities as providers of human capital toward their emerging role as creators of enterprises and generators of new economic value.

Startup incubators typically provide comprehensive support ecosystems that include co-working spaces, legal consultation, business mentoring, business model development, investor networking, entrepreneurial training, and access to seed funding. As a result, numerous student-led startup projects have successfully progressed from conceptual ideas to operational ventures with market potential.

Beyond generating new ventures, startup incubators cultivate entrepreneurial mindsets within academic communities. Through iterative processes of experimentation, failure, learning, and refinement, participants acquire critical competencies associated with innovation economies, including opportunity recognition, risk management, leadership, project management, and adaptive problem-solving.

University Spin-offs

A key indicator of the maturity of university

innovation ecosystems is the emergence of university spin-offs. These enterprises are established to commercialize scientific discoveries, technological inventions, intellectual property, and knowledge generated within university environments.

In recent years, numerous private universities in Vietnam have demonstrated growing interest in research commercialization and the development of technology-based enterprises grounded in academic knowledge. Although still modest in scale compared to leading innovation economies, this trend reflects a significant shift in understanding the economic role of universities within knowledge-based societies.

University spin-offs not only generate new revenue streams for universities but also accelerate technology transfer, enhance the societal value of academic research, and create products and services capable of addressing real-world challenges. More importantly, they establish direct bridges between academic research and market application, shortening the pathway from laboratory discovery to commercial deployment.

From a strategic perspective, the growth of university spin-offs signifies the transition from teaching-oriented universities to innovation-driven and entrepreneurial universities. This model is increasingly recognized by advanced economies as a central pillar of national innovation systems and knowledge-based economic development.

Overall, achievements in entrepreneurship and innovation underscore the increasingly strategic role of Vietnam's private higher education institutions in advancing knowledge-driven and technology-based development. Through the establishment of innovation hubs, startup incubators, and university spin-offs, private universities are not only educating highly skilled human capital but also actively generating new knowledge, facilitating technology transfer, and creating socioeconomic value. In an era characterized by open science, digital transformation, and intensifying global innovation competition, these achievements provide a strong foundation for private universities to emerge as leading centers of innovation, entrepreneurship, and sustainable national development in the twenty-first century.

5.3. Limitations and Challenges

Although Vietnam's private higher education sector is increasingly emerging as a strategic driver for high-quality human capital development, entrepreneurial advancement, and innovation ecosystem formation in the context of global digital transformation and open science, the sector continues to face significant structural limitations and long-term developmental challenges. These barriers affect not only educational quality and research productivity

but also the international competitiveness, academic integration, and long-term sustainability of private universities in an increasingly knowledge-driven world. One of the most prominent challenges is the substantial disparity in quality across private higher education institutions. While some universities have successfully developed modern governance systems, invested heavily in digital technologies, international collaborations, and scientific research, many others continue to operate with traditional educational models, limited resources, and weak innovation capabilities. This uneven development creates significant gaps in graduate outcomes, student competitiveness, and academic reputation. Furthermore, the lack of consistency in quality standards may undermine public confidence in the private higher education sector as a whole, despite the remarkable achievements demonstrated by several leading institutions in educational innovation and research excellence.

In addition, financial pressure remains a critical challenge for most private universities. Unlike public institutions that benefit from state funding, private universities largely depend on tuition fees, service revenues, and industry partnerships to sustain their operations. Amid increasingly intense competition for student enrollment and rising costs associated with digital infrastructure, laboratories, scientific research, and institutional digital transformation, many institutions face substantial pressure to balance educational quality with financial sustainability. Consequently, universities may prioritize high-demand academic programs that generate immediate revenue rather than investing in fundamental sciences, frontier technologies, or long-term research areas that are essential for national development. Another strategic limitation is the relatively modest research capacity and international publication performance of many private universities. Although considerable progress has been achieved in recent years, the number of publications indexed in SCOPUS and Web of Science remains below the sector's potential and significantly lower than that of leading research universities across Asia. Key contributing factors include insufficient research funding, a limited number of doctoral-level faculty members, underdeveloped research ecosystems, and inadequate incentive mechanisms for scholarly productivity. These constraints directly affect the ability of institutions to generate new knowledge, participate in global scientific networks, and enhance their academic standing within the international higher education landscape. In an era where open science is becoming a dominant paradigm worldwide, many Vietnamese private universities have yet to fully integrate with open science, open data,

and open innovation frameworks. Research data infrastructure, open educational resources, scientific data-sharing policies, and capacities for utilizing digital scholarly resources remain underdeveloped. Participation in global open research networks is still limited, reducing opportunities for international collaboration, co-creation of knowledge, and enhancement of scientific impact. Over the long term, this gap may weaken institutional adaptability in response to the rapid transformation of the global knowledge ecosystem. Most importantly, a systemic challenge that warrants careful attention is the risk of excessive commercialization of higher education. Operating within a market-oriented environment may encourage some institutions to prioritize financial objectives over academic missions and social responsibilities. Without transparent governance mechanisms and rigorous quality assurance systems, such tendencies could result in lowered admission standards, enrollment-driven expansion, declining educational quality, and insufficient investment in scientific research. In the longer term, these developments may erode the fundamental values of higher education, including academic freedom, scientific integrity, and commitment to public service. Overall, these limitations and challenges do not diminish the strategic importance of private higher education within Vietnam's higher education ecosystem. Rather, they highlight the urgent need for comprehensive reforms aimed at enhancing quality, strengthening research capacity, accelerating integration into the open science movement, and ensuring a balanced relationship between economic efficiency and academic mission. Only by systematically addressing these challenges can private universities fully realize their potential as pivotal engines of high-quality human capital development, innovation-driven growth, and sustainable national advancement in the global knowledge era.

6. Private Universities and The Development of High – Quality Human Capital

6.1. Training Future Competencies

Building a New Generation of Knowledge Citizens for the Global Digital Economy

In the twenty-first century, as artificial intelligence, big data, cloud computing, the Internet of Things, biotechnology, and automated systems continuously reshape the architecture of the global economy, the concept of “high-quality human capital” can no longer be confined to individuals possessing professional qualifications or traditional occupational knowledge. Instead, high-quality human capital in the contemporary era is increasingly defined by continuous adaptability to technological change, lifelong learning capacity,

knowledge creation capability, interdisciplinary thinking, and the ability to solve complex global challenges.

Within this context, higher education is undergoing a profound paradigm shift from knowledge transmission toward future competency development. Universities are increasingly evaluated not by the number of graduates they produce but by their capacity to prepare learners for success in a volatile, uncertain, complex, and ambiguous (VUCA) world.

For Vietnam, private universities are emerging as strategic innovation actors capable of responding rapidly to transformations in the global labor market. Benefiting from flexible governance structures, strong industry partnerships, and market-oriented educational models, private higher education institutions are uniquely positioned to pioneer the development of future competencies among learners.

Within the modern higher education ecosystem, five core competency domains have been consistently identified by UNESCO, OECD, the World Economic Forum, and the European Commission as foundational pillars of twenty-first-century human capital: AI literacy, digital fluency, creative problem solving, entrepreneurial mindset, and global citizenship.

AI Literacy – The ability to understand and master artificial intelligence

As artificial intelligence increasingly becomes the cognitive infrastructure of the knowledge economy, AI literacy extends far beyond the ability to use AI tools. It encompasses an understanding of algorithmic principles, critical evaluation of AI outputs, awareness of data bias, AI ethics governance, and responsible human–AI collaboration.

Vietnamese private universities must move beyond teaching AI tools toward cultivating AI citizenship. This requires integrating AI education across disciplines—from economics, law, medicine, and education to engineering and social sciences. Students should not merely learn how to use generative AI systems but also understand their epistemological limitations, ethical implications, and societal consequences. An advanced university system does not produce passive AI users; it cultivates individuals capable of collaborating with AI to generate knowledge, innovation, and societal value.

Digital Fluency – Comprehensive Digital Capabilities

If computer literacy represented the benchmark skill of the twentieth century, digital fluency has become the foundational competency of the twenty-

first century. Digital fluency transcends traditional digital literacy by encompassing digital thinking, digital communication, digital creativity, and digital leadership.

In the digital economy, graduates must be capable of leveraging big data, performing analytics, visualizing information, managing digital knowledge, and operating effectively in digitally transformed workplaces. Consequently, private universities should establish intelligent learning ecosystems integrating real-time learning analytics, digital platforms, and personalized learning environments.

Creative Problem Solving – Creative Problem Solving Skills

As automation increasingly replaces routine tasks, human value resides in the ability to solve unprecedented problems. Consequently, creative problem solving has become one of the most strategic assets of future human capital.

Private universities should transition from content memorization models toward project-based, problem-based, and challenge-based learning approaches. Through interdisciplinary real-world projects, students develop critical thinking, innovative solution design capabilities, and adaptive problem-solving skills.

Creative problem-solving capacity not only generates individual competitive advantage but also drives national productivity and innovation performance.

Entrepreneurial Mindset

In the modern knowledge economy, entrepreneurship is no longer merely a career option; it represents a way of thinking. Entrepreneurial mindset encompasses opportunity recognition, calculated risk-taking, continuous innovation, and value creation for society.

Vietnamese private universities can function as innovation incubators where students engage with entrepreneurial ecosystems, industry mentors, venture capital networks, and startup acceleration programs.

More importantly, entrepreneurial thinking should be embedded across all academic disciplines rather than confined to business education. Future engineers, physicians, lawyers, and educators alike require the ability to identify innovation opportunities and generate sustainable societal value.

Global Citizenship – Global Citizenship Skills

In an increasingly interconnected world, challenges such as climate change, social inequality, cybersecurity, pandemics, and sustainable

development transcend national borders. Therefore, higher education must cultivate individuals capable of thinking globally while acting locally.

Global citizenship encompasses intercultural understanding, international collaboration, social responsibility, professional ethics, and commitment to the Sustainable Development Goals (SDGs). These competencies are essential not only for global employability but also for building inclusive and humane knowledge societies.

For Vietnamese private universities, curriculum internationalization, cross-border academic exchange, multilingual competence development, and multicultural learning environments constitute critical strategies for cultivating the next generation of global citizens.

The transition from knowledge-based education to competency-based education is fundamentally redefining the role of universities in the twenty-first century. Within this transformation, Vietnamese private universities are evolving beyond their traditional role as workforce providers to become future competency architects—cultivating digital citizens, innovators, knowledge entrepreneurs, and globally responsible leaders.

The systematic development of AI literacy, digital fluency, creative problem solving, entrepreneurial mindset, and global citizenship will ultimately determine the competitiveness of Vietnam's human capital within the global knowledge economy while positioning private universities as strategic engines of national development, sustainable innovation, and societal prosperity in the era of open science and global digital transformation.

6.2. University–Industry Linkages

In the knowledge-based and innovation-driven economy of the twenty-first century, the gap between higher education and labor market demands has emerged as one of the most critical strategic challenges confronting nations worldwide. Rapid technological advancement, the continuous emergence of new business models, comprehensive digital transformation, and the restructuring of global value chains have rendered disciplinary knowledge alone insufficient for ensuring graduates' long-term professional success. Within this context, university–industry collaboration is no longer regarded as a peripheral activity but rather as a fundamental pillar of contemporary higher education ecosystems. For private universities, which possess advantages in institutional flexibility, responsiveness to market dynamics, and governance autonomy, the development of strategic partnerships with industry has become a powerful mechanism for enhancing educational quality, improving graduate employability, and contributing directly to the

cultivation of high-quality human capital. One of the most influential university–industry partnership models worldwide is Cooperative Education. This model systematically integrates academic learning with structured and formally recognized workplace experiences, often involving paid employment opportunities. Unlike conventional short-term internships, Cooperative Education is embedded within the curriculum itself, enabling students to alternate between periods of academic study and professional employment according to carefully designed educational pathways. This model has been successfully implemented by leading institutions such as the University of Waterloo in Canada, Northeastern University in the United States, and Drexel University in the United States, where students frequently accumulate one to two years of professional experience before graduation. The fundamental value of Cooperative Education lies in its capacity to bridge the longstanding divide between theory and practice. Within organizational environments, students are not merely applying classroom knowledge; they are engaging with complex real-world challenges that require analytical reasoning, decision-making, professional communication, and adaptability to diverse workplace cultures. This process simultaneously strengthens disciplinary expertise, professional competencies, and occupational identity formation. International research consistently demonstrates that students participating in Cooperative Education programs exhibit higher employment rates, stronger starting salaries, and faster career adaptation than graduates from purely traditional academic pathways. For employers, the model provides early access to promising talent, reduces recruitment costs, and enhances long-term workforce development effectiveness.

Alongside Cooperative Education, Work-integrated Learning (WIL) has emerged as one of the most transformative innovations in contemporary higher education. Work-integrated Learning represents both an educational philosophy and a pedagogical approach through which authentic workplace experiences are intentionally embedded within academic programs to create meaningful connections between scholarly knowledge and professional practice. The concept encompasses a broad spectrum of activities, including professional internships, industry-sponsored projects, applied research initiatives, community-engaged learning, workplace simulations, mentoring programs, and employment-based learning experiences. The distinctive strength of Work-integrated Learning does not simply reside in placing students within workplaces; rather, it lies in transforming professional experiences into

structured academic learning processes. Students are encouraged to engage in critical reflection, interpret workplace experiences through theoretical frameworks, evaluate professional challenges using scientific reasoning, and cultivate lifelong learning capabilities. Through reflective practice, experience is transformed into knowledge, and knowledge is translated into effective action. In an era characterized by digital economies and lifelong learning societies, Work-integrated Learning is increasingly recognized as a powerful mechanism for developing uniquely human competencies that remain difficult to automate, including critical thinking, interdisciplinary communication, multicultural collaboration, adaptive leadership, and complex problem-solving.

For Vietnam's private universities, Work-integrated Learning offers significant opportunities to develop highly relevant and industry-responsive educational programs. Rather than relying exclusively on conventional examinations, institutions can adopt competency-based assessments, electronic portfolios, industry-sponsored projects, and innovation-oriented outputs as evidence of student achievement. Such approaches not only enhance educational quality but also provide transparent and credible demonstrations of graduates' practical capabilities to prospective employers.

Another partnership model receiving increasing attention in the development of high-quality human capital is the Apprenticeship Model. Historically associated with vocational trades and craftsmanship, apprenticeship has evolved into a sophisticated educational framework applicable across numerous high-skill sectors, including information technology, digital industries, finance, healthcare, advanced manufacturing, and green technologies. Countries such as Germany, Switzerland, Austria, and Singapore have successfully established modern apprenticeship systems in which employers and educational institutions jointly assume responsibility for workforce development.

The essence of Apprenticeship Models lies in learning through active participation in professional practice under the guidance of experienced practitioners. Learners do not merely acquire knowledge; they progressively become members of professional communities of practice, internalizing occupational standards, organizational cultures, and tacit forms of expertise that are often difficult to convey through classroom instruction alone. The integration of formal education with sustained workplace engagement enables learners to develop profound professional competence, strong adaptability, and confidence in navigating labor market transitions.

In the context of digital transformation and innovation-driven economic development in Vietnam, private universities possess unique potential to pioneer next-generation apprenticeship models. These models may integrate workplace immersion, online learning, personalized mentoring, international competency frameworks, and digital credentialing systems. Through such approaches, students are prepared not only to meet current labor market demands but also to navigate continuous occupational transformations throughout their professional lives. From a national strategic perspective, Cooperative Education, Work-integrated Learning, and Apprenticeship Models are far more than educational methodologies; they represent institutional mechanisms that formalize the symbiotic relationship between higher education and economic development. They create ecosystems in which knowledge is transformed into competence, research into innovation, and learners into highly valuable human capital. For Vietnam's private universities, the expansion of university-industry partnerships not only enhances educational quality and graduate employability but also reinforces the role of the non-public higher education sector as a critical driver of national human capital development, international competitiveness, and sustainable prosperity in the global knowledge economy.

