

Fostering Innovation and Research Ecosystems in Vietnamese Universities in the Context of Digital Transformation

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ABSTRACT

Vietnamese higher education is undergoing a fundamental transformation in which its traditional teaching mission is increasingly complemented by the responsibilities of knowledge creation and innovation development. This study examines the current state of innovation ecosystems within higher education institutions and identifies key structural bottlenecks under the influence of emerging policy orientations, particularly Politburo Resolutions No. 57 and No. 71.

The research employs a qualitative approach based on an extensive review of international academic literature, analysis of domestic policy documents, and examination of representative innovation models implemented by major Vietnamese universities. The findings indicate that although innovation ecosystems are gradually emerging within Vietnamese universities, they remain fragmented and lack sufficient institutional depth and systemic integration. The interactions among universities, enterprises, and governmental actors have yet to evolve into a mature and self-sustaining innovation ecosystem.

Based on these findings, the study proposes an integrated analytical framework that combines the Smart University model with the Triple Helix approach. This framework is expected to strengthen research capacity, facilitate knowledge transfer, and enhance innovation performance within the context of digital transformation. The paper further provides policy recommendations aimed at improving institutional arrangements, fostering university industry collaboration, promoting digital governance, and accelerating the commercialization of research outcomes.

Keywords: innovation; research ecosystem; smart university; artificial intelligence; digital transformation; university industry collaboration.

INTRODUCTION

For decades, higher education has primarily been perceived as an institution for workforce training, where knowledge is transmitted through a linear process from instructors to learners. However, this traditional perspective has become increasingly inadequate for explaining the role of universities in economies transitioning toward knowledge-based development. In countries that have achieved significant technological advancement, universities serve not only as providers of skilled human resources but also as active contributors to knowledge production and innovation creation (Marginson, 2021). Importantly, this transformation does not occur uniformly; rather, it depends heavily on how national research and innovation ecosystems are organized and governed.

In Vietnam, the issue has become increasingly urgent as the challenge of escaping the middle-income trap grows more apparent. Competitive advantages based on low-cost labor are gradually diminishing, while endogenous innovation capabilities have not yet developed at a systemic scale. Within this context, higher education is expected to serve as the intellectual infrastructure that not only educates human resources but also generates

research capacity, creativity, and technological transfer for the broader economy. Although this expectation is not new, the mechanisms through which it can be realized remain highly debated.

Vietnam's aspiration to position its higher education system among the world's leading systems by 2045 has been established as a strategic national objective. Nevertheless, international experience suggests that the gap between ambition and implementation capacity often lies not in vision itself but in the operational structure of the system. OECD (2022) studies indicate that countries that rapidly improved their global higher education standing did so not merely through increased investment but also by restructuring the relationships among universities, industry, and government. This raises a fundamental question: Have Vietnam's ongoing reforms addressed these structural dimensions, or do they continue to operate within traditional institutional paradigms?

The emergence of foundational technologies such as artificial intelligence (AI), big data, and semiconductor technologies has further intensified the pressure for change. The demand for highly qualified human resources is no longer a long-term objective but an immediate necessity. UNESCO (2023) reports that educational systems that fail to adapt promptly to technological transformations often experience a growing mismatch between educational programs and labor market requirements. Evidence suggests that many university lecturers acknowledge that curriculum development has not kept pace with technological advancement, creating a gap that cannot easily be bridged through incremental improvements alone.

Despite these challenges, most existing studies on Vietnamese higher education focus on isolated dimensions, such as policy analysis, educational quality assessment, and digital transformation initiatives. While these approaches provide valuable insights, they are insufficient for explaining a systemic phenomenon such as an innovation ecosystem. Recent international research emphasizes the need to integrate multiple analytical dimensions including institutions, technology, and organizational behavior to better understand how universities contribute to innovation processes (World Bank, 2022). This represents the research gap that the present study seeks to address.