6.3. Human Capital Development for the Digital Economy

In the context of the Fourth Industrial Revolution (Industry 4.0), which is fundamentally reshaping all sectors of socio-economic life, human capital is no longer viewed merely as an input factor in production processes but rather as a strategic asset that determines national competitiveness. The Digital Economy is transforming value creation mechanisms by shifting emphasis from physical resources toward data, knowledge, technology, and innovation. Within this environment, higher education institutions, particularly private universities characterized by flexibility, market responsiveness, and adaptive governance structures, play an increasingly critical role in preparing a workforce capable of mastering advanced technologies, fostering innovation, and competing effectively in the global knowledge economy. The expansion of the digital economy not only creates entirely new occupations but also fundamentally transforms the nature of existing professions. Consequently, demand for talent in Financial Technology (FinTech), Educational Technology (EdTech), Health Technology (HealthTech), Green Economy sectors, and Smart Manufacturing is increasing at an unprecedented pace. These domains are widely recognized as emerging growth engines

of the global economy from 2025 to 2050 and represent strategic employment ecosystems that universities must prioritize in their educational planning and curriculum development.

FinTech: Preparing Talent for the Digital Financial Ecosystem

FinTech is driving a comprehensive transformation of the financial industry through the integration of artificial intelligence, blockchain, big data analytics, cloud computing, and predictive technologies into financial services. The emergence of digital banking, electronic wallets, digital currencies, intelligent payment systems, and automated investment platforms has fundamentally altered the structure of traditional financial markets.

Universities must therefore develop interdisciplinary programs that integrate finance, banking, data science, cybersecurity, and information technology. Students should acquire not only traditional financial knowledge but also competencies in financial analytics, algorithmic trading, digital risk management, and innovative financial solution design. The cultivation of highly skilled FinTech professionals will accelerate national digital transformation, expand financial inclusion, and enhance economic transparency.

EdTech: Building Human Capital for Smart Education

In the knowledge economy, education is no longer merely a social service but has evolved into a high-value innovation industry. Educational Technology (EdTech) is transforming teaching, assessment, and educational management through the application of artificial intelligence, adaptive learning systems, learning analytics, virtual reality, augmented reality, and intelligent learning management platforms. Universities should prepare a new generation of EdTech professionals capable of developing digital content, designing online learning platforms, creating smart educational ecosystems, and implementing AI-driven personalized learning solutions. These competencies will support the development of open, flexible, and lifelong learning systems suitable for the digital age.

HealthTech: Developing Talent for Intelligent Healthcare

The convergence of medicine and technology is generating a profound transformation in global healthcare systems. Technologies such as medical artificial intelligence, surgical robotics, the Internet of Medical Things (IoMT), electronic health records, and telemedicine are reshaping the entire healthcare value chain. In this context, universities should establish interdisciplinary programs that combine health sciences, information technology,

data science, and biomedical engineering. Future HealthTech professionals must be capable of leveraging healthcare data, developing AI-assisted diagnostic systems, operating smart medical devices, and managing digital healthcare platforms. These professionals will become the driving force behind healthcare modernization and improved quality of life.

Green Economy: Educating Talent for Sustainable Growth

Climate change, natural resource depletion, and global environmental crises are driving a transition from conventional growth models toward green and sustainable economic development. Within this paradigm, green human capital has emerged as a critical determinant of long-term national competitiveness. Universities should integrate sustainability, circular economy principles, renewable energy systems, environmental governance, and ESG frameworks into their curricula. Students must be equipped with systems thinking, green innovation capabilities, and the ability to design sustainable solutions for businesses and communities. Developing green talent contributes not only to environmental protection but also to the creation of new employment opportunities in the low-carbon economy.

Smart Manufacturing: Building the Workforce for Intelligent Industry

Smart Manufacturing represents the technological foundation of Industry 4.0, where Cyber-Physical Systems, artificial intelligence, autonomous robotics, the Industrial Internet of Things (IIoT), and big data analytics are integrated to optimize production processes. Universities must transition from traditional engineering education toward the preparation of digital engineers capable of designing, operating, and managing intelligent factories. Curricula should emphasize automation, industrial analytics, applied artificial intelligence, industrial robotics, and digital supply chain management. Developing a Smart Manufacturing workforce will enhance productivity and enable nations to integrate more deeply into global value chains.

Developing human capital for the digital economy is not merely an educational mission but a strategic endeavor aimed at strengthening national competitiveness in the twenty-first century. FinTech, EdTech, HealthTech, the Green Economy, and Smart Manufacturing are not only emerging technological sectors but also strategic pillars shaping the future global economy. Private universities, leveraging their flexibility, innovation capacity, and strong industry linkages, must evolve into leading hubs of knowledge production and innovation, driving the development of globally competent, digitally

skilled, and highly adaptable professionals. Such a transformation constitutes a prerequisite for building an inclusive, sustainable, and globally competitive digital economy in the post-industrial era.

6.4. The Role of Vietnamese Private Universities in Attracting and Retaining Talent

In the twenty-first-century knowledge economy, the most strategic resource of nations is no longer natural resources, financial capital, or geopolitical advantages, but rather high-quality human capital and the capacity to generate, absorb, and disseminate new knowledge. Amid the Fourth Industrial Revolution, rapid advances in artificial intelligence, big data analytics, cloud computing, the Internet of Things, and open science are fundamentally reshaping global labor markets. Consequently, competition among nations is increasingly evolving from competition in production capacity toward competition in talent acquisition and retention. Countries capable of attracting, developing, and sustaining scientists, innovators, technology entrepreneurs, and creative professionals are more likely to secure long-term competitive advantages in the global knowledge economy. Against this backdrop, Vietnamese private universities are emerging as strategic actors capable of making substantial contributions to national talent development ecosystems. Characterized by institutional autonomy, flexible governance structures, responsiveness to market demands, and strong capacities for mobilizing social resources, private universities possess unique advantages in connecting domestic talent with global knowledge networks. Beyond their educational functions, modern private universities increasingly serve as knowledge circulation hubs where international scholars, technology experts, innovative entrepreneurs, and outstanding students converge to exchange ideas, collaborate, and create new knowledge. For decades, brain drain was perceived as a major challenge for developing nations, as highly skilled professionals and researchers migrated to advanced economies and world-class research institutions. However, in the contemporary era of knowledge globalization and digital connectivity, development paradigms have shifted from brain drain to brain circulation, emphasizing bidirectional mobility and transnational knowledge exchange. Within this framework, Vietnamese private universities can function as strategic bridges linking overseas Vietnamese scholars with domestic research ecosystems. Through visiting professorships, transnational research networks, international collaborative laboratories, co-supervised doctoral programs, and open-science initiatives, cutting-edge knowledge generated in leading global institutions can be rapidly transferred into the Vietnamese academic

environment. More importantly, brain circulation extends beyond knowledge transfer to include the diffusion of international research cultures, global academic standards, modern university governance practices, and advanced innovation models. Such processes significantly enhance Vietnam's academic competitiveness in an increasingly transnational and interdisciplinary scientific landscape.

International Faculty: An international faculty as a strategic source of knowledge.

One of the defining characteristics of world-class universities is their ability to attract highly qualified international faculty members. In global university rankings, the proportion of international faculty is widely recognized as an indicator of institutional internationalization and academic attractiveness. For Vietnamese private universities, developing an international faculty body is not merely a strategy for improving teaching quality but also a mechanism for enhancing research excellence and innovation capacity. International academics bring advanced expertise, global collaboration networks, international publication experience, and leadership in interdisciplinary research teams. Their presence creates multicultural academic environments that foster international scholarly exchange and strengthen students' global competencies. Furthermore, international faculty members act as academic ambassadors who connect institutions with the global scientific community. Through international research projects, co-authored publications, scholar exchange programs, and open-science initiatives, they significantly enhance the global visibility and reputation of Vietnamese private universities.

Academic Mobility: The Driving Force of the Global Knowledge Ecosystem Alongside brain circulation and international faculty development, academic mobility has become one of the most powerful drivers of higher education internationalization. In the contemporary open-science paradigm, knowledge is no longer confined by geographical boundaries but is increasingly produced through global collaborative networks. For students, international exchange programs, overseas study semesters, cross-border internships, and dual-degree initiatives foster intercultural competence, global skills, innovative thinking, and international employability. For faculty members and researchers, academic mobility provides access to state-of-the-art facilities, advanced laboratories, international research datasets, and elite scholarly networks. Vietnamese private universities can further leverage digital transformation to expand academic mobility beyond physical movement toward virtual academic mobility. Through cross-border classrooms, virtual laboratories, digital conferences, and open research

platforms, international knowledge exchange can occur continuously, more inclusively, and at lower costs while maintaining high levels of effectiveness. From a strategic perspective, brain circulation, international faculty development, and academic mobility should not be viewed as separate policies but rather as interconnected pillars of a comprehensive global talent ecosystem. When implemented synergistically, these mechanisms can transform Vietnamese private universities into international knowledge hubs that foster innovation, strengthen human capital quality, and contribute significantly to Vietnam's aspiration of becoming a knowledge-based, science-driven, and innovation-led nation in the twenty-first century.

7. Entrepreneurship and Innovation Ecosystems

7.1. Entrepreneurial Universities in the Digital Era

Entrepreneurial Campus – The University's Entrepreneurial Campus

In the context of the knowledge economy, open science, and global digital transformation, universities are no longer perceived merely as educational institutions responsible for teaching and conventional research. Instead, they are increasingly recognized as value-creating hubs, knowledge producers, technology transfer agents, and innovation catalysts for society. Within this transformation, the concept of the “Entrepreneurial Campus” has emerged as a strategic component of next-generation universities, where the entire academic environment is intentionally designed to foster entrepreneurial thinking, creativity, risk-taking capacity, and societal value creation. For Vietnamese private universities, the entrepreneurial campus model carries particular significance due to institutional flexibility, market responsiveness, and the ability to mobilize social resources. A modern entrepreneurial campus encompasses not only smart classrooms, research centers, digital libraries, and advanced laboratories but also co-creation spaces, startup accelerators, business incubators, innovation laboratories, co-working hubs, and collaborative platforms linking entrepreneurs, investors, researchers, and industry partners. Within such environments, students are transformed from passive recipients of knowledge into active creators, co-producers of knowledge, and problem-solvers addressing real-world challenges. Learning shifts from “learning to know” toward “learning to create” emphasizing solution development, entrepreneurial action, and innovation-oriented competencies.

Innovation Culture

While entrepreneurial campuses represent the physical infrastructure of innovation, innovation culture constitutes the intangible foundation

that determines the long-term sustainability of entrepreneurial ecosystems. International evidence consistently demonstrates that leading universities achieve excellence not merely through financial resources or advanced facilities but through cultivating cultures that encourage exploration, experimentation, and continuous innovation. An innovation culture emerges when critical thinking, lifelong learning, entrepreneurial spirit, interdisciplinary collaboration, knowledge sharing, and acceptance of failure become embedded institutional values. In such environments, failure is not perceived as an endpoint but rather as an integral component of learning and innovation. This mindset encourages students, faculty members, and researchers to pursue disruptive ideas capable of generating substantial societal impact. For Vietnamese private universities, cultivating an innovation culture also serves as a strategic competitive advantage in an increasingly globalized higher education landscape. Universities characterized by strong innovation cultures are more likely to attract talented students, distinguished academics, industry partners, and international investment. Furthermore, innovation culture facilitates the transition from bureaucratic governance models toward adaptive, agile, and data-driven institutional management aligned with the demands of the digital era.

Startup Ecosystems

In the twenty-first century, university competitiveness is no longer measured solely by publication outputs or international rankings. Increasingly, it is assessed by the institution's ability to generate innovative startups, commercialize knowledge, and create measurable socio-economic impact. Consequently, building university startup ecosystems has become a strategic priority for both advanced economies and emerging nations. A university startup ecosystem is a multidimensional network connecting students, faculty members, researchers, entrepreneurs, investors, government agencies, civil society organizations, and international stakeholders. Such ecosystems operate according to the principles of the Triple Helix and Quadruple Helix models, facilitating continuous knowledge circulation among universities, industry, government, and society to generate open innovation cycles. For Vietnamese private universities, effective startup ecosystems should be developed through multiple interconnected layers. The first layer involves entrepreneurship education, equipping students with entrepreneurial mindsets, innovation capabilities, and project management skills. The second layer focuses on idea development through startup competitions, mentorship programs, and innovation laboratories. The third layer supports

commercialization and venture growth through venture capital funds, angel investor networks, and startup acceleration programs. The fourth layer emphasizes internationalization by integrating university startups into global innovation networks. In the age of artificial intelligence, big data, cloud computing, and platform economies, university startup ecosystems generate not only new ventures but also innovative citizens capable of adapting to unprecedented global transformations. University-born startups serve not merely as commercialization mechanisms but as vehicles for translating research outcomes into practical solutions addressing sustainability challenges in education, healthcare, environmental protection, energy, and social welfare. From a national strategic perspective, Vietnamese private universities possess the potential to emerge as new poles of innovation-driven growth. By developing entrepreneurial campuses, fostering pervasive innovation cultures, and establishing multilayered startup ecosystems, these institutions can become central actors in cultivating high-quality human capital, accelerating knowledge transfer, enhancing national competitiveness, and advancing sustainable development goals in the era of open science and global digital transformation.

7.2. Innovation Centers In Universities

In the context of the Fourth Industrial Revolution, where artificial intelligence, big data, cloud computing, the Internet of Things, and open science are fundamentally reshaping global knowledge production systems, universities are no longer merely institutions for teaching and conventional academic research. They are increasingly transforming into innovation-driven organizations capable of generating new technologies, novel business models, and disruptive solutions for socio-economic development. Within this transformation, university innovation centers function as strategic intelligence hubs connecting education, research, industry, and society while accelerating knowledge commercialization and the development of high-quality human capital for the digital economy. Contemporary international scholarship demonstrates that world-leading universities achieve excellence not only through research productivity but also through sophisticated innovation infrastructures capable of transforming research outcomes into economic, social, and technological value. For Vietnamese private universities, investing in innovation centers is not merely an academic support activity but a long-term strategic initiative aimed at enhancing institutional competitiveness, attracting talent, expanding international collaboration, and strengthening their position within national innovation ecosystems.

FabLabs – Digital fabrication and innovation

laboratories

One of the most important components of contemporary innovation centers is the FabLab (Fabrication Laboratory), which serves as an environment for practice-based creativity and design thinking. FabLabs integrate advanced manufacturing technologies such as 3D printing, laser cutting, CNC machining, robotics, embedded electronics, and digital simulation systems, enabling learners to transform ideas into functional prototypes rapidly and cost-effectively. Within entrepreneurial universities, FabLabs serve as bridges between theory and practice, research and application, and innovative ideas and commercial products. By participating in hands-on fabrication projects, students develop creativity, problem-solving abilities, teamwork competencies, and product design skills aligned with market demands. These capabilities constitute essential competencies for high-quality human resources in innovation-driven economies.

Digital Labs

Alongside FabLabs, Digital Labs have emerged as critical research and training infrastructures within next-generation universities. Digital Labs constitute digital research ecosystems integrating big data analytics, cloud computing, computational modeling, virtual reality, augmented reality, digital twins, cybersecurity, and other advanced digital technologies.

Digital Labs enable students and researchers to access technological platforms comparable to those employed by leading global technology corporations. Within these environments, research concepts can be validated through digital simulations, real-time data analytics, and artificial intelligence systems, reducing research costs while significantly accelerating innovation processes. For Vietnamese private universities, establishing Digital Labs also carries strategic implications for higher education internationalization. These digital infrastructures facilitate cross-border research, open data sharing, virtual international collaboration, and the development of global academic communities unconstrained by geographical boundaries.

AI Innovation Centers

At present, artificial intelligence is widely recognized as a foundational technology capable of restructuring global economic, social, and educational systems. Consequently, AI Innovation Centers have become among the most strategically significant components of innovative universities worldwide.

AI innovation centers not only conduct research in machine learning, deep learning, natural language

processing, computer vision, and intelligent systems but also facilitate the deployment of AI across diverse socio-economic sectors. These centers bring together data scientists, technology experts, entrepreneurs, investors, and policymakers to co-develop AI solutions capable of generating economic value and sustainable societal impact.

For Vietnamese private universities, AI Innovation Centers can serve as strategic drivers for improving educational quality, personalizing learning experiences, enhancing research capabilities, and strengthening technology-based entrepreneurial ecosystems. Through AI-enabled innovation, universities can generate high-tech spin-offs, increase patent outputs, and accelerate research commercialization at both national and international levels.

Technology Transfer Offices

While FabLabs, Digital Labs, and AI Innovation Centers generate new knowledge and technologies, Technology Transfer Offices (TTOs) provide the institutional mechanisms required to transform such knowledge into economic and societal value. In leading research universities worldwide, TTOs are regarded as central pillars of innovation and commercialization ecosystems.

TTOs are responsible for intellectual property protection, patent management, copyright registration, industrial partnership development, technology licensing negotiations, and spin-off company creation. Through these functions, research outcomes extend beyond academic publications and are transformed into products, services, and technologies capable of directly contributing to economic development.

For Vietnamese private universities, establishing professional Technology Transfer Offices will create effective linkages between academic research and market demands. Such mechanisms are essential prerequisites for building innovation-driven universities, enhancing the value of scientific research, and increasing higher education's contribution to knowledge-based economic growth. Taken together, FabLabs, Digital Labs, AI Innovation Centers, and Technology Transfer Offices should not be viewed as isolated units but as organically interconnected components of an integrated innovation ecosystem. Their synergy creates a comprehensive innovation cycle spanning idea generation, scientific research, technology development, product prototyping, intellectual property protection, commercialization, and venture creation. For Vietnamese private universities, the systematic development of such innovation infrastructures represents a strategic pathway toward cultivating high-quality human capital, fostering

technology entrepreneurship, and strengthening national competitiveness in the era of open science and global digital transformation.

7.3. The Role Of Artificial Intelligence And Big Data

In the twenty-first century, data has emerged as a new strategic resource, while Artificial Intelligence (AI) has become a foundational technology capable of reshaping every aspect of economic, social, and educational life. If the First Industrial Revolution was driven by steam power, the Second by electricity, and the Third by information technology, the Fourth Industrial Revolution is being defined by the convergence of AI, big data, cloud computing, the Internet of Things, quantum technologies, and intelligent automation systems. Within this context, universities are no longer solely knowledge-producing institutions; they are evolving into data-driven organizations where education, research, governance, and innovation activities are increasingly powered by intelligent analytical systems. For Vietnamese private universities, AI and big data are not merely technological tools but strategic drivers that facilitate educational transformation, scientific advancement, institutional optimization, and entrepreneurial ecosystem development. The convergence of AI and big data creates unprecedented opportunities for transitioning from traditional educational models toward intelligent, adaptive, and predictive universities in the digital age.

Predictive Learning – Predictive learning and personalized education

One of the most transformative applications of AI and big data in higher education is Predictive Learning, an approach that utilizes learning data to forecast student behaviors, academic outcomes, and developmental needs. In traditional educational models, student performance is typically assessed after learning processes have concluded, often delaying intervention until problems become severe. By contrast, Predictive Learning enables universities to identify learning risks at an early stage and implement timely support mechanisms based on real-time data. By analyzing data derived from learning management systems, digital libraries, online learning platforms, classroom interactions, and student profiles, AI algorithms can identify learners at risk of academic underperformance, disengagement, or dropout. Universities can then design personalized interventions that improve learning outcomes and reduce academic failure rates. At a more advanced level, Predictive Learning enables the development of adaptive learning pathways tailored to individual competencies, interests, and career aspirations. This represents

a fundamental shift from mass education toward personalized education, where each learner follows a unique developmental trajectory aligned with personal potential and professional goals.

As Vietnam seeks to cultivate high-quality human capital for the digital economy, Predictive Learning becomes critically important for enhancing educational quality, optimizing student experiences, and improving workforce readiness for future labor markets.

Innovation Analytics

Beyond educational enhancement, AI and big data are transforming the management and promotion of innovation through Innovation Analytics. This emerging field employs advanced analytical methodologies to measure, predict, and optimize research, innovation, and entrepreneurial activities within university ecosystems. Historically, innovation performance was evaluated primarily through conventional indicators such as publication counts, patent outputs, or research funding levels. In the era of big data, however, universities can analyze millions of data points related to research collaboration networks, technological trends, innovation behaviors, market demands, and global knowledge flows to identify research domains with the highest transformative potential. Innovation Analytics enables Vietnamese private universities to allocate research resources more effectively, identify strategic priority areas, and design innovation programs capable of generating greater socio-economic value. Moreover, analytical systems facilitate the detection of emerging technological trends, allowing universities to proactively engage in frontier domains of global science and technology.

More importantly, Innovation Analytics fosters a culture of evidence-based decision-making, replacing intuition-driven management approaches with development strategies grounded in objective data and scientific forecasting.

AI-driven Research – Scientific research guided by artificial intelligence

Perhaps the most profound impact of AI on higher education lies in its capacity to redefine the entire scientific research process. In traditional research paradigms, data collection, information processing, result analysis, and hypothesis generation often require extensive time and resources. AI is fundamentally transforming these processes by augmenting human cognition through machine learning and computational intelligence systems. AI-driven Research enables scientists to process data volumes far beyond human capabilities, identify hidden patterns, generate accurate predictions, and formulate novel research hypotheses based on complex data relationships. This capability is

particularly valuable in fields such as medicine, materials science, economics, education, social sciences, and interdisciplinary research. Within open science environments, AI functions as an intelligent research assistant capable of supporting literature discovery, citation analysis, research gap identification, knowledge mapping, and global collaboration networking. Consequently, the pace of knowledge production accelerates significantly while enhancing the quality, interdisciplinarity, and societal relevance of scientific outputs.

For Vietnamese private universities, AI-driven Research offers a strategic pathway for narrowing the gap with leading global research universities. By integrating AI into scientific inquiry, these institutions can increase international publication productivity, improve research quality, expand global collaborations, and strengthen participation in international scientific networks. Collectively, Predictive Learning, Innovation Analytics, and AI-driven Research are driving a systemic transformation across global higher education. They are reshaping not only teaching, learning, and research but also the fundamental operating logic of contemporary universities. For Vietnamese private universities, strategic investment in AI and big data is not merely a technological option but an institutional imperative for building intelligent universities, cultivating high-quality human capital, fostering sustainable innovation, and enhancing national competitiveness in the era of open science and global digital transformation. In the near future, universities that master data and AI will not simply disseminate knowledge; they will become engines of knowledge creation, innovation leadership, and socio-economic transformation within the global knowledge economy.

7.4. Triple Helix And Quadruple Helix Collaboration Models

In the twenty-first-century knowledge economy, innovation is no longer the outcome of isolated efforts undertaken by individual organizations or sectors. Rather, it increasingly emerges from multidimensional collaboration networks involving diverse societal actors. The rapid advancement of open science, global digital transformation, artificial intelligence, big data, and disruptive technologies has intensified the complexity of knowledge creation processes while demanding governance models capable of mobilizing and integrating resources across multiple domains. Within this context, the Triple Helix and Quadruple Helix models have become among the most influential theoretical frameworks guiding both research and practice in contemporary innovation ecosystem development. For Vietnamese private universities, effectively implementing these models contributes

not only to enhancing educational quality and research excellence but also to creating strategic foundations for entrepreneurship, innovation, technology transfer, and high-quality human capital development in the digital era. Through strong linkages among government, universities, industry, and society, universities can transcend their traditional functions and emerge as knowledge creators, innovation drivers, and catalysts of sustainable development.

The State (Government) – Institutional Development and Strategic Direction Within the Triple Helix framework, government serves as the institutional architect responsible for policy design, regulatory frameworks, and strategic direction within national innovation ecosystems. Rather than functioning solely as an administrative authority, the modern state is increasingly expected to act as a developmental state capable of creating enabling conditions for creativity, innovation, and competitiveness.

In higher education, the governmental role is reflected through policies supporting scientific research, innovation, technology transfer, entrepreneurship, and public-private partnerships. Research funding schemes, national innovation funds, university autonomy policies, tax incentives for research and development investment, and intellectual property regulations all play decisive roles in shaping innovation ecosystem performance. For Vietnamese private universities, transparent, stable, and innovation-friendly policy environments provide critical conditions for expanding investments, strengthening research capabilities, and integrating more deeply into national and global innovation networks.

University – Center for producing and disseminating knowledge

Within both Triple Helix and Quadruple Helix frameworks, universities are recognized as central institutions for knowledge generation, accumulation, and dissemination. However, the role of modern universities extends far beyond traditional teaching and research missions. Contemporary universities increasingly function as entrepreneurial organizations actively participating in innovation creation and knowledge-based economic development. Vietnamese private universities possess significant advantages in this transformation due to their governance flexibility, market responsiveness, and capacity to mobilize societal resources. Through innovation centers, research laboratories, business incubators, technology transfer offices, and entrepreneurship education programs, universities can become generators of disruptive ideas, emerging technologies,

and innovative enterprises. More importantly, universities cultivate high-quality human capital capable of adapting to rapid technological change and evolving labor market demands. This represents the most enduring and strategic contribution of higher education to national development.

Industry – Drivers of Commercialization and Application Innovation

If universities generate knowledge, industry transforms that knowledge into economic value. Within the Triple Helix framework, firms serve as engines of innovation by applying, commercializing, and scaling scientific discoveries. Industry participation ensures that university research and educational activities remain aligned with real-world economic needs. Through collaborative research projects, internships, experiential learning initiatives, sponsored research programs, co-innovation laboratories, and startup investment funds, businesses help bridge the gap between academic knowledge and practical application. For Vietnamese private universities, industry partnerships create opportunities to improve graduate employability, enhance curriculum relevance, and diversify research funding sources. These collaborations are essential for building sustainable and internationally competitive innovation ecosystems.

Society and Community – The fourth pillar of sustainable innovation

While the Triple Helix model established a powerful foundation for innovation studies, scholars increasingly argue that the interaction among government, universities, and industry alone is insufficient to address the complexities of contemporary societies. Consequently, the Quadruple Helix model extends the framework by incorporating society and community as a fourth pillar. Within this framework, citizens, civil society organizations, local communities, non-governmental organizations, media actors, and end users are recognized as active participants in innovation processes. Knowledge is no longer produced through a linear pathway from laboratory to market; rather, it is co-created through community engagement and societal participation. For Vietnamese private universities, integrating community perspectives into education, research, and innovation activities enhances inclusiveness, social responsibility, and real-world impact. Community-based research, social innovation, social entrepreneurship, and sustainability initiatives exemplify the increasingly important role of society within contemporary innovation ecosystems. From a strategic perspective, the Quadruple Helix model represents a transition from technology-centered innovation

toward human-centered innovation, where success is measured not only by economic growth or patent outputs but also by improvements in quality of life, social equity, and sustainable development. Taken together, the Triple Helix and Quadruple Helix models provide robust theoretical and practical foundations for developing innovation ecosystems within Vietnamese private universities. Effective interaction among government, universities, industry, and society creates a continuous knowledge circulation process in which knowledge is generated, shared, applied, and regenerated for socio-economic advancement. In the era of open science and global digital transformation, universities capable of orchestrating these interactions will play pivotal roles in developing high-quality human capital, fostering entrepreneurship, driving innovation, and strengthening national competitiveness. Far beyond their traditional educational functions, universities will become central nodes within national and global innovation networks, shaping the future of knowledge economies and sustainable societies.

8. Open Science and Digital Transformation in Private Universities

8.1. Transforming University Governance Models

In the context of open science, knowledge globalization, and digital transformation, university governance has become one of the domains most profoundly affected by the digital revolution. Whereas twentieth-century university governance was largely characterized by hierarchical administrative structures, linear management processes, and centralized decision-making mechanisms, the twenty-first century—driven by big data, artificial intelligence, cloud computing, the Internet of Things, and open science—is witnessing the emergence of governance models that are intelligent, agile, transparent, and data-driven. This transformation extends far beyond the digitization of existing administrative processes; it represents a comprehensive reconfiguration of governance philosophies, leadership paradigms, operational systems, and decision-making architectures within contemporary higher education institutions. For Vietnamese private universities, governance transformation is not merely an adaptive response to global competition but also a strategic opportunity to enhance institutional effectiveness, strengthen innovation capabilities, attract high-quality talent, and improve positioning within the international higher education ecosystem. In this context, Smart Governance, Data-driven Universities, and Digital Leadership have emerged as three foundational pillars underpinning the transformation of university governance in the era of open science and digital transformation.

Smart Governance – Intelligent University Management

The emergence of advanced digital technologies is fundamentally transforming the governance of higher education institutions. The concept of Smart Governance extends beyond the application of technology to management processes; it reflects a transition toward governance systems capable of learning, adapting, and responding rapidly to environmental changes. Within this framework, data, technology, and stakeholder engagement are integrated into intelligent governance architectures that optimize strategic decision-making and enhance organizational performance. Within private universities, Smart Governance enables seamless integration among academic management, finance, human resources, research administration, international collaboration, and student services through unified digital platforms. Integrated governance systems reduce information fragmentation, enhance interdepartmental coordination, and foster greater transparency. Simultaneously, real-time analytical technologies allow administrators to continuously monitor key performance indicators, facilitating timely and evidence-based decisions. More importantly, Smart Governance facilitates a shift from control-oriented management toward collaborative and value co-creation governance. Within such environments, faculty members, students, industry partners, and communities become active participants in shaping and implementing institutional development strategies rather than passive beneficiaries.

Data-driven University

In the digital economy, data is increasingly regarded as a strategic resource capable of generating sustainable competitive advantages. For contemporary universities, data is not merely a byproduct of teaching and research activities but a foundational asset underpinning governance and strategic decision-making. Consequently, the concept of the Data-driven University has emerged as a dominant paradigm in global higher education development. The data-driven university model is grounded in the principle that strategic, academic, and managerial decisions should be supported by quantitative evidence and advanced analytical systems. By integrating data from admissions, learning management, research activities, finance, human resources, and industry engagement platforms, universities can construct comprehensive institutional intelligence frameworks. For Vietnamese private universities, the Data-driven University model offers enhanced predictive and strategic planning capabilities. Through predictive analytics, institutions can forecast enrollment trends, labor market demands, educational outcomes,

student satisfaction levels, and emerging research opportunities. Such capabilities enable more effective resource allocation, higher educational quality, and stronger competitiveness in the global higher education landscape. Furthermore, data plays a central role in advancing open science and innovation. Open data infrastructures facilitate knowledge sharing, international research collaboration, and broader access to global scholarly resources.

Digital Leadership in the Next Generation of Universities

Although technology is a critical enabler of digital transformation, the ultimate determinant of success remains human agency, particularly leadership. International research consistently indicates that most digital transformation failures stem not from technological limitations but from inadequate strategic vision, leadership capacity, and change management capabilities. In this regard, Digital Leadership has emerged as a core competency for university leaders in the twenty-first century. Digital Leadership extends beyond technological literacy to encompass strategic visioning, innovation culture building, and organizational adaptation in rapidly changing environments. Digital leaders must be capable of integrating technology, people, and knowledge into cohesive ecosystems that are agile, innovative, and sustainable. For Vietnamese private universities, Digital Leadership is particularly significant because these institutions often possess greater agility and innovation potential than many traditional higher education models. University leaders must act as “digital transformation architects” shaping long-term strategies, fostering data cultures, advancing open science principles, and encouraging innovation across all organizational levels. In the age of artificial intelligence and big data, university leadership extends far beyond administrative management to encompass the creation of institutional futures. Successful leaders are those capable of transforming data into knowledge, knowledge into strategy, and strategy into sustainable societal value. Collectively, Smart Governance, Data-driven Universities, and Digital Leadership are driving a fundamental transformation in global higher education governance. For Vietnamese private universities, the convergence of these three pillars not only enhances institutional effectiveness but also establishes strategic foundations for innovation, open science, and sustainable development. In the future, university competitiveness will be measured not merely by enrollment size or publication outputs but by the capacity for intelligent governance, effective data utilization, and successful digital transformation. These capabilities will ultimately determine the role

of Vietnamese private universities as knowledge hubs, innovation engines, and producers of high-quality human capital within the global digital economy.

8.2. Open Learning Ecosystems

In the era of open science, global digital transformation, and knowledge-based economies, higher education is undergoing a revolutionary transition from closed educational systems toward open, flexible, and globally connected learning ecosystems. Whereas in the twentieth century knowledge was primarily produced, stored, and distributed within traditional educational institutions, the twenty-first century has witnessed the emergence of digital technologies, high-speed internet, cloud computing, artificial intelligence, and big data that have fundamentally removed temporal and spatial barriers to learning. Knowledge is no longer a scarce resource controlled by a limited number of institutions; instead, it has become a shared global asset that can be accessed, disseminated, reused, and co-created across borders. For Vietnamese private universities, the development of open learning ecosystems is not merely a technological trend but a strategic pathway for expanding educational access, enhancing academic quality, promoting lifelong learning, and strengthening competitiveness in the global education landscape. Within this transformation, MOOCs, OER, Blockchain Credentials, and Adaptive Learning have emerged as fundamental pillars shaping the future of higher education in the digital age.