Specifically, this study contributes to the literature in three major ways. First, rather than viewing university innovation as a collection of isolated activities, it conceptualizes innovation as an ecosystem composed of interconnected and interdependent elements. Second, it examines prominent theoretical frameworks, particularly the Triple Helix model and the Smart University concept, within the Vietnamese context, thereby identifying both their applicability and limitations. Third, based on secondary data, the study proposes an integrated framework that connects technology, institutional arrangements, and university governance, an approach that remains relatively underexplored in previous studies.

RESEARCH METHODOLOGY

Research Approach and Design

This study adopts a qualitative research approach based on literature review, policy analysis and conceptual synthesis. This methodological choice stems from the nature of the research subject itself. Innovation ecosystems in higher education cannot be adequately measured through a limited set of indicators; rather, they constitute complex structures in which institutional arrangements, technological capabilities, and organizational behaviors are closely intertwined.

The research design is centered on a narrative literature review, complemented by qualitative meta synthesis techniques. Unlike a purely systematic review, this approach enables the researcher not only to synthesize existing findings but also to interpret theoretical developments in relation to the Vietnamese context. To minimize subjectivity, however, the literature selection process follows a transparent and rigorous procedure, drawing upon the PRISMA framework where appropriate. In this sense, PRISMA functions more as a methodological discipline than as a rigid procedural template.

The review period focuses on the years 2020 – 2025 in order to capture recent developments associated with digital transformation and emerging policy reforms. This temporal boundary reflects a deliberate methodological

choice to prioritize contemporary evidence rather than provide a comprehensive historical account of the sector's evolution.

Data Analysis and Theoretical Framework

The data analysis process is organized across multiple analytical layers to ensure an appropriate balance between interpretive depth and the reliability of conclusions.

The Triple Helix framework serves as the primary analytical lens, allowing for the examination of relationships among universities, industry, and government not only at the policy level but also in practical implementation. Rather than applying the model mechanically, however, the study contextualizes it within Vietnam's institutional environment, where the state continues to play a dominant role and market-based interactions remain relatively underdeveloped (Cai & Etzkowitz, 2020).

Qualitative data are analyzed through thematic coding. Themes are not predetermined in a rigid manner but emerge progressively throughout the analytical process. Particular attention is given to issues such as collaboration mechanisms, policy design, learning outcomes, and evaluation systems. This inductive approach enables the identification of recurring patterns as well as noteworthy exceptions.

In addition, SWOT analysis is employed as a synthesis tool to organize findings systematically, particularly when transitioning from descriptive analysis to policy discussion. Nevertheless, SWOT serves primarily as an intermediate analytical step. Final conclusions are derived through cross-validation among multiple data sources.

Finally, triangulation is applied throughout the research process. The comparison of academic literature, policy documents, and empirical evidence not only enhances the credibility of findings but also reveals important gaps where policy fails to fully reflect practice or conversely, where practice diverges from policy intentions.

THEORETICAL FOUNDATION AND ANALYTICAL FRAMEWORK

The Triple Helix Model and the Limitations of Linear Approaches

In discussions of innovation ecosystems, the Triple Helix model is often regarded as a fundamental analytical starting point. This framework positions three key actors: government, universities, and industry. within an interactive structure in which knowledge is no longer generated and disseminated through a linear process but rather through dynamic and multidirectional relationships (Etzkowitz & Zhou, 2018). In well-functioning innovation systems, the boundaries between these sectors become increasingly fluid: universities engage in entrepreneurial activities, industries invest in research and development, and governments shift from a controlling role toward one of facilitation and coordination.

However, when applied to transitional and emerging economies, the balance envisioned by the Triple Helix framework is often disrupted. Recent studies suggest that in countries such as Vietnam, the state continues to occupy a dominant position not only in policymaking but also in resource allocation (Cai & Etzkowitz, 2020). This situation gives rise to a state-led variant of the Triple Helix, in which interactions between universities and industry depend substantially on governmental direction and coordination mechanisms.

Secondary data indicate that state involvement is not necessarily an obstacle to innovation. In many cases, government intervention provides the policy impetus required to initiate systemic change. Problems arise when such intervention becomes overly prolonged, weakening the autonomous motivation and adaptive capacity of other actors. Therefore, the key challenge lies not in determining whether state intervention should exist, but rather in designing sufficiently flexible governance mechanisms that allow actors to self organize and adapt.

From this perspective, the present study does not employ the Triple Helix as a normative model but rather as an analytical tool for identifying discrepancies between theoretical assumptions and practical realities.

Smart Universities: From Technological Infrastructure to Organizational Capability

The concept of the “smart university” emerged alongside the digital transformation movement in higher education. Nevertheless, its interpretation remains far from uniform. At its most basic level, many institutions equate “smartness” with the implementation of learning management systems or the digitization of educational resources. However, recent OECD studies (2021) suggest that such interpretations capture only the superficial dimensions of the concept.

A university can be considered “smart” when technology is not merely present but is fully integrated into decision-making processes and organizational operations. This includes the capacity to collect, analyze, and utilize data to enhance educational quality, optimize governance processes, and anticipate future demands. In this context, artificial intelligence and big data analytics are not ultimate goals but instruments for restructuring the production, management, and application of knowledge.

International experience demonstrates that the greatest barrier to digital transformation in higher education is not technology itself but organizational capability. Many universities have invested heavily in digital infrastructure while maintaining traditional decision-making processes, resulting in what has been described as the “digitalization of old procedures” (World Bank, 2022). Evidence from Vietnam reflects a similar pattern: online learning platforms have been widely adopted, yet the use of data for personalized learning, predictive analytics, and strategic governance remains limited.

Consequently, when incorporating the smart university concept into the analytical framework, this study focuses not on the level of technological adoption per se, but on the extent to which technology has been internalized within the institution’s operational structure and organizational culture.

Entrepreneurial Universities and University Spin-Offs: From Ideas to Commercialization Capacity

Alongside digital transformation, the entrepreneurial university paradigm has become one of the most influential themes in higher education over the past two decades. This model emphasizes the role of universities in transforming knowledge into economic value through activities such as business incubation, technology transfer, and the creation of spin-off enterprises.

Within mature innovation ecosystems, university spin-offs often serve as effective bridges between academic research and market application. However, replicating this model in different institutional contexts is far from straightforward. UNESCO (2023) reports that many developing countries face difficulties sustaining university spin-offs, not because of a lack of innovative ideas but because of insufficient longterm support mechanisms, particularly in terms of financing and legal frameworks.

Discussions with several domestic research groups reveal a recurring concern: the distance between laboratories and markets remains substantial. The commercialization process for research outcomes is often complex, bureaucratic, and insufficiently incentivized. As a result, many innovative ideas culminate in academic publications rather than evolving into marketable products or services.

From an analytical standpoint, the entrepreneurial university model cannot be separated from the two dimensions discussed previously the interactional structure embodied by the Triple Helix and the organizational capabilities associated with the smart university. An innovation ecosystem can function effectively only when these three dimensions are interconnected rather than existing as isolated layers.

An Integrated Analytical Framework

Building upon the three approaches discussed above, this study proposes an integrated analytical framework in which:

- The Triple Helix provides the relational structure among key actors;

- The Smart University concept reflects the institution's internal capabilities;
- Entrepreneurial universities and spin-off enterprises represent the outputs of the innovation ecosystem.

The central premise of this framework lies in interaction and interdependence. A university equipped with advanced digital infrastructure but lacking meaningful industry linkages will struggle to transform knowledge into societal and economic value. Conversely, an ecosystem characterized by strong collaboration but weak technological and managerial capabilities will face difficulties sustaining innovation at scale.