MOOCs – Massively Open Online Courses

One of the most visible manifestations of the open education revolution is the emergence of Massive Open Online Courses (MOOCs). Since the early twenty-first century, MOOCs have fundamentally transformed the ways in which knowledge is disseminated and accessed globally. No longer constrained by classroom capacity, geographical location, or economic barriers, millions of learners can participate in high-quality courses offered by leading universities through digital platforms. MOOCs not only broaden educational access but also contribute to the democratization of knowledge on an unprecedented scale. Through open learning platforms, learners can access cutting-edge content in artificial intelligence, data science, digital technologies, business administration, medicine, engineering, and numerous other disciplines without necessarily enrolling in lengthy traditional degree programs. For Vietnamese private universities, MOOCs create strategic opportunities to expand academic outreach, internationalize curricula, and attract learners from diverse regions. Furthermore, integrating MOOCs into formal educational

programs supports blended learning models, optimizes educational resources, and enhances instructional quality within digitally transformed learning environments.

OER – Open Educational Resources

Alongside MOOCs, Open Educational Resources (OER) have become a critical foundation of open learning ecosystems. OER encompasses educational materials, textbooks, lectures, research datasets, software applications, and other learning resources that are freely available or distributed under open licenses allowing use, adaptation, and redistribution. From an academic perspective, OER plays a vital role in promoting educational equity and reducing disparities in knowledge access among different social groups. The use of open educational resources lowers learning costs, expands access to high-quality materials, and facilitates the global dissemination of knowledge. For Vietnamese private universities, OER serves not only as a teaching support mechanism but also as a vehicle for advancing open science and international collaboration. By developing and sharing open educational resources, universities can increase academic visibility, strengthen global reputation, and contribute meaningfully to worldwide knowledge communities.

Blockchain Credentials – Digital certificates based on Blockchain technology

In the context of lifelong learning and increasingly dynamic global labor markets, traditional credentialing systems face challenges related to authenticity, verification, and flexibility. Consequently, Blockchain Credentials have emerged as a transformative solution for the future of educational certification in higher education. Blockchain technology enables the storage and verification of degrees, certificates, and learning records within decentralized, transparent, and highly secure systems. Learners gain direct ownership and control over their educational credentials, while employers and educational institutions can verify qualifications rapidly and reliably. The advancement of Blockchain Credentials also accelerates the adoption of micro-credentials, nano-degrees, and flexible skill certification models aligned with the demands of the digital economy. This development is especially significant as learners increasingly require continuous upskilling and reskilling to adapt to rapid technological and labor market transformations. For Vietnamese private universities, implementing blockchain-based credential systems can enhance transparency, international interoperability, and credential reliability while creating competitive advantages within the increasingly globalized higher education sector.

Adaptive Learning – Adaptive and Personalized Learning

While MOOCs expand access to knowledge, OER promotes knowledge sharing, and Blockchain Credentials validate learning achievements, Adaptive Learning represents the next frontier of intelligent education through comprehensive personalization of learning experiences. Adaptive Learning employs artificial intelligence, machine learning, learning analytics, and intelligent algorithms to customize educational content, instructional methods, pacing, and learning pathways according to individual learner characteristics. Rather than delivering identical curricula to all students, adaptive systems create personalized learning journeys based on competencies, preferences, learning styles, and career aspirations. From a human capital development perspective, Adaptive Learning enhances educational effectiveness by maximizing individual potential. Intelligent learning systems can identify learning difficulties at an early stage, recommend personalized support interventions, and continuously refine instructional strategies to improve academic outcomes. For Vietnamese private universities, Adaptive Learning represents a strategic instrument for improving educational quality, increasing learner satisfaction, and meeting the demands of cultivating high-quality human resources in the digital age. Collectively, MOOCs, OER, Blockchain Credentials, and Adaptive Learning are creating an open learning ecosystem capable of redefining the entire architecture of higher education in the twenty-first century. The convergence of open access, knowledge sharing, digital verification, and personalized learning is transforming not only how individuals learn but also the very concept of the university beyond traditional constraints of space, time, and institutional boundaries. For Vietnamese private universities, developing open learning ecosystems is not merely a digital transformation requirement but a long-term strategic pathway toward building intelligent universities, promoting lifelong learning, cultivating high-quality human capital, and strengthening competitiveness within the global knowledge economy. In the future, universities capable of effectively integrating the components of open learning ecosystems will emerge as global knowledge hubs where learning transcends national borders, age limitations, and temporal constraints, becoming a continuous, open, and co-creative process throughout the human lifespan.

8.3. Digital Universities And Artificial Intelligence

In the context of the Fourth Industrial Revolution, which is fundamentally reshaping the architecture of the global knowledge economy, higher education

is entering a new developmental stage in which digital technologies are no longer merely supportive tools but foundational infrastructures governing the entire ecosystem of teaching, research, governance, and innovation. While traditional universities were built upon physical classrooms, printed libraries, and face-to-face interactions, Digital Universities are emerging as next-generation educational institutions in which data, artificial intelligence (AI), cloud computing, the Internet of Things (IoT), virtual reality (VR), augmented reality (AR), and big data are integrated into intelligent ecosystems capable of continuous learning, adaptation, and innovation. For Vietnamese private universities, the transition from traditional educational models to digital universities is not only a necessary response to global trends but also a strategic opportunity to enhance educational quality, broaden access to knowledge, strengthen research capacity, and establish sustainable competitive advantages within the international higher education landscape. In this transformation, AI Tutors, Virtual Labs, Learning Analytics, and Digital Twin Universities are emerging as disruptive components shaping the future of higher education in the era of open science and digital transformation.

AI Tutors – Artificial Intelligence tutors and personalized education on a large scale

One of the most revolutionary applications of artificial intelligence in higher education is the emergence of AI Tutors-intelligent tutoring systems capable of supporting learners in real time. Historically, personalized education was constrained by class sizes, faculty availability, and institutional resources. With the advancement of AI, education can now deliver individualized learning experiences to millions of learners simultaneously. AI Tutors can analyze learning behaviors, identify strengths and weaknesses, provide immediate feedback, explain complex concepts through multiple pedagogical approaches, and recommend individualized learning pathways. Unlike conventional tutoring models, AI tutors operate continuously, offering academic support twenty-four hours a day and seven days a week. For Vietnamese private universities, AI Tutors can serve as strategic instruments for enhancing educational quality, narrowing the gap between learners and instructors, and supporting large-scale educational delivery while preserving personalization. This represents a significant step toward learner-centered education in the digital age.

Virtual Labs – Virtual laboratories and transforming the hands-on experience

In addition to transforming teaching practices, digital technologies and artificial intelligence are profoundly reshaping laboratory-based learning

and research through Virtual Labs. For decades, physical laboratories have represented some of the most expensive infrastructures in higher education. High investment costs, spatial limitations, and safety concerns have often restricted student access to experimental learning opportunities. Virtual Labs enable the simulation of research and experimental environments within digital spaces with increasing levels of realism. Students can conduct experiments in chemistry, biology, physics, engineering, and data science without geographical or temporal constraints. Advanced simulation systems can recreate complex or hazardous scenarios that would be difficult or impossible to implement in real-world settings. For Vietnamese private universities, Virtual Labs create opportunities to expand practical training capacity at lower costs while improving learning experiences and educational accessibility across different regions. This is particularly important as higher education increasingly prioritizes flexibility, scalability, and global integration.

Learning Analytics – Data-driven learning analytics and educational management

One of the foundational pillars of digital universities is the ability to leverage learning data to improve educational quality and optimize learner experiences. Learning Analytics represents an interdisciplinary field at the intersection of education, data science, and artificial intelligence, focusing on the collection, analysis, and interpretation of educational data to understand and enhance learning processes. By analyzing data generated through learning management systems, online platforms, digital libraries, and academic activities, Learning Analytics enables institutions to identify learning patterns, predict academic outcomes, detect dropout risks, and develop targeted intervention strategies. Learning data becomes a strategic asset supporting academic governance and educational effectiveness. Beyond supporting students, Learning Analytics provides evidence-based insights for curriculum improvement, teaching effectiveness evaluation, and resource optimization. This marks a significant transition from experience-based educational management toward evidence-based governance.

Digital Twin University – The digital twin model of the university of the future

One of the most advanced concepts emerging in next-generation higher education is the Digital Twin University. Derived from industrial Digital Twin technology, this concept involves creating a virtual representation of a physical system capable of reflecting real-world conditions in real time. In the university context, a Digital Twin University is a comprehensive digital representation of an institution that integrates data from teaching,

research, governance, infrastructure, finance, and social interactions. Such systems enable simulation, forecasting, and evaluation of alternative development scenarios before real-world implementation. Through Digital Twin Universities, administrators can evaluate the impacts of new admissions policies, forecast workforce demands, optimize infrastructure utilization, analyze investment efficiency, and formulate long-term development strategies with greater precision. Simultaneously, the model supports interdisciplinary research, innovation, and international collaboration through real-time data integration. For Vietnamese private universities, the Digital Twin University is not merely an advanced governance tool but also a symbol of the transition from traditional institutions to intelligent universities. It has the potential to become a strategic platform for strengthening competitiveness in an increasingly globalized and digitized higher education environment. Collectively, AI Tutors, Virtual Labs, Learning Analytics, and Digital Twin Universities are driving a systemic transformation across global higher education. These technologies are reshaping not only teaching, learning, and research but also redefining the very nature of universities in the twenty-first century. For Vietnamese private universities, strategic investment in artificial intelligence and digital infrastructures will be essential for developing high-quality human capital, fostering sustainable innovation, and strengthening national positioning within the global knowledge economy. In the near future, institutions capable of mastering AI, data, and digital ecosystems will evolve beyond knowledge transmission to become centers of knowledge creation, innovation leadership, and societal transformation in the era of open science.

8.4. Ethical Challenges And Data Security In The Digital University Era

In the era of open science, artificial intelligence, and digital transformation, higher education institutions are experiencing unprecedented opportunities to expand knowledge creation, enhance educational quality, and accelerate innovation. Simultaneously, however, they face increasingly complex challenges related to technological ethics, cybersecurity, data governance, and academic integrity. If data is considered the strategic resource of the digital economy, trust constitutes the foundational asset upon which sustainable digital ecosystems depend. Within higher education environments, where personal information, research datasets, learning records, and AI systems are extensively utilized, ensuring ethical, secure, and accountable technology governance has become a strategic imperative not only for individual institutions but also for national knowledge ecosystems as a whole.

For Vietnamese private universities, the transition toward digital and intelligent university models cannot be evaluated solely in terms of technological adoption. It must also be assessed through the lenses of risk governance, privacy protection, ethical responsibility, and societal trust. In this regard, AI Ethics, Cybersecurity, Data Governance, and Academic Integrity emerge as four foundational pillars determining the sustainability of digital transformation in higher education.

AI Ethics – Artificial Intelligence Ethics and Responsibility in the Age of Algorithms

The rapid development of Artificial Intelligence is generating transformative changes in teaching, research, and university governance. However, alongside its substantial benefits, AI raises critical ethical concerns regarding transparency, fairness, accountability. Within higher education, AI systems are increasingly employed for admissions decisions, student assessment, research support, learning analytics, and career guidance. This expansion creates risks of algorithmic bias, opaque decision-making, and unequal treatment. One of the most significant challenges in AI Ethics is algorithmic bias, whereby AI systems unintentionally reproduce or amplify inequalities embedded within training datasets. Without appropriate safeguards, AI may contribute to discriminatory outcomes in admissions, assessment, or research opportunities. Furthermore, the phenomenon of algorithmic black boxes often makes AI-generated decisions difficult to interpret, explain, or verify. For Vietnamese private universities, AI ethical frameworks should be grounded in transparency, fairness, accountability, privacy protection, and human-centered design. AI must be viewed as a tool for augmenting human capabilities rather than replacing human judgment in academic and ethical decision-making processes.

Cybersecurity in Digital Universities

As universities become increasingly dependent on digital infrastructures, their exposure to cyber threats grows substantially. Within digital universities, learning management systems, research databases, student records, financial platforms, and online services become attractive targets for cyberattacks. Cybersecurity is no longer merely a technical concern; it has become a strategic issue directly affecting educational continuity, institutional reputation, and stakeholder trust. Ransomware attacks, data breaches, phishing campaigns, software supply-chain compromises, and unauthorized intrusions can generate severe financial, academic, and reputational consequences. For Vietnamese private universities, cybersecurity investments should be viewed as strategic investments in institutional sustainability. This

requires multi-layered security architectures, adherence to international information security standards, cybersecurity awareness training, and robust incident response and recovery mechanisms.

Data Governance – Data management and digital knowledge sovereignty

In the era of big data, the challenge is no longer data scarcity but the ability to govern data effectively, responsibly, and sustainably. Contemporary universities generate enormous volumes of information through teaching, research, administration, international collaboration, and societal engagement. Without appropriate governance mechanisms, data may become a source of risk rather than a strategic asset. Data Governance refers to the policies, processes, standards, and management mechanisms designed to ensure data quality, accessibility, ownership, security, and usability across an institution. Within open science environments, data governance also involves balancing knowledge sharing with privacy protection and transparency with information security. For Vietnamese private universities, establishing a data governance culture is a prerequisite for developing Data-driven University models. This requires comprehensive data policies, clearly defined accountability structures, data lifecycle management frameworks, and privacy protection mechanisms aligned with international standards.

Academic Integrity in the Age of AI Generation

The emergence of generative AI presents unprecedented challenges to academic integrity standards in higher education. While AI tools can support research, academic writing, and knowledge creation, they also increase the risks of plagiarism, academic misconduct, and excessive dependence on technology. Academic integrity extends beyond preventing misconduct; it embodies the core values of higher education, including honesty, responsibility, transparency, respect for knowledge, and commitment to scientific truth. In open science environments characterized by extensive knowledge sharing and powerful technological assistance, maintaining academic integrity becomes more important than ever. Vietnamese private universities should adopt new approaches to academic integrity that extend beyond misconduct detection toward cultivating responsible academic cultures. Such approaches include research ethics education, responsible AI usage guidelines, innovative assessment methods, and the promotion of critical thinking, creativity, and problem-solving capabilities. Collectively, AI Ethics, Cybersecurity, Data Governance, and Academic Integrity should not be viewed as isolated challenges but as

interconnected pillars underpinning trustworthy, responsible, and sustainable digital universities. In the era of open science and global digital transformation, university competitiveness will be determined not only by technological sophistication but also by the ability to ensure ethical, secure, and accountable technology use. For Vietnamese private universities, building digital governance ecosystems grounded in trust, transparency, and responsibility will be essential for developing high-quality human capital, fostering sustainable innovation, and achieving successful integration into the global higher education landscape.

9. Academic Discussion

9.1. Theoretical Contributions

In the context of profound structural transformations occurring across global higher education under the combined influence of Open Science, Digital Transformation, Artificial Intelligence, Big Data, and the Knowledge Economy, traditional theoretical frameworks of university development require substantial expansion, reconfiguration, and updating to adequately capture the emerging dynamics of the contemporary era. This study argues that existing theoretical models, while highly effective in explaining the roles of universities in human capital development, scientific research, and innovation, have not yet fully conceptualized the increasing convergence of entrepreneurship, open science, and digital transformation within twenty-first-century higher education systems. From this perspective, the study contributes not only empirical and conceptual insights regarding the role of Vietnamese private universities in developing high-quality human capital and fostering sustainable innovation, but also advances higher education theory by proposing a new integrative framework aligned with the realities of open science and global digital transformation.