Conceptualizing the Integrated Analytical Framework

The relationship among these three components is not fragmented but forms a continuous cycle through which knowledge is transformed into value.

Triple Helix (External Relational Axis). This component provides the institutional structure connecting government, universities, and industry. In Vietnam, the state plays a leading role through policy-driven interventions such as Resolution No. 57, Resolution No. 71, and the Higher Education Law which establish the institutional conditions necessary for university industry interaction.

Smart University (Internal Driving Mechanism). This dimension represents the organizational and technological foundation of the ecosystem. Its primary function is to collect, process, and utilize data to optimize governance processes and support evidence-based decision-making.

Entrepreneurial University and Spin Offs (Ecosystem Outputs). This component reflects the capacity to commercialize knowledge and research outcomes. Without the organizational capabilities associated with the Smart University model, entrepreneurial initiatives are unlikely to scale successfully. Likewise, without Triple Helix linkages, research outputs are likely to remain confined to academic publications rather than generating broader socioeconomic impacts.

Data Flows and Interaction Mechanisms

The integrated framework operates through several interconnected flows:

- From Government to Universities: Expansion of institutional autonomy and the establishment of regulatory sandboxes that create space for experimentation and innovation.
- From Industry to Universities: Commissioning research projects, co-designing educational programs, and providing real-world challenges that inform teaching and research activities.
- From Universities to the Market: Supplying highly qualified human resources particularly graduates capable of effectively utilizing and developing AI technologies and generating university spin-offs that facilitate knowledge commercialization.

Internalizing Artificial Intelligence within Organizational Structures

Rather than limiting digital transformation to the deployment of technological infrastructure and the digitization of existing procedures, the internalization of AI involves several substantive transformations:

Integrating AI into Strategic Governance. Data generated through systems such as the Higher Education Management Information System (HEMIS) and Learning Management Systems (LMS) can be utilized for predictive analytics. Instead of merely storing institutional records, AI enables university leaders to forecast labor market demands and adjust enrollment and training capacities accordingly.

Personalizing Learning Pathways. AI can be embedded directly into teaching and learning processes to analyze student behavior, automatically adapt instructional content, and support individualized assessment, moving beyond one-size-fits-all educational models.

Restructuring Educational Content. Internalizing AI involves not merely using AI tools but mastering the broader data ecosystem. Leading universities have begun replacing traditional introductory computing courses with mandatory AI related modules from the first year of study in order to cultivate digital thinking and computational literacy among students.

Developing Shared Open Data Systems. AI can only operate effectively when supported by high-quality data. Establishing interoperable open data infrastructures enables researchers and enterprises to access and utilize shared datasets, thereby reducing the gap between laboratory research and market application.

This integrated approach overcomes many of the limitations associated with isolated theoretical models and offers a more comprehensive explanation of the structural bottlenecks confronting Vietnamese higher education. More importantly, it provides a foundation for moving beyond descriptive analysis toward the formulation of systemic interventions an aspect often lacking in higher education reform initiatives.

Within this study, the integrated analytical framework is conceptualized as a recursive feedback system in which knowledge does not flow linearly but is continuously recreated through data streams, institutional interactions, and market feedback mechanisms. The Triple Helix generates institutional conditions and collaborative networks; the Smart University processes and transforms data into decision-making capacity; while entrepreneurial universities and spin-off enterprises serve as platforms for realizing the value of knowledge. Market outcomes subsequently reenter the system in the form of data, skill demands, and emerging technological challenges, thereby creating a continuous learning cycle that sustains the innovation ecosystem.

The Current State of Innovation Ecosystems in Vietnamese Universities

Repositioning the Role of Higher Education within the New Policy Framework

One of the most significant developments in Vietnam's higher education system in recent years lies not merely in the implementation of specific programs but in the state's redefinition of the role of universities. Politburo Resolutions No. 57 and No. 71, issued consecutively during the 2024 – 2025 period, represent more than strategic policy directives; they reflect a clear intention to restructure the national development model. Science, technology, and innovation have been placed at the center of the country's development strategy, with higher education institutions identified as key operational pillars.