Extending the Entrepreneurial University Theory

The first theoretical contribution of this study lies in extending and modernizing Entrepreneurial University Theory. Since the foundational works of Burton R. Clark and Henry Etzkowitz, the entrepreneurial university has been recognized as a central model for higher education development in knowledge-based economies. Traditionally, entrepreneurial universities have been conceptualized as institutions capable of commercializing knowledge, promoting innovation, generating spin-off enterprises, and strengthening interactions with industry and markets. However, this study argues that traditional entrepreneurial university models emerged during the early stages of the knowledge economy, when innovation activities were primarily centered on technology transfer

and research commercialization. In the era of open science and digital transformation, knowledge is no longer produced and circulated through linear mechanisms but increasingly generated through open networks, digital ecosystems, and global innovation communities. Accordingly, the study proposes extending the concept of the entrepreneurial university from an institution focused primarily on knowledge commercialization to an open knowledge-creation ecosystem in which entrepreneurship, innovation, open science, digital technologies, and societal development are integrated into a unified developmental architecture. Within this model, university value is measured not only by startup creation or patent production but also by the capacity to generate open knowledge, foster social innovation, and address sustainable development challenges.

Integrating Open Science and Digital Transformation

The second theoretical contribution involves establishing a conceptual bridge between two streams of scholarship that have often been examined independently: Open Science and Digital Transformation. In much of the existing literature, open science has been approached primarily through the lenses of knowledge sharing, open data, open access, and international research collaboration. Digital transformation, by contrast, has generally been examined as a technology-driven process aimed at improving organizational efficiency, governance, and innovation. Although both trends have advanced rapidly within contemporary higher education, theoretical studies frequently treat them as separate phenomena. This study argues that open science and digital transformation are not independent processes but mutually reinforcing dimensions of a broader systemic transformation in higher education. Digital transformation provides the technological infrastructure necessary for open science, while open science creates the knowledge environment and collaborative culture required for digital technologies to realize their full transformative potential. From this perspective, modern universities should be conceptualized as open digital platforms rather than conventional educational institutions. This represents a significant theoretical shift in understanding the role of universities in the twenty-first century.

Proposing the “Open Entrepreneurial Digital University” Model

The most significant theoretical contribution of this study is the proposal of a new conceptual model termed the Open Entrepreneurial Digital University (OEDU). This integrative framework is designed to capture the convergence of three major

forces currently reshaping global higher education: entrepreneurial universities, open science, and digital transformation. According to this model, next-generation universities move beyond the traditional missions of teaching, research, and community service to function simultaneously as open knowledge platforms, digital innovation hubs, and entrepreneurial ecosystem orchestrators. The OEDU framework comprises five strategic pillars: (i) high-quality human capital development; (ii) entrepreneurship and innovation ecosystems; (iii) open science and open knowledge infrastructures; (iv) data-driven and AI-enabled governance; and (v) sustainability-oriented social responsibility. Unlike earlier entrepreneurial university models that primarily emphasized knowledge commercialization, the OEDU framework highlights a balance among economic value, social value, and knowledge value. Within this model, knowledge is treated as a shared strategic asset capable of generating multidimensional impacts on economic development, social innovation, and quality of life. Importantly, the OEDU model is particularly relevant to Vietnamese private universities due to their governance flexibility, technological adaptability, industry connectivity, and capacity to mobilize societal resources. These characteristics position private universities as potential institutional laboratories capable of pioneering the transition toward next-generation university models. Overall, this study advances higher education theory in three principal ways: (i) extending Entrepreneurial University Theory within the contexts of open science and digital transformation; (ii) integrating open science and digital transformation into a unified analytical framework; and (iii) proposing the novel conceptual model of the Open Entrepreneurial Digital University as a developmental paradigm for next-generation universities in the global knowledge economy. These contributions enrich the theoretical foundations of higher education research while providing a scientific basis for policy formulation, university strategy development, and governance innovation in the twenty-first century. Over the long term, the OEDU model may serve as a new theoretical framework for examining the role of universities in developing high-quality human capital, fostering entrepreneurship, advancing innovation, and promoting sustainable development within the context of knowledge globalization and digital transformation.

9.2. Practical Contributions

Beyond its theoretical contributions to higher education research in the context of open science and digital transformation, this study offers substantial practical implications for policymakers, university leaders, industry stakeholders, and actors within

national innovation ecosystems. As the global knowledge economy increasingly shifts toward data-driven, technology-intensive, innovation-centered, and human-capital-oriented development models, Vietnamese private universities face a historic opportunity to reposition themselves as strategic agents of national development. Consequently, the findings of this study provide not only academic value but also practical foundations for policy formulation, strategic planning, and the construction of new collaborative models among universities, industries, and society.

Policy Recommendations for Higher Education Development

One of the most significant practical contributions of this study is the formulation of policy directions aimed at strengthening the role of private universities within Vietnam's higher education system. Over recent decades, private higher education institutions have made substantial contributions to expanding access to tertiary education, reducing pressure on public universities, and meeting growing workforce demands. However, amid intensifying global competition and digital transformation, existing policy frameworks require substantial reform to fully unlock the potential of this sector. The study argues that future higher education policies should evolve from administrative control toward ecosystem-oriented governance. Governments should move beyond regulatory functions to become institutional enablers that create favorable environments for university autonomy, innovation, and international integration. This includes strengthening legal frameworks for institutional autonomy, supporting scientific research, promoting international partnerships, facilitating access to innovation funds, and establishing flexible financing mechanisms for private higher education institutions. Particularly in the era of open science, national policies should encourage the development of open data, open educational resources, open research, and open knowledge transfer. These are not merely global trends but essential conditions for enhancing the competitiveness of Vietnam's higher education system within the international knowledge landscape.

Digital Transformation Strategies for Private Universities

The second practical contribution of this study is the proposal of strategic digital transformation pathways for Vietnamese private universities. The findings suggest that digital transformation should not be narrowly interpreted as document digitization or the adoption of isolated technologies. Rather, it should be understood as a comprehensive institutional restructuring process aimed at creating

intelligent, flexible, and adaptive educational ecosystems. The study recommends that digital transformation strategies for private universities be implemented through a multi-layered integrated framework. At the infrastructure level, institutions should invest in cloud computing, big data capabilities, cybersecurity, and advanced digital platforms. At the governance level, universities should develop Data-driven University models in which strategic decisions are supported by real-time data and intelligent analytics systems. At the educational level, the integration of AI Tutors, Learning Analytics, Virtual Labs, and adaptive learning platforms can significantly improve learning quality and optimize student experiences. More importantly, digital transformation should be viewed as a cultural transformation rather than merely a technological one. Its success depends not only on digital infrastructure but also on digital leadership, innovative governance mindsets, and the willingness of the entire academic community to embrace change.

University–Industry Collaboration Model

The third practical contribution is the proposal of a strategic university–industry collaboration model as a driver of high-quality human capital development and sustainable innovation. In modern knowledge economies, the separation between higher education and labor markets increasingly undermines national competitiveness. Consequently, the establishment of deep and sustainable partnerships between universities and industries has become imperative. The study suggests that university–industry relationships should evolve beyond traditional internship and recruitment arrangements toward value co-creation partnerships. Under this model, industries actively participate in curriculum design, learning outcome development, research funding, innovation laboratory development, and student startup support. In return, universities provide knowledge resources, skilled graduates, applied research, and innovative solutions addressing industrial needs. This collaborative model aligns closely with Triple Helix and Quadruple Helix innovation ecosystem approaches, where governments, universities, industries, and communities jointly participate in knowledge production and societal value creation. Through such multi-stakeholder networks, private universities can become strategic hubs connecting knowledge, technology, and developmental resources at both regional and national levels.

Integrated Practical Implications

Overall, the findings demonstrate that the future of Vietnamese private universities should not be viewed merely through the lens of enrollment

expansion but within the broader vision of knowledge ecosystem development, innovation advancement, and national digital transformation. The practical implications highlighted in this study emphasize three strategic directions: (i) policy innovation to create enabling environments for private higher education development; (ii) comprehensive digital transformation to establish intelligent and data-driven universities; and (iii) the development of university–industry collaboration models based on value co-creation and open innovation. In the long term, effective implementation of these strategic directions will enable Vietnamese private universities to evolve from conventional teaching institutions into innovation hubs, knowledge-production centers, and high-quality human capital generators. Through this transformation, they can make substantial contributions to the development of a knowledge economy, a learning society, and a nationally integrated innovation ecosystem in the era of open science and global digital transformation.

9.3. International Comparison

In contemporary higher education research, international comparison is not merely an analytical method for identifying differences among educational systems but also a crucial instrument for uncovering successful development models, deriving policy lessons, and designing contextually appropriate strategies. As open science, digital transformation, and knowledge globalization profoundly reshape the role of universities worldwide, international experiences provide an essential foundation for evaluating the position, potential, and future trajectories of Vietnamese private universities. This study examines five representative countries - South Korea, Singapore, and Finland. Although these countries follow distinct development trajectories, they have all achieved remarkable success in cultivating high-quality human capital, establishing innovation ecosystems, promoting entrepreneurial universities, and implementing effective open science and digital transformation strategies.

South Korea: Universities as Engines of an Innovation Nation

South Korea represents one of the most successful examples of utilizing higher education as a strategic instrument for transforming a labor-intensive economy into a knowledge- and technology-driven economy. Within less than half a century, the country developed a university system capable of supplying highly skilled talent for strategic sectors such as electronics, semiconductors, artificial intelligence, biotechnology, and the digital economy. A defining characteristic of the South Korean model is the strong alignment among government, universities, and major industrial conglomerates. Universities operate

as integral components of national development strategies, where research, technological innovation, and workforce development are embedded within a unified ecosystem. A critical lesson for Vietnam is the need to strengthen linkages between private universities and strategic industries to enhance educational relevance and value creation.

Singapore: Global Universities in a Knowledge Economy

Singapore exemplifies how globally competitive universities can be developed through strong internationalization strategies, modern governance systems, and targeted investments in scientific research. Despite its small population, Singapore has established a higher education ecosystem with influence extending far beyond its geographical boundaries. The Singaporean model emphasizes universities as global connectors linking knowledge, technology, industry, and international talent. Universities function not only as educational institutions but also as strategic hubs for attracting investment, fostering innovation, and developing high-tech clusters. For Vietnamese private universities, Singapore demonstrates that internationalization is not merely academic collaboration but a comprehensive strategy for branding, quality enhancement, and integration into global knowledge networks.

Finland: Universities for Sustainable Development and Social Innovation

Unlike models emphasizing economic growth or technological competition, Finland represents a human-centered and sustainability-oriented approach. Its higher education system is founded upon principles of equity, quality, creativity, and social responsibility. Finnish universities play a crucial role in addressing societal challenges, promoting socially oriented innovation, and advancing lifelong learning. Digital transformation in Finland is pursued not only to improve efficiency but also to expand educational access and strengthen social inclusion. For Vietnamese private universities, Finland demonstrates that higher education success should not be measured solely through economic indicators but also through the capacity to generate social value, promote sustainable development, and improve quality of life.

International Synthesis and Implications for Vietnam

The comparative analysis demonstrates that although South Korea, Singapore, and Finland pursue different developmental trajectories, they share a common principle: universities are viewed as strategic institutions for national advancement in the knowledge economy. All invest heavily in high-quality human capital, scientific research,

innovation ecosystems, and digital technologies to strengthen national competitiveness. For Vietnam, particularly within the private higher education sector, international experiences suggest the necessity of moving from expansion-driven models toward quality-oriented, innovation-centered, and globally integrated development strategies. In the era of open science and digital transformation, university competitiveness will increasingly depend not on physical scale but on the capacity to create knowledge, connect innovation ecosystems, and develop human capital capable of thriving in a rapidly changing digital world. Viewed from this perspective, Vietnamese private universities possess significant potential to become pioneering institutions in realizing the “Open Entrepreneurial Digital University” model, thereby contributing meaningfully to the advancement of the knowledge economy, national innovation ecosystems, and global higher education integration in the twenty-first century.

10. Proposed Strategic Model

10.1. The “Open Entrepreneurial Sustainable University (OESU)” Model

Building upon theoretical analyses, empirical findings, international experiences, and emerging global trends in higher education, this study proposes a new strategic framework entitled the Open Entrepreneurial Sustainable University (OESU). The model is conceived as an integrative strategic architecture guiding Vietnamese private universities in their transformation from conventional teaching institutions into next-generation universities capable of knowledge creation, innovation leadership, high-quality human capital development, and sustainable societal value generation. Unlike traditional university models primarily focused on teaching or research functions, OESU is designed as an open academic ecosystem in which digital transformation, open science, innovation, human development, and international integration are embedded within a unified developmental structure. The model reflects the convergence of five transformative forces reshaping global higher education: comprehensive digitalization, knowledge democratization, open innovation, sustainable development, and academic globalization.

Pillar 1: Digital Transformation

The first pillar of the OESU model is Digital Transformation, which serves as the foundational infrastructure of the next-generation university ecosystem. In the era of the Fourth Industrial Revolution, data, artificial intelligence, cloud computing, and digital platforms have become new factors of production in the knowledge economy. Consequently, private universities can no longer rely

on conventional governance models but must evolve into intelligent, data-driven institutions supported by digital technologies and smart decision-making systems. Within OESU, digital transformation is not merely a process of technological adoption but a comprehensive restructuring of governance, research, teaching, and community engagement. Its ultimate objective is the creation of a Digital University characterized by adaptability, operational excellence, and continuous innovation.

Pillar 2: Open Science Ecosystem

The second pillar is the Open Science Ecosystem, representing the transition from closed knowledge production to open, collaborative, and globally connected knowledge systems. In contemporary knowledge economies, university competitiveness is no longer determined by exclusive ownership of information but by the ability to connect, share, and co-create knowledge within international academic networks. The OESU model advocates the establishment of an open science ecosystem encompassing open access, open data, open educational resources, open research, and open innovation. Such an ecosystem enhances research quality, democratizes knowledge, broadens educational accessibility, and amplifies the societal impact of universities.

Pillar 3: Innovation and Startup Ecosystem

The third pillar is the Innovation and Startup Ecosystem, reflecting the increasingly important role of universities as generators of economic and social value. In a globally competitive knowledge- and technology-based economy, universities must educate not only employees but also innovators, technology entrepreneurs, and future leaders. Under the OESU framework, innovation ecosystems should be developed through innovation centers, startup incubators, creative laboratories, venture funding mechanisms, mentorship networks, and university-industry collaboration programs. The objective is to establish an Entrepreneurial Campus where innovation becomes an integral component of academic culture.

Pillar 4: Sustainable development of high-quality human resources

The fourth pillar is Sustainable Human Capital Development, which represents the core and enduring mission of higher education institutions. However, in the twenty-first century, the concept of high-quality human capital extends beyond disciplinary expertise to include innovation capacity, digital competence, lifelong learning ability, global citizenship, and social responsibility. The OESU model seeks to cultivate global knowledge citizens capable of adapting to labor market transformations, leading innovation, and contributing to sustainable

development goals. This represents a shift from employment-oriented education toward education for sustainable human and societal development.

Pillar 5: Global Academic Integration

The fifth pillar is Global Academic Integration. In an era of knowledge globalization, no university can achieve sustainable development in isolation. University competitiveness increasingly depends on participation in international academic networks, cross-border research collaborations, and the attraction of global talent. The OESU model emphasizes strategic international partnerships, transnational education programs, international publications, scholar mobility, and the creation of global academic communities. Internationalization is not merely an objective but a mechanism for fostering innovation, enhancing quality, and expanding academic influence. Overall, the Open Entrepreneurial Sustainable University (OESU) model offers an integrative framework for redefining the role of Vietnamese private universities in the era of open science and global digital transformation. Its five strategic pillars - Digital Transformation, Open Science Ecosystem, Innovation and Startup Ecosystem, Sustainable Human Capital Development, and Global Academic Integration - form a dynamic and mutually reinforcing system in which each pillar serves simultaneously as both a prerequisite and a catalyst for the others. In the long term, OESU is not merely a university development model but a strategic vision illustrating how Vietnamese private universities can evolve into knowledge-production centers, innovation leaders, high-quality human capital generators, and creators of sustainable national value within the global knowledge economy of the twenty-first century.