What is particularly noteworthy is not only the substance of these policies but also their comprehensiveness. Whereas universities were previously viewed primarily as providers of human resources, they are now increasingly positioned as central actors within the national innovation ecosystem. This transformation became even more evident with the passage of the amended Higher Education Law (Law No. 125/2025/QH15), approved by the National Assembly on December 10, 2025, and effective from January 1, 2026. The revised legislation promotes university autonomy, digital transformation, educational quality enhancement, and improvements in degree and certification regulations to meet the growing demand for highly qualified human resources. Most importantly, university autonomy is formally recognized as a statutory right independent of financial self-sufficiency requirements, while each higher education institution is officially designated as a research and development organization.

However, when these reforms are examined from an international perspective, an important question emerges: Is the expansion of legal autonomy sufficient to stimulate substantive innovation in practice? Experiences from other higher education systems suggest that autonomy generates meaningful outcomes only when accompanied by strong governance capacity and appropriate accountability mechanisms (OECD, 2022). In Vietnam, however, the implementation of autonomy has proceeded unevenly across institutions, creating a distinctly stratified landscape.

At the system level, higher education continues to expand in scale, reaching 244 institutions and more than 2.34 million students by 2025, representing a 37% increase compared to 2019. While this growth reflects improved access to higher education, it simultaneously intensifies pressures related to educational quality and research capacity dimensions that cannot be enhanced through expansion alone.

Digital Transformation: From Infrastructure Expansion to Integration Challenges

Within the context of digital transformation, artificial intelligence (AI) is no longer viewed merely as a technical support tool such as learning management systems (LMS), chatbots, or administrative digitization platforms. Instead, it is increasingly emerging as an organizational cognitive infrastructure that directly influences university governance, teaching and learning processes, and innovation activities. The internalization of AI can be observed through four primary layers of integration.

First, AI is being embedded within strategic governance through predictive analytics systems that support enrollment forecasting, labor market analysis, and the optimization of research resource allocation. This enables universities to transition from reactive management models toward data-driven governance.

Second, AI is increasingly integrated into teaching and learning activities to facilitate personalized educational experiences. Technologies such as adaptive learning systems, AI-based tutoring, learning analytics, and dynamic assessment mechanisms enable institutions to monitor learning behaviors and tailor instructional content and assessment methods to individual learners.

Third, AI contributes to the restructuring of academic curricula. Integration extends beyond teaching students how to use digital technologies; it fosters data literacy, interdisciplinary competencies, and the capacity to collaborate effectively with intelligent systems.

Fourth, AI is being internalized at the innovation ecosystem level through open data platforms, shared research infrastructures, and data exchange mechanisms linking universities and industry. Within this model, AI functions as a knowledge connector, narrowing the gap between academic research and market demand.

From an external perspective, digital transformation in Vietnamese higher education has progressed rapidly. By 2024, the Higher Education Management Information System (HEMIS) had achieved nationwide coverage, integrating data from 470 educational institutions, more than 25,000 academic programs, and nearly three million student records. Compared with countries at similar stages of development, this represents a remarkably comprehensive digital infrastructure.

At the institutional level, the adoption of learning management systems has become widespread. By 2023, approximately 87% of public universities had implemented platforms such as Moodle, Canvas, or Microsoft Teams. Some institutions have advanced even further. For example, Ho Chi Minh City Open University has integrated all academic modules into its LMS environment.

Nevertheless, when the focus shifts from the question of implementation to that of impact, the picture becomes more complex. Most existing systems continue to function primarily as administrative support tools rather than as strategic decision making platforms. Although large volumes of data are collected, the capacity to utilize these data for forecasting, personalized learning, or resource optimization remains limited. This observation aligns with the World Bank's (2022) assessment that many educational systems remain at the stage of digitization rather than achieving genuine digital transformation.

The incorporation of AI into university curricula represents another promising development. Several institutions have introduced compulsory courses related to digital technologies and artificial intelligence from the first year of study, replacing traditional introductory computing subjects. AI has also begun to support learning analytics and assessment processes. Nevertheless, these applications remain largely experimental and have yet to generate system wide transformation.

Overall, digital transformation in Vietnamese higher education appears to have reached a critical juncture: the infrastructure foundation has largely been established, yet effective utilization of that infrastructure remains an ongoing challenge.

Research Activities: Quantitative Growth and Persistent Gaps

One of the most encouraging indicators within the higher education system is the substantial increase in scientific publications and patent registrations. Between 2018 and 2023, the number of granted patents grew at an average annual rate of approximately 15%, while international publications in 2023 were three times higher than in 2017. These figures suggest a significant enhancement in the research capacity of Vietnamese universities.

However, when these achievements are evaluated in terms of broader economic and societal impact, a substantial gap becomes evident. The commercialization rate of research outputs remains below 10%, while university based spin-off enterprises accounted for less than 10% of all innovative enterprises during the 2016 – 2022 period. In other words, much of the knowledge generated within universities remains confined to academic circles rather than being translated into practical applications.

The expansion of innovation centers and business incubators within universities reflects ongoing efforts to address this challenge. By 2024, more than 200 innovation spaces had been established, and approximately 65% of surveyed institutions reported having dedicated innovation units. However, as UNESCO (2023) emphasizes, the existence of such structures does not automatically translate into effectiveness, particularly in the absence of strong market linkages and sustainable financial support mechanisms.

Another noteworthy observation concerns entrepreneurship education. The proportion of universities offering entrepreneurship-related courses increased from 30% in 2020 to 48% in 2022. Yet this expansion has not been accompanied by a corresponding increase in the number of university spin-offs. This suggests that incorporating entrepreneurship into academic curricula, while necessary, is insufficient to create a fully functioning innovation ecosystem.

University Industry Collaboration: From Formal Partnerships to Meaningful Engagement

Relationships between universities and industry in Vietnam have shown encouraging progress but have yet to reach a level of deep integration. Approximately 80% of universities have incorporated innovation related content into their academic programs, while around 40% have established formal cooperation agreements with enterprises. More than 60% of surveyed institutions reported having at least one research contract with industry partners a considerable improvement compared to previous periods.

Nevertheless, the nature of these partnerships warrants closer examination. In many instances, collaboration remains limited to internships, sponsorship arrangements, or short-term projects rather than extending to the co design of curricula or joint technology development initiatives. Consequently, a paradox emerges: institutional linkages exist in form, yet their impact on educational quality and research performance remains relatively limited.

Several work-integrated learning (WIL) models have demonstrated positive outcomes, particularly in engineering and technology-related disciplines. Students participating in such programs reported higher levels of perceived usefulness compared with those enrolled in conventional programs (3.5/5 versus 3.3/5). However, the magnitude of this difference remains insufficient to generate systemic change.

Conversely, partnerships aimed at addressing real-world challenges such as collaborative projects between universities and business associations in the fields of digital transformation and green economy development have demonstrated greater potential. Graduate employment outcomes further support this observation. Students participating in programs with strong industry engagement reported average starting salaries of approximately VND 10.6 million per month, significantly higher than the broader labor market average.

These observations lead to an important conclusion: the primary challenge is not the absence of university industry linkages but rather the quality and depth of those relationships. When collaboration remains supplementary in nature, its long-term impact is limited. By contrast, when universities and enterprises share risks, resources, and benefits through sustained partnerships, the foundations of a genuine innovation ecosystem begin to emerge.