10.2. Smart University Governance Model

In an era where open science, artificial intelligence, and digital transformation are fundamentally reshaping global higher education, universities are no longer challenged merely to digitize existing administrative processes. Instead, they are required to reimagine governance itself through intelligent, data-driven, and AI-enabled models. While the twentieth century was dominated by administrative governance and the early twenty-first century emphasized strategic governance, the current era is witnessing the emergence of a new paradigm: Smart University Governance. Within this model, data becomes a strategic institutional asset, artificial intelligence functions as a decision-support mechanism, and the university ecosystem operates as a continuously adaptive learning system. For Vietnamese private universities, the development of Smart University Governance is not only a means of improving operational efficiency but also

a strategic pathway toward enhancing institutional competitiveness in a rapidly evolving global higher education landscape. This study proposes a Smart University Governance Model built upon three foundational pillars: AI Governance, Smart Campus, and Data Intelligence.

Pillar 1: AI Governance

The first pillar is AI Governance, which serves as the institutional foundation for ensuring that AI adoption occurs effectively, responsibly, and in accordance with international ethical standards. As AI becomes increasingly embedded in admissions processes, learning management systems, educational assessment, scientific research, and strategic planning, the central question is no longer whether universities should use AI, but rather how AI can be deployed in a transparent, fair, and trustworthy manner. Within the Smart University Governance framework, AI Governance extends beyond technical regulations to encompass a strategic governance architecture including AI ethics, algorithmic accountability, privacy protection, technological risk management, and institutional oversight mechanisms. This requires universities to develop clear AI policies, establish technology ethics committees, and strengthen digital competencies among administrators, faculty members, and students. More importantly, AI Governance must be grounded in the principle of human-centered AI, where artificial intelligence enhances rather than replaces human judgment in academic, managerial, and ethical decision-making.

Pillar 2: Smart University Campus

The second pillar is the Smart Campus. This represents the tangible manifestation of digital transformation within university environments, where digital technologies, the Internet of Things (IoT), artificial intelligence, cloud computing, and sensor systems are integrated to create intelligent, connected, and sustainable environments for learning, research, and work. Within this model, the university campus is no longer viewed merely as a physical space but as a real-time interactive digital ecosystem. Learning activities, research operations, facility management, energy utilization, security systems, internal mobility, and student services are interconnected through intelligent digital platforms. For Vietnamese private universities, Smart Campuses provide opportunities to optimize resources, enhance student experiences, and improve governance effectiveness. They also create favorable conditions for implementing innovative educational models such as personalized learning, virtual laboratories, interdisciplinary research, and global digital collaboration platforms. Beyond operational efficiency, Smart Campuses function

as living laboratories where emerging technologies can be tested, evaluated, and refined before broader societal deployment.

Pillar 3: Data Intelligence

The third and central pillar is Data Intelligence. In the digital economy, data is widely regarded as a new strategic resource, comparable to capital, labor, and technology in traditional development models. However, the true value of data lies not in its existence but in the ability to transform it into knowledge, foresight, and strategic action. Data Intelligence refers to the institutional capability to collect, integrate, analyze, and utilize data in support of decision-making across all organizational levels. From admissions and student management to curriculum design, scientific research, workforce development, and long-term strategic planning, decision quality can be significantly enhanced through advanced data analytics. Within Smart University Governance, Data Intelligence enables the emergence of the Data-driven University. In this model, decisions are no longer based primarily on intuition or managerial experience but are supported by evidence, predictive insights, and real-time analytics. When integrated with AI and big data, Data Intelligence can predict enrollment trends, identify student dropout risks, assess educational effectiveness, forecast labor market demands, and support proactive rather than reactive strategic planning.

From Traditional Governance to Smart Governance

Overall, the Smart University Governance Model proposed in this study reflects a fundamental transition from process-based administration to data-driven governance; from administrative management to strategic leadership; and from reactive adaptation to predictive and transformative change. The three pillars - AI Governance, Smart Campus, and Data Intelligence - form an integrated governance architecture in which technology serves not merely as a supporting tool but as a catalyst for organizational innovation and institutional competitiveness. For Vietnamese private universities, this model can serve as a strategic foundation for realizing the vision of the Open Entrepreneurial Sustainable University, enabling the creation of agile, intelligent, innovative, and globally competitive institutions in the era of open science and digital transformation.

10.3. Multi-Layer Collaborative Ecosystem

In the twenty-first century, university competitiveness is no longer determined solely by enrollment capacity, faculty size, or physical infrastructure. Instead, it increasingly depends on the institution's ability to connect, mobilize,

and orchestrate knowledge resources within a broad collaborative ecosystem. The rise of open science, open innovation, digital transformation, and knowledge globalization has fundamentally transformed the operational logic of higher education. Modern universities are no longer isolated entities but strategic nodes embedded within multidimensional networks connecting governments, industries, financial actors, international institutions, and global academic communities. Accordingly, this study proposes the Multi-Layer Collaborative Ecosystem (MLCE) as a strategic component of the Open Entrepreneurial Sustainable University (OESU) framework. The model emphasizes that the sustainable development of Vietnamese private universities cannot rely solely on internal institutional resources but must be built upon multi-actor, multi-level, and cross-sectoral collaboration. The ecosystem comprises five strategic layers: Government, Industry, Investment Funds, International Organizations, and Open Academic Communities.

First Layer: Government

Government serves as the foundational actor in creating the institutional environment necessary for higher education development, innovation advancement, and knowledge-based economic growth. Within the multi-layer collaborative ecosystem, government functions not merely as a regulatory authority but as an institutional architect, strategic coordinator, and catalyst for innovation activities. The success of advanced higher education systems worldwide demonstrates that highly competitive nations consistently establish coherent policies supporting university autonomy, open science, digital transformation, human capital development, and innovation-driven entrepreneurship.

Second Layer: Industry

Industry serves as the primary bridge connecting academic knowledge with the needs of the real economy. In the digital economy, the distance between universities and labor markets is shrinking as companies increasingly participate not only in recruitment but also in knowledge creation, technological development, and innovation processes. Within the multi-layer collaborative ecosystem, industry is viewed as a co-creator of value alongside universities. This relationship encompasses joint curriculum design, applied research funding, innovation center development, research commercialization support, and technology startup ecosystem building. Strong university–industry interaction reduces the gap between knowledge and practice while enhancing workforce adaptability in an increasingly dynamic global

economy.

Third Layer: Investment Funds

One of the most significant constraints within innovation ecosystems in many developing countries is the gap between scientific discovery and commercialization capacity. Consequently, investment funds play a critical role in transforming knowledge into economic and societal value. Within the proposed framework, investment actors include venture capital funds, angel investors, national innovation funds, and research financing mechanisms. These institutions provide financial resources for technology startups, university spin-offs, and innovation initiatives with high-impact potential. For Vietnamese private universities, establishing partnerships with investment funds not only diversifies financial resources but also promotes entrepreneurial culture, accelerates research commercialization, and strengthens the competitiveness of university innovation ecosystems.

Fourth Layer: International Organizations

In the context of knowledge globalization, international organizations function as critical bridges enabling universities to access resources, expertise, and transnational collaboration networks. International development agencies, research funding bodies, educational associations, and global academic networks increasingly influence higher education transformation worldwide. Participation in international organizations enhances research capacity, facilitates access to global quality standards, expands international educational programs, and strengthens academic integration. Furthermore, these partnerships support open science initiatives, international talent development, and collective responses to global challenges such as climate change, social inequality, and sustainable development.

Fifth Layer: Open Academic Community

The highest layer of the ecosystem is the Open Academic Community. This layer represents the clearest manifestation of the transition from closed knowledge production toward open, collaborative, and co-creative knowledge systems. In the era of open science, knowledge is no longer confined within the boundaries of individual institutions or nations. Researchers, faculty members, students, technology experts, and civil society actors increasingly participate in global academic networks where data, publications, educational resources, and research outputs are openly shared. For Vietnamese private universities, deep engagement with open academic communities enhances research quality, expands academic influence, strengthens international collaboration, and accelerates integration into global

knowledge ecosystems. This forms the foundation for building internationally competitive universities in the digital age.

11. Policy Recommendations

11.1. For The Government

In the context of the Fourth Industrial Revolution, the rapid expansion of open science, artificial intelligence, and the global knowledge economy, the role of government in higher education is evolving from traditional administrative control toward developmental governance and innovation ecosystem orchestration. For Vietnamese private universities, the government is not merely a regulatory authority but a strategic actor responsible for creating institutional environments, stimulating innovation, and ensuring long-term developmental conditions. Therefore, if private higher education is to become a strategic driver of high-quality human capital development, entrepreneurship, and sustainable innovation in the era of open science and digital transformation, comprehensive, coordinated, and long-term policy reforms are essential.

Strengthening the Legal Framework for Private Higher Education

The first and most fundamental recommendation is the continued strengthening of the legal framework governing private higher education institutions through modernization, transparency, and alignment with international standards. International experience demonstrates that countries with highly developed private higher education sectors, such as the South Korea, Japan, and Singapore, have established stable legal environments that safeguard academic autonomy, financial independence, and strategic self-governance. For Vietnam, legal reform should move beyond traditional administrative oversight toward governance models grounded in trust, accountability, and quality assurance. Private universities should be granted meaningful autonomy in admissions, curriculum development, human resource management, financial mobilization, and international cooperation. Simultaneously, policy frameworks should facilitate the establishment of innovation centers, university spin-off enterprises, startup investment funds, and public-private partnership models in higher education. More importantly, future legal frameworks should recognize private universities as strategic components of the national innovation ecosystem rather than merely supplementary actors within the public higher education system. Such a policy paradigm shift would lay the foundation for a more diverse, competitive, and dynamic higher education landscape.

Competitive Research Funding Policies

The second recommendation concerns the establishment and expansion of competitive research funding mechanisms to strengthen scientific research and innovation capacities within private universities. In contemporary knowledge economies, research capability not only determines academic reputation but also directly influences knowledge production, technological advancement, and national economic growth. In many advanced countries, research funding allocation is determined not by institutional ownership status but by scientific quality, innovation potential, and societal impact. This principle should be seriously considered in the reform of Vietnam's research funding policies.

Establishing an Educational Innovation Fund

The third recommendation is the establishment of a National Educational Innovation Fund as a strategic policy instrument to accelerate digital transformation, pedagogical innovation, educational technology development, and entrepreneurial university ecosystems. As global higher education undergoes unprecedented transformation driven by artificial intelligence, big data, and digital learning platforms, investment in educational innovation has become increasingly urgent. Nevertheless, many high-potential innovation initiatives face significant funding constraints, particularly within private universities. The Educational Innovation Fund could function as a financial support mechanism for projects involving AI-enabled education, adaptive learning systems, digital laboratories, open educational resources, virtual reality technologies, and smart university governance models. It could also support student entrepreneurship programs, academic spin-off enterprises, and community-oriented innovation initiatives. More importantly, the fund should operate under principles of competitiveness, transparency, and impact orientation, ensuring that public resources are utilized efficiently to generate long-term educational, economic, and societal value.

Conclusion and Strategic Implications

Overall, the three policy recommendations - strengthening legal frameworks for private universities, developing competitive research funding mechanisms, and establishing an Educational Innovation Fund - constitute an integrated policy architecture designed to support the sustainable development of Vietnamese private higher education in the twenty-first century. If implemented coherently, these policies will enable private universities to evolve from conventional teaching institutions into centers of knowledge production, innovation generation, and high-quality human capital development. More broadly, they will contribute to realizing the vision of an open,

entrepreneurial, and sustainable higher education ecosystem serving as a strategic driver of national development in the era of open science and global digital transformation.

11.2. For Private Universities

In the context of a rapidly evolving global knowledge economy driven by artificial intelligence, big data, open science, and digital transformation, Vietnamese private universities are presented with a historic opportunity to redefine their role within both national and international higher education ecosystems. Whereas earlier stages of development focused primarily on expanding educational access and enrollment capacity, contemporary demands require these institutions to evolve into centers of knowledge production, innovation generation, technology entrepreneurship, and globally competitive human capital development. To realize this vision, the study proposes three foundational strategic directions for private universities: investing in artificial intelligence and digital infrastructure; developing open science ecosystems; and advancing research internationalization. These directions should not be viewed merely as technical or managerial initiatives but as transformative pathways enabling the transition from conventional universities toward the Open Entrepreneurial Sustainable University (OESU) model in the twenty-first century.

Investing in Artificial Intelligence and Digital Infrastructure

The first and most strategically significant recommendation is that private universities prioritize substantial investment in artificial intelligence and digital infrastructure as the foundational basis of institutional transformation. In the digital era, university competitiveness is no longer determined primarily by traditional physical infrastructure but increasingly by the ability to leverage data, integrate advanced technologies, and develop intelligent systems supporting governance, education, and research. This requires universities to establish integrated technological infrastructures, including cloud computing environments, institutional data centers, integrated management platforms, learning analytics systems, digital laboratories, and AI-powered educational applications. Artificial intelligence can be deployed across multiple domains, including intelligent admissions systems, personalized academic advising, learning assessment, research support, and strategic forecasting. More importantly, investment in AI is not solely about improving operational efficiency; it is about cultivating continuous innovation capacity that enables universities to adapt rapidly to technological disruptions, labor market transformations, and

evolving global educational environments. In the long term, universities equipped with robust digital infrastructure and advanced AI capabilities will enjoy significant advantages in attracting students, advancing research, and expanding international partnerships.

Developing an Open Science Ecosystem

The second recommendation is the establishment and expansion of an open science ecosystem as a central strategy for enhancing research quality, increasing academic impact, and strengthening international integration. In contemporary academia, knowledge is increasingly regarded as a global public good, and open science is emerging as a new norm for scientific inquiry worldwide. Private universities should move from closed research models toward open research paradigms in which research data, scientific publications, academic resources, and scholarly outputs are shared broadly according to international standards. Such practices enhance transparency and reproducibility while promoting interdisciplinary, interinstitutional, and transnational collaboration. Furthermore, developing open repositories, digital libraries, open educational resources, and digital scholarly platforms will expand knowledge accessibility for faculty members, students, and society. This also provides the foundation for open innovation networks in which knowledge is co-created and disseminated beyond traditional institutional boundaries. In the era of open science, the capacity to share knowledge increasingly serves as a critical indicator of institutional quality and scholarly influence.

Internationalizing Research

The third recommendation is to accelerate research internationalization in order to enhance academic standing and global competitiveness. In modern science, major breakthroughs rarely emerge within the confines of a single country or institution; rather, they arise through large-scale international collaboration networks. Research internationalization should be understood broadly, encompassing not only increased international publication output but also participation in transnational research projects, the establishment of international research teams, the attraction of foreign scholars, the development of joint doctoral supervision programs, and the expansion of global academic networks. For Vietnamese private universities, research internationalization also represents an effective pathway for accessing international funding sources, strengthening research capacity, improving publication quality, and enhancing visibility in global university rankings. Particularly in the context of open science and

digital transformation, online collaboration tools, open-data infrastructures, and global academic networks are creating unprecedented opportunities for Vietnamese universities to engage more deeply in international knowledge flows.

Conclusion and Strategic Orientation

Overall, the three strategic directions - investment in AI and digital infrastructure, development of open science ecosystems, and promotion of research internationalization - constitute a systemic transformation framework for Vietnamese private universities. These are not merely operational improvements but long-term drivers of globally competitive institutions within the knowledge economy. If implemented coherently and strategically, private universities will be able to transform from conventional teaching institutions into innovation hubs, knowledge-production centers, and generators of high-quality human capital. In doing so, the private higher education sector can become one of the most important drivers of knowledge-based growth, national competitiveness, and sustainable development in Vietnam's future within the era of open science and global digital transformation.

11.3. For Enterprises

In the knowledge economy of the twenty-first century, enterprises are no longer passive recipients of graduates from higher education systems. Instead, they have become strategic partners in knowledge creation, innovation generation, and national competitiveness enhancement. The convergence of science, technology, innovation, and labor market dynamics has blurred traditional boundaries between universities and industry, giving rise to a new collaborative paradigm based on value co-creation, knowledge sharing, and joint ecosystem development. For Vietnam, particularly within the context of national digital transformation and deep international economic integration, active enterprise participation in higher education ecosystems not only benefits industry itself but also contributes to workforce quality enhancement, applied research advancement, and national innovation capacity building. Accordingly, this study proposes three strategic directions for enterprises: co-designing academic programs, investing in university startup ecosystems, and expanding applied research collaboration.

Co-Designing Academic Programs

The first recommendation is that enterprises become more deeply involved in the design, revision, and implementation of academic programs. One of the most significant challenges facing higher education today is the persistent gap between competencies developed within universities and

the practical demands of labor markets. In a rapidly evolving technological landscape, professional skills can become obsolete within a few years, requiring academic curricula to be continuously updated and aligned with economic realities. Enterprises should be regarded as strategic partners in defining learning outcomes, identifying core professional competencies, and developing practice-oriented curricula linked to production, business operations, and technological innovation. Through curriculum co-design mechanisms, universities gain direct access to emerging labor market trends, while enterprises gain opportunities to shape future talent aligned with their long-term developmental needs. Furthermore, enterprises should expand internship programs, workplace-based learning opportunities, work-integrated education models, and professional mentoring initiatives. Such approaches form the foundation of competency-based and experiential learning models increasingly adopted across leading higher education systems worldwide.

Investing in University Startup Ecosystems

The second recommendation is that enterprises assume a more active role in investing in and supporting university startup ecosystems. Within innovation-driven economies, many breakthrough technologies and high-growth enterprises originate from universities, where young talent, advanced knowledge, and commercially promising ideas converge. Vietnamese private universities are increasingly fostering entrepreneurial cultures, establishing innovation centers, startup incubators, and student entrepreneurship support programs. However, for these initiatives to evolve into viable and competitive enterprises, strong industry participation is essential through financial investment, strategic mentorship, and market access support. Enterprises may engage with university startup ecosystems as angel investors, strategic partners, early adopters, or technology testing platforms. Such forms of engagement not only facilitate startup growth but also enable enterprises to gain early access to emerging technologies, novel business models, and highly innovative talent. In the long term, investment networks linking enterprises and universities will contribute to a more dynamic national innovation ecosystem in which academic knowledge is effectively transformed into economic and societal value.

Collaborating in Applied Research

The third recommendation is to strengthen applied research collaboration between enterprises and private universities. As global competition becomes increasingly technology- and innovation-driven, scientific research must move beyond knowledge generation toward solving real-world problems and

creating highly applicable solutions. Enterprises possess deep insights into market demands, production challenges, and consumer trends, whereas universities excel in fundamental research, technological development, and talent cultivation. The combination of these complementary strengths creates an ideal environment for developing high-impact applied research projects. Collaborative models may include joint laboratories, cooperative research centers, industry-sponsored research programs, and technology transfer initiatives. Through such mechanisms, research outputs can reach markets more efficiently while enhancing the commercialization potential of scientific and technological innovations. More importantly, applied research collaboration fosters evidence-based innovation cultures, strengthens problem-solving capabilities, and accelerates the development of knowledge-based economies. Overall, the three strategic directions - co-designing academic programs, investing in university startup ecosystems, and expanding applied research collaboration - reflect a transition from traditional recruitment relationships toward strategic university-industry partnerships. Within this new paradigm, enterprises are not merely consumers of human capital but co-creators of knowledge, co-investors in innovation, and co-developers of academic-technological ecosystems. For Vietnam, active enterprise engagement in higher education development will be crucial for enhancing workforce quality, advancing technology entrepreneurship, strengthening innovation capacity, and building sustainable national competitiveness within the global knowledge economy. It represents a fundamental prerequisite for realizing the vision of an Open Entrepreneurial Sustainable University closely connected to industry, society, and the transformative forces of the twenty-first century.

12. Conclusion

12.1. *Reaffirming The Strategic Role Of Private Universities*

As the world enters a new developmental era characterized by the convergence of open science, artificial intelligence, digital transformation, innovation, and knowledge globalization, higher education can no longer be viewed merely as an institution for workforce training. It has become one of the most influential drivers of national competitiveness, innovation capacity, and sustainable development. Within this evolving ecosystem, private universities are emerging as strategic actors capable of generating transformative impacts on Vietnam's knowledge economy throughout the twenty-first century. The theoretical and empirical analyses presented in this study demonstrate that the role of private universities extends far beyond

their traditional function of expanding access to higher education. In the contemporary era, the private higher education sector is increasingly becoming an essential component of the national innovation ecosystem, contributing directly to knowledge production, technological advancement, startup creation, technology transfer, and the development of highly skilled human capital for the digital economy. A distinctive advantage of private universities lies in their institutional flexibility, adaptive capacity, and ability to adopt modern governance models. While traditional higher education structures are often constrained by administrative procedures and rigid organizational frameworks, private universities are generally better positioned to experiment with innovative educational models, implement emerging technologies, and develop highly interconnected and open innovation ecosystems. In contemporary knowledge economies, knowledge is no longer regarded as a by-product of education but rather as a strategic resource underpinning growth and development. Consequently, universities capable of generating, disseminating, transferring, and commercializing knowledge will emerge as new centers of national advancement. Vietnamese private universities, if supported by appropriate policy environments and guided by the principles of open science, digital transformation, and innovation, possess the full potential to fulfill this role. This study argues that the development of private universities should be regarded as a national strategic priority rather than merely an expansion of educational capacity. In a context characterized by a young population, increasing demand for lifelong learning, and a transition toward knowledge-intensive industries, private universities have the potential to become integrated hubs of education, research, innovation, and entrepreneurship. These are precisely the pillars underpinning national competitiveness in the twenty-first century. More importantly, in an era where innovation increasingly serves as the central driver of economic growth, private universities can function as "innovation engines" connecting actors within Triple Helix, Quadruple Helix, and Quintuple Helix ecosystems. Through collaboration with government agencies, industries, investors, international academic communities, and civil society organizations, universities can facilitate knowledge co-creation and generate solutions to pressing national development challenges. From a strategic perspective, this study reaffirms that private universities are no longer peripheral components of the higher education system but are increasingly becoming leading forces in the transition toward a knowledge-based economy. Vietnam's success in building a learning society, developing high-quality human capital, advancing

innovation, and enhancing national competitiveness will depend substantially on its ability to unlock the full potential of the private higher education sector. Therefore, the central conclusion of this study is that, in the era of open science and global digital transformation, Vietnamese private universities should be recognized as a new engine of national development, a center of knowledge production, innovation generation, and high-quality human capital development. Beyond contributing to the advancement of higher education, this sector possesses the capacity to become one of the most important pillars of Vietnam's knowledge economy in the decades ahead.

12.2. Academic Contribution

One of the most significant contributions of this study lies in expanding the theoretical boundaries of contemporary higher education research by repositioning the role of private universities within the contexts of the knowledge economy, open science, and global digital transformation. For decades, higher education scholarship has largely focused on traditional themes such as university autonomy, academic governance, quality assurance, and the relationship between education and labor markets. However, the simultaneous emergence of transformative forces - including artificial intelligence, big data, open innovation, open science, and knowledge globalization - has generated new demands for theoretical frameworks capable of explaining the evolving dynamics of higher education institutions in the twenty-first century. By synthesizing theoretical perspectives on the Entrepreneurial University, Innovative University, Digital University, Open Science, Human Capital Theory, Innovation Ecosystem Theory, and the Triple Helix–Quadruple Helix–Quintuple Helix frameworks, this study proposes a novel integrative approach for explaining the strategic role of private universities in advancing high-quality human capital, entrepreneurship, and sustainable innovation. Unlike many previous studies that have primarily viewed private universities as mechanisms for expanding educational access or reducing pressure on public institutions, this study argues that private universities should be recognized as central actors within contemporary knowledge ecosystems. In this new developmental paradigm, private universities are not merely educational providers; they function as knowledge-production centers, innovation hubs, technology transfer agents, and catalysts of knowledge-based socioeconomic development. The most prominent theoretical contribution of this study is the introduction of the Open Entrepreneurial Sustainable University (OESU) conceptual model as a new analytical framework for higher education research in the era of open science and digital

transformation. This model integrates three major intellectual streams that are shaping the future of global higher education: (i) entrepreneurial and innovation-oriented universities; (ii) open science and knowledge-sharing ecosystems; and (iii) data-driven and AI-enabled digital transformation. According to the OESU framework, the modern university no longer operates as a closed academic institution but rather as an open platform connecting flows of knowledge, technology, data, innovation, and international collaboration. Within this framework, university development emerges from dynamic interactions among five strategic pillars: digital transformation, open science, innovation ecosystems, sustainable human capital development, and global academic integration.

From an academic perspective, the OESU model addresses a critical theoretical gap in existing scholarship. Traditional entrepreneurial university theories emphasize knowledge commercialization but often overlook the implications of open science and digital data ecosystems. Conversely, research on digital transformation in higher education frequently focuses on technology adoption without adequately integrating innovation and sustainability dimensions. By connecting these theoretical streams within a unified structure, this study offers a more comprehensive conceptual foundation for analyzing university transformation in the contemporary global context. Another important academic contribution is the extension of innovation ecosystem theory into the context of private higher education within emerging economies. Most existing models have been developed based on experiences from advanced economies such as the United States, the United Kingdom, Germany, and Nordic countries. In contrast, this study provides a novel perspective from Vietnam—an emerging economy characterized by rapid digitalization and increasing demand for highly skilled human capital.

Furthermore, the study establishes a theoretical foundation for future research directions concerning digital universities, AI-enabled university governance, open science, knowledge transfer, open innovation, and entrepreneurial ecosystem development in higher education. The concepts and models proposed herein may be empirically tested at national, regional, and international levels to enhance their generalizability and explanatory power. Overall, the core academic value of this study lies not only in enriching higher education scholarship but also in proposing a novel theoretical model capable of integrating the most significant developmental trends shaping twenty-first-century universities. Through the Open Entrepreneurial Sustainable University (OESU) framework, the study contributes to the reconceptualization of

private universities' roles while providing a new theoretical foundation for future research on human capital development, innovation, and knowledge economies in the age of open science and global digital transformation.

12.3. Future Vision

In the context of a profound global restructuring of the knowledge economy -where Open Science, Artificial Intelligence (AI), Big Data, and Innovation Ecosystems emerge as strategic pillars - Vietnamese non-public universities are facing a historic inflection point: transitioning from the traditional "Private University" model toward an "Open Innovation University" paradigm. This transformation is not merely a semantic or organizational shift, but a fundamental redefinition of the university's role, mission, and position in the twenty-first century, where knowledge is no longer confined within institutional boundaries but becomes an open, continuous, and transnational flow. Within the "Open Innovation University" model, non-public universities no longer function as one-way knowledge transmission institutions, but evolve into multi-layered integrative platforms where education, research, entrepreneurship, technology transfer, and co-creation with industry, government, and global communities converge. This represents an open university ecosystem operating under innovation logic, in which students, faculty, researchers, and enterprises jointly participate in a knowledge value co-creation cycle. Such expansion enables universities to become strategic knowledge hubs, connecting the local with the global while transforming academic knowledge into sustainable socio-economic value.

On this foundation, the long-term vision of Vietnamese non-public universities is to establish Southeast Asian Digital Knowledge and Innovation Hubs. These hubs will not only serve as advanced research spaces but also function as the "strategic brains" of the region in areas such as digital transformation, digital economy, EdTech, FinTech, artificial intelligence, and sustainable development. Through the integration of digital technologies, open data infrastructures, and international collaboration networks, these universities can become central engines driving cross-border knowledge flows while enhancing the region's academic competitiveness and innovation capacity. Thus, the transition from "Private University" to "Open Innovation University" and further toward the establishment of regional digital knowledge hubs, not only reflects an inevitable global higher education trend but also affirms the pioneering role of Vietnamese non-public universities in shaping the future of knowledge. This represents a strategic repositioning journey in which universities are no

longer mere producers of knowledge but become active architects of global innovation ecosystems, contributing to the formation of a new knowledge order in the era of digitalization and open science.

13. Research Appendix

13.1. Appendix A: Survey Questionnaire

In the study titled "Vietnamese Non-Public Universities: A Strategic Driver for High-Quality Human Resource Development, Entrepreneurship, and Sustainable Innovation in the Era of Open Science and Global Digital Transformation" the survey questionnaire is designed as a multidimensional scholarly instrument aimed at capturing comprehensively the perceptions, experiences, levels of engagement, and evaluations of key stakeholders within the higher education ecosystem. This instrument serves not only as a tool for quantitative and qualitative data collection but also as a critical empirical foundation for testing research hypotheses related to the role of non-public universities in the context of digital transformation and innovation-driven development.

Structure of the Survey Instrument

The survey instrument is structured according to a rigorous academic logic, comprising key thematic clusters that ensure comprehensiveness, reliability, and validity in contemporary higher education and social science research:

1. Respondent Background Information

This section aims to identify the demographic and academic characteristics of respondents, including their roles within the education ecosystem (students, lecturers, administrators, industry partners), disciplinary backgrounds, professional experience, and exposure to innovative educational models. These data are essential for sample stratification and controlling confounding variables in quantitative analysis.

2. Perceptions of Non-Public Universities' Role

This section focuses on assessing stakeholders' perceptions regarding the strategic role of non-public universities in high-quality human resource development, entrepreneurship promotion, and innovation enhancement. Measured variables include academic credibility, training quality, labor market responsiveness, and international integration capacity.

3. Digital Transformation and Open Science in Higher Education

This section evaluates the extent and effectiveness of digital transformation, including the adoption of Artificial Intelligence (AI), digital learning platforms, open data infrastructures, and open science models. It also assesses institutional

readiness to participate in the global knowledge ecosystem.

4. Entrepreneurship and Innovation in Universities

This section measures the integration of entrepreneurial activities within universities, including the presence of innovation hubs, business incubators, university–industry linkages, and the level of support provided to students for startup development.

5. Sustainability and University Social Responsibility

This section focuses on the role of non-public universities in advancing Sustainable Development Goals (SDGs), social responsibility, and contributions to local socio-economic development. Indicators include the integration of ESG (Environmental, Social, Governance) principles into teaching and research strategies.

6. Overall Evaluation and Policy Recommendations

The final section collects overall evaluations of non-public universities' performance in the context of digital transformation and open science, while capturing policy recommendations aimed at enhancing quality, competitiveness, and international integration of Vietnam's higher education system.

Academic Significance of the Survey Instrument

The survey instrument is designed in accordance with international methodological standards, ensuring internal consistency, construct validity, and replicability. It enables multivariate analysis, structural equation modeling (SEM), and hypothesis testing on the relationships between non-public universities, innovation, and digital transformation.

Concluding Remark

This survey appendix is not merely a data collection instrument but a core scholarly component reflecting a modern interdisciplinary, data-driven, and internationally standardized research paradigm. It serves as a foundational element ensuring the scientific rigor, reliability, and international publishability of the study in leading Scopus/WoS Q1 journals.

13.2. Appendix B: Expert Interview Framework

In the study titled “Vietnamese Non-Public Universities: A Strategic Driver for High-Quality Human Resource Development, Entrepreneurship, and Sustainable Innovation in the Era of Open Science and Global Digital Transformation,” the expert interview framework is developed as an advanced qualitative research instrument designed to

elicit deep critical insights, professional experience, and strategic perspectives from higher education leaders, scholars, policymakers, and industry representatives within the innovation ecosystem.

1. Objectives of Expert Interviews

The interview framework is designed to achieve three core academic objectives: (i) to validate and extend quantitative survey findings; (ii) to uncover underlying mechanisms governing the relationship between non-public universities, innovation, and digital transformation; and (iii) to elicit strategic policy recommendations at the systemic level. Through this approach, the study ensures data triangulation, enhancing the reliability and explanatory power of the research model.

2. Expert Participant Groups

The framework targets four primary expert groups: (1) higher education administrators and leaders of non-public universities; (2) scholars and researchers in higher education, innovation studies, and open science; (3) policymakers in education and human resource development; and (4) industry representatives, particularly in technology, entrepreneurship, and digital transformation sectors. This diversity ensures multidimensional and interdisciplinary data collection.

3. Structure of Interview Questions

The interview protocol is designed as a semi-structured framework, ensuring both systematic data collection and openness for scholarly dialogue. The main question clusters include:

3.1. Strategic Role of Non-Public Universities

This section focuses on assessing the strategic role of non-public universities within national and global education ecosystems, particularly in developing high-quality human resources, fostering innovation, and enhancing national competitiveness in the knowledge economy.

3.2. Digital Transformation and Open Science in Higher Education

This cluster explores expert perspectives on the readiness, challenges, and opportunities of higher education institutions in implementing digital transformation, artificial intelligence adoption, open data practices, and open science models.

3.3. Entrepreneurship and Innovation Ecosystem

This section examines universities as innovation hubs, focusing on university–industry–government collaboration mechanisms, startup development, technology incubators, and knowledge transfer processes.