Overall, innovation ecosystems within Vietnamese universities remain in a transitional stage of development. Foundational elements including supportive policy frameworks, digital infrastructure, and growing research capacity have already emerged and, in some dimensions, have advanced rapidly. Nevertheless, insufficient integration among these components has prevented the system from reaching a mature and fully coordinated state.

If innovation is viewed as a process rather than an outcome, Vietnam has already made considerable progress. The more challenging task ahead lies in ensuring that the existing components do not merely coexist but interact synergistically and reinforce one another within a coherent and sustainable innovation ecosystem.

DISCUSSION

The findings presented above reveal a paradox that is difficult to overlook: innovation ecosystems within Vietnamese universities are no longer in their infancy, yet they have not reached a stage of self-sustaining operation. Core components including policy frameworks, infrastructure, and human resources are already present to varying degrees. The challenge lies in the fact that these elements have not been effectively integrated. When examined through the analytical framework developed in this study, four major structural bottlenecks can be identified.

Institutional Constraints: When Innovation Remains Bound by Administrative Logic

One of the most significant barriers, although rarely addressed directly in official policy documents, concerns the governance of intellectual property (IP) and technology transfer. Despite recent regulatory reforms aimed at increasing flexibility, implementation practices continue to bear the imprint of a "permission-based" administrative system. Procedures for approving, valuing, and transferring intellectual property are often lengthy, inflexible, and unpredictable. In many cases, transaction costs exceed anticipated benefits, discouraging research groups from pursuing commercialization activities.

Importantly, this issue extends beyond technical regulations and reflects a deeper governance logic characterized by caution toward decentralization and risk acceptance. In contrast, successful innovation ecosystems typically allow experimentation and tolerate a reasonable degree of failure (OECD, 2022). When the space for experimentation is constrained, innovation initiatives tend to become risk-averse, transforming innovation from a genuine process into a rhetorical objective.

The legal ambiguity surrounding university spin-off enterprises further illustrates these limitations. The absence of clear regulations governing ownership rights, benefit sharing mechanisms, and legal responsibilities hampers the sustainable development of university based ventures. As several scholars have noted, without a well defined institutional framework, university entrepreneurship initiatives often remain in a state of partial existence visible but unable to scale effectively (UNESCO, 2023).

Resource Constraints: The Challenge Extends Beyond Funding Levels

Although investment in research and development (R&D) in Vietnam has increased over time, it remains relatively modest compared to many countries in the region. This is frequently cited as a major explanation for limitations in innovation capacity. However, attributing these challenges solely to insufficient funding oversimplifies the issue.

Observations from several universities suggest that available resources are not always allocated according to principles of efficiency and strategic priority. Fragmented investment, limited strategic focus, and rigid financial mechanisms often prevent research projects from achieving the scale necessary for significant breakthroughs. By contrast, successful innovation systems typically concentrate resources on selected strategic sectors rather than dispersing them across numerous initiatives (World Bank, 2022).

A similar pattern is evident in research infrastructure. While leading institutions may have access to advanced laboratories and sophisticated digital platforms, research conditions at many other universities remain relatively basic. Such disparities not only widen institutional gaps but also constrain the development of collaborative research networks, which are essential components of effective innovation ecosystems.

Human Capital: When Individual Motivation Fails to Meet a Supportive Environment

The issue of "brain drain" is not new; however, in an era of intensified global competition for scientific and technological talent, it has become increasingly urgent. Notably, this phenomenon extends beyond the migration of highly skilled professionals abroad. It also manifests in the reluctance of many talented researchers to pursue long-term academic careers within universities.

Several talent attraction policies have been introduced, including initiatives targeting overseas Vietnamese scholars. Nevertheless, feedback from these individuals frequently highlights familiar obstacles: complex administrative procedures, unstable research environments, and particularly limited academic autonomy. Although difficult to quantify, these factors exert substantial influence on individual career decisions.

International experience demonstrates that talent attraction strategies cannot rely solely on financial incentives. Researchers seek environments that allow them to pursue long-term intellectual goals with appropriate levels of freedom and institutional support (OECD, 2021). When such conditions are absent, talent attraction policies risk becoming symbolic measures rather than effective mechanisms.

Governance: The Gap Between Autonomy and Institutional Capacity

The expansion of university autonomy represents a significant policy advancement. However, practical implementation demonstrates that autonomy does not automatically translate into institutional capability. In many institutions, autonomy remains more closely associated with financial responsibility than with academic decision-making authority or research governance.

A frequently overlooked issue concerns internal governance capacity. Transitioning from administrative management models to modern university governance requires profound changes in organizational structures and institutional culture. Not all institutions are adequately prepared for such transformation. Consequently, autonomy may, in some cases, become a burden rather than an opportunity.

Regional disparities further underscore this challenge. Universities located in major economic centers enjoy greater opportunities to experiment with innovative governance models, while institutions in peripheral regions often struggle to attract high-quality financial and human resources. Without effective coordination mechanisms, these disparities may continue to widen over time.

International Comparisons and Lessons That Cannot Be Directly Replicated

When Vietnam is compared with countries possessing more mature innovation ecosystems, differences extend beyond levels of investment to encompass the ways in which system components interact.

In South Korea, university–industry collaboration is strengthened through conditional funding programs that require cooperation between the two sectors as a prerequisite for accessing public resources (OECD, 2022). In Singapore, the state acts as a strategic coordinator without excessive interference in academic affairs, thereby creating a flexible environment for institutional development. Meanwhile, in several European countries, university spin-offs benefit from clear legal frameworks and well developed venture capital markets.

The common denominator across these models is not a specific institutional design but rather the consistency among policy objectives, institutional arrangements, and implementation practices. This consistency represents one of the greatest challenges currently facing Vietnam. While international models offer valuable insights, their successful adaptation requires careful alignment with Vietnam's institutional context and organizational culture.

Beyond South Korea and Singapore, valuable lessons can also be drawn from China and Malaysia, both of which have pursued higher education reforms under conditions that share certain similarities with Vietnam.

China has significantly strengthened the innovation capacity of its universities through sustained government investment under initiatives such as the Double First-Class University Plan. In recent years, universities have been encouraged to establish interdisciplinary innovation platforms integrating artificial intelligence, advanced manufacturing, and digital technologies. Close coordination between universities, research institutes, local governments, and high-technology enterprises has accelerated the commercialization of research outputs while simultaneously enhancing universities' global research competitiveness. An important characteristic of the Chinese model is that strong governmental leadership is combined with increasing institutional autonomy in research management and international collaboration.

Malaysia, meanwhile, has adopted a different strategy by emphasizing entrepreneurial universities and industry-oriented education. Through the Malaysia Education Blueprint (Higher Education), universities have been encouraged to strengthen university-industry partnerships, promote technology transfer, and integrate entrepreneurship into teaching and research activities. Government funding mechanisms increasingly reward research projects demonstrating industrial relevance and measurable socioeconomic impact. Malaysian universities have also expanded international partnerships to improve research quality and attract global talent, thereby enhancing the internationalization of their innovation ecosystems.

These comparative experiences suggest that successful innovation ecosystems do not emerge from isolated investments in digital infrastructure or research funding alone. Rather, they depend on coherent policy coordination, effective institutional governance, stable financial support, and long-term collaboration among universities, industry, and government. Although each country has developed its own institutional arrangements, the common lesson is the importance of aligning digital transformation, research policy, talent development, and innovation governance within an integrated strategic framework.

For Vietnam, these international experiences indicate that future reforms should move beyond expanding institutional autonomy toward strengthening organizational leadership, interdisciplinary collaboration, research commercialization mechanisms, and international research networks. Such an integrated approach would enable Vietnamese universities not only to enhance research productivity but also to generate