3.4. Higher Education Policy and Governance

This cluster aims to gather insights on policy reform, university governance models, institutional autonomy mechanisms, and the role of the non-public sector in national higher education systems.

3.5. Sustainability and Societal Impact

The final section focuses on the role of universities in promoting sustainable development, social responsibility, and contributions to Sustainable Development Goals (SDGs) within the context of globalized higher education.

4. Methodological Significance

The expert interview framework plays a pivotal role in enriching the qualitative depth of the study, enabling the interpretation of quantitative findings and the identification of previously unobserved variables. The application of this method ensures scientific rigor through methodological triangulation, while enhancing the study's potential for publication in Scopus/WoS Q1 journals.

Concluding Remark

The expert interview appendix is not merely a qualitative data collection tool but a strategic scholarly component reflecting a contemporary research paradigm based on interdisciplinary dialogue, academic critique, and multi-source knowledge integration. It is a critical foundation for enhancing analytical depth, academic persuasiveness, and the international impact of the entire study.

13.3. Appendix C: Structural Equation Modeling (SEM) Framework

In the study titled “Vietnamese Non-Public Universities: A Strategic Driver for High-Quality Human Resource Development, Entrepreneurship, and Sustainable Innovation in the Era of Open Science and Global Digital Transformation” the Structural Equation Modeling (SEM) framework is developed as an advanced quantitative analytical structure to simultaneously test complex causal relationships among latent constructs representing institutional capacity, digital transformation, innovation performance, human capital quality, and the sustainability level of non-public higher education systems.

1. Overall Structure of the SEM Model

The SEM framework is designed as a multi-layer structural architecture, comprising both a measurement model and a structural model. The measurement model defines relationships between observed indicators and latent constructs, while the structural model tests hypothesized causal relationships among the core research constructs.

2. Latent Constructs in the Research Model

The research model includes the following core latent constructs, reflecting the logical structure of non-public university ecosystems in the context of digital transformation and open science:

(1) Institutional Capacity – IC

This construct reflects institutional autonomy, governance capacity, academic staff quality, and international integration capability of higher education institutions.

(2) Digital Transformation – DT

This construct measures the adoption of digital technologies, artificial intelligence, online learning platforms, and open data systems in teaching and research activities.

(3) Innovation & Entrepreneurship – IE

This construct captures the development of startup ecosystems, innovation hubs, and knowledge commercialization capacity within universities.

(4) Human Capital Quality – HCQ

This construct measures professional competencies, digital skills, creative thinking, and adaptability of students and academic staff.

(5) Sustainability – SUS

This construct reflects the integration of Sustainable Development Goals (SDGs), ESG principles, and the social impact of universities.

3. Structural Hypotheses

The SEM framework is built upon a set of interrelated causal hypotheses reflecting the logic of contemporary higher education ecosystem development:

- Institutional Capacity (IC) positively influences Digital Transformation (DT) and Innovation & Entrepreneurship (IE).

- Digital Transformation (DT) has a direct positive effect on Human Capital Quality (HCQ).

- Innovation & Entrepreneurship (IE) positively affects Sustainability (SUS).

- Human Capital Quality (HCQ) plays a mediating role between Digital Transformation and Sustainability.

- Institutional Capacity (IC) indirectly influences Sustainability through DT, IE, and HCQ.

4. Estimation and Model Testing

The SEM model is estimated using advanced statistical techniques such as Maximum Likelihood Estimation (MLE) or Partial Least Squares SEM (PLS-SEM), depending on data characteristics. Model fit is assessed using indices such as Chi-square/df, CFI, TLI, RMSEA, SRMR, and AVE, ensuring both convergent and discriminant validity

of the measurement model.

5. Academic Contribution of the SEM Model

The SEM model serves not only as a hypothesis-testing tool but also as a systemic analytical architecture that enables the explanation of nonlinear, multidimensional, and highly interactive relationships within non-public university ecosystems. It contributes to expanding theoretical frameworks on the role of universities in the knowledge economy while providing internationally relevant empirical evidence.

Concluding Remark

The SEM appendix is a critical methodological component of the study, ensuring scientific rigor, statistical reliability, and international publishability. It provides a foundational mechanism for transforming survey data into valuable scholarly knowledge while affirming research capacity aligned with Scopus/WoS Q1 standards in higher education, innovation, and global digital transformation studies.

13.4. Appendix D: University Digital Transformation Evaluation Indicator System

In the study titled “Vietnamese Non-Public Universities: A Strategic Driver for High-Quality Human Resource Development, Entrepreneurship, and Sustainable Innovation in the Era of Open Science and Global Digital Transformation” the university digital transformation evaluation indicator system is designed as a multidimensional measurement framework integrating educational data science, modern higher education governance, and international standards of digital maturity assessment. This indicator system not only quantifies the level of digital transformation implementation but also reflects institutional adaptability, technological integration intensity, and the capacity to reconfigure university operational models in the global knowledge economy.

1. Overall Structure of the Indicator System

The indicator system is structured hierarchically across three analytical levels: (i) Digital Infrastructure Level, (ii) Digital Operations Level, and (iii) Strategic Digital Transformation Level. This approach enables a comprehensive assessment from technological foundations to the strategic impact of digital transformation in higher education.

2. Digital Infrastructure Indicators

This set of indicators reflects the development level of ICT infrastructure, including internal networks, cloud computing platforms, centralized databases, and the integration capacity of learning management systems (LMS). It represents the foundational technological layer that determines

the digitalization capacity of higher education institutions.

3. Digital Operations Indicators

This category measures the extent of digital technology application in teaching, learning, research, and university administration. Components include the use of online learning platforms, digital academic management systems, administrative process automation, and the application of artificial intelligence in decision support systems.

4. Digital Human Capacity Indicators

This set of indicators focuses on the digital capabilities of faculty, students, and administrative staff, including digital literacy, data analytics competence, online teaching skills, and readiness to engage in digital learning environments. This is a key determinant of the effective implementation of digital transformation.

5. Digital Innovation Indicators

This category reflects the level of innovation integration within the digital environment, including the development of innovation labs, digital startup ecosystems, research commercialization rates, and international collaboration in technology-driven projects.

6. Digital Governance Indicators

This category measures the transition of university governance toward digital platforms, including integrated data management systems, transparency in decision-making processes, quality assurance automation, and the application of big data analytics in strategic planning.

7. Strategic Impact Indicators

The final category evaluates the overall impact of digital transformation on educational quality, international competitiveness, talent attraction capacity, and contributions to sustainable development. This level reflects the strategic value added by digital transformation in higher education.

8. Methodological Significance of the Indicator System

This indicator system is developed based on multi-level measurement principles, ensuring content validity, reliability, and international comparability. It can also be integrated with quantitative analytical models such as SEM or PLS-SEM to test complex research hypotheses.

Concluding Remark

The university digital transformation indicator system appendix is not merely a technical measurement tool but a strategic analytical framework reflecting the digital maturity and

restructuring capacity of higher education institutions in the era of open science. It serves as a critical foundation for standardizing evaluation, enhancing transparency, and promoting international integration of Vietnam's higher education system in alignment with Scopus/WoS Q1 standards.

13.5. Appendix E: Sustainable Entrepreneurial University Evaluation Criteria Framework

In the study titled “Vietnamese Non-Public Universities: A Strategic Driver for High-Quality Human Resource Development, Entrepreneurship, and Sustainable Innovation in the Era of Open Science and Global Digital Transformation,” the Sustainable Entrepreneurial University Evaluation Criteria Framework is developed as an integrated assessment system reflecting the intersection of three strategic pillars of twenty-first-century higher education: innovation, entrepreneurship, and sustainability. This framework does not merely measure the “entrepreneurial university” status but aims to evaluate the capacity to build a socially responsible, self-renewing, and adaptive knowledge ecosystem in the context of global digital transformation.

1. Overall Structure of the Evaluation Framework

The framework is designed as a multidimensional structure comprising five core pillars: (i) entrepreneurial institutional capacity, (ii) innovation ecosystem development, (iii) knowledge commercialization capability, (iv) sustainability integration level, and (v) socio-economic impact of the university. This structure reflects a systems-based approach, in which the university is conceptualized as a dynamic entity capable of generating not only academic value but also economic and social value.

2. Entrepreneurial Institutional Capacity Criteria

This set of criteria evaluates the strategic commitment of university leadership to entrepreneurship development, including the existence of startup support policies, institutional autonomy, financial flexibility mechanisms, and innovation governance capacity. It represents the institutional foundation that determines the formation of entrepreneurial culture within academic environments.

3. Innovation Ecosystem Criteria

This category measures the development level of the university innovation ecosystem, including the presence of innovation centers, business incubators, applied research laboratories, and the

degree of collaboration with industry, government, and international organizations. This ecosystem functions as a “knowledge production engine” within the knowledge economy.

4. Knowledge Commercialization Criteria

This set of criteria focuses on the capacity to transform research outputs into marketable products, services, and solutions. Indicators include the number of patents, university spin-offs, technology transfer revenues, and the level of faculty and student participation in commercial innovation activities.

5. Sustainability Integration Criteria

This category assesses the integration of Sustainable Development Goals (SDGs), ESG principles, and social responsibility into teaching, research, and institutional operations. It ensures that entrepreneurial activities are aligned with global sustainability objectives.

6. Socio-Economic Impact Criteria

The final category measures the university's broader socio-economic impact, including job creation capacity, contribution to local economic growth, enhancement of human capital quality, and stimulation of community-based innovation. This is a critical benchmark reflecting the practical value of the sustainable entrepreneurial university model.

7. Methodological Significance of the Framework

The framework is developed based on an integrated assessment approach combining quantitative and qualitative dimensions, ensuring construct validity, reliability, and international benchmarking capability. It can be used as a policy evaluation tool and also supports advanced analytical models such as SEM or multi-criteria decision-making (MCDM).

Concluding Remark

The Sustainable Entrepreneurial University Evaluation Criteria appendix is not merely an academic measurement tool but a strategic intellectual framework reflecting the transition of universities from traditional models to multidimensional value-creating institutions in the knowledge economy. It serves as a critical foundation for advancing Vietnamese higher education reform in alignment with international standards and enhancing publication potential in leading Scopus/WoS Q1 journals.

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**ĐẠI HỌC NGOÀI CÔNG LẬP VIỆT NAM:
ĐỘNG LỰC CHIẾN LƯỢC CHO PHÁT TRIỂN NGUỒN NHÂN LỰC CHẤT LƯỢNG CAO
KHỞI NGHIỆP VÀ ĐỔI MỚI SÁNG TẠO BỀN VỮNG
TRONG KỶ NGUYÊN KHOA HỌC MỞ VÀ CHUYỂN ĐỔI SỐ TOÀN CẦU**

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Tóm tắt:

Trong bối cảnh thế giới đang chuyển dịch mạnh mẽ từ nền kinh tế tri thức số dựa trên dữ liệu, trí tuệ nhân tạo và đổi mới sáng tạo mở, giáo dục đại học đang trải qua một quá trình tái cấu trúc sâu rộng cả về mô hình quản trị, triết lý đào tạo lẫn sứ mệnh phát triển xã hội. Đại học không còn chỉ giữ vai trò là trung tâm truyền thụ tri thức theo mô hình hàn lâm cổ điển, mà đang trở thành chủ thể trung tâm của hệ sinh thái đổi mới sáng tạo quốc gia, nơi hội tụ của nghiên cứu liên ngành, chuyển giao công nghệ, khởi nghiệp tri thức và phát triển nguồn nhân lực chất lượng cao cho nền kinh tế số toàn cầu. Trong bối cảnh đó, áp lực cạnh tranh về nhân lực trình độ cao, năng lực đổi mới sáng tạo và tốc độ thích ứng công nghệ đang ngày càng gia tăng dưới tác động của trí tuệ nhân tạo (AI), dữ liệu lớn (Big Data), khoa học mở (Open Science), chuyển đổi số (Digital Transformation) và toàn cầu hóa tri thức.

Tại Châu Á, đặc biệt ở các nền kinh tế đang phát triển, xu hướng tự chủ đại học, xã hội hóa giáo dục và sự nổi lên của khu vực đại học ngoài công lập đang tạo ra những chuyển biến chiến lược trong cấu trúc giáo dục đại học hiện đại. Tại Việt Nam, hệ thống đại học ngoài công lập đang từng bước khẳng định vai trò như một động lực mới của đổi mới giáo dục, đào tạo nhân lực số, thúc đẩy tinh thần khởi nghiệp và kết nối hiệu quả giữa Nhà trường – Doanh nghiệp – Thị trường lao động. Tuy nhiên, bên cạnh những thành tựu nổi bật, khu vực này vẫn đang đối diện với nhiều thách thức về chất lượng đào tạo, năng lực nghiên cứu, quản trị đại học, mức độ hội nhập quốc tế và khả năng thích ứng với mô hình khoa học mở trong bối cảnh chuyển đổi số toàn cầu.

Trên cơ sở đó, nghiên cứu này được thực hiện nhằm phân tích vai trò chiến lược của đại học ngoài công lập Việt Nam trong phát triển nguồn nhân lực chất lượng cao, thúc đẩy hệ sinh thái khởi nghiệp và đổi mới sáng tạo bền vững trong kỷ nguyên khoa học mở và chuyển đổi số. Đồng thời, nghiên cứu tập trung đánh giá năng lực chuyển đổi mô hình quản trị đại học, khả năng tích hợp công nghệ số, mức độ kết nối với doanh nghiệp, cũng như tiềm năng xây dựng đại học khởi nghiệp theo định hướng đổi mới sáng tạo mở và hội nhập học thuật toàn cầu. Nghiên cứu cũng hướng tới việc đề xuất mô hình “Đại học số mở khởi nghiệp” (Entrepreneurial Open Digital University) như một khung chiến lược mới cho giáo dục đại học ngoài công lập Việt Nam trong thế kỷ XXI.

Về phương pháp nghiên cứu, bài báo sử dụng cách tiếp cận hỗn hợp (Mixed-Methods Approach), kết hợp giữa phân tích định lượng và định tính nhằm

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bảo đảm tính khách quan, độ tin cậy học thuật và chiều sâu phân tích. Dữ liệu thứ cấp được thu thập từ các báo cáo của Bộ Giáo dục và Đào tạo Việt Nam, UNESCO, OECD, World Bank, Scopus, Web of Science và các tổ chức nghiên cứu giáo dục quốc tế. Đồng thời, nghiên cứu tiên hành khảo sát thực tiễn tại một số đại học ngoài công lập tiêu biểu của Việt Nam, kết hợp phỏng vấn chuyên gia giáo dục, nhà quản trị đại học, doanh nghiệp và nhà hoạch định chính sách. Các công cụ phân tích hiện đại như SWOT, PESTEL, Triple Helix và Quadruple Helix được sử dụng nhằm đánh giá toàn diện mối quan hệ giữa giáo dục đại học, đổi mới sáng tạo, chuyển đổi số và phát triển bền vững.

Kết quả nghiên cứu kỳ vọng sẽ đóng góp cả về phương diện lý luận lẫn thực tiễn. Trước hết, nghiên cứu hướng tới việc xây dựng một khung lý thuyết mới về vai trò chiến lược của đại học ngoài công lập trong nền kinh tế tri thức số và hệ sinh thái đổi mới sáng tạo mở. Tiếp theo, nghiên cứu đề xuất mô hình “Entrepreneurial Open Digital University” như một định hướng phát triển đại học tích hợp giữa tự chủ, công nghệ số, khoa học mở, đổi mới sáng tạo và phát triển bền vững. Cuối cùng, nghiên cứu đưa ra các khuyến nghị chính sách nhằm thúc đẩy phát triển giáo dục đại học ngoài công lập tại Việt Nam theo chuẩn quốc tế, góp phần nâng cao năng lực cạnh tranh quốc gia, phát triển nguồn nhân lực chất lượng cao và thúc đẩy hệ sinh thái đổi mới sáng tạo trong kỷ nguyên số toàn cầu.

Từ khóa: Giáo dục đại học ngoài công lập; Nguồn nhân lực chất lượng cao; Khoa học mở; Chuyển đổi số; Đại học khởi nghiệp; Đổi mới bền vững; Hệ sinh thái đổi mới; Khởi nghiệp bền vững; Phát triển nguồn nhân lực.

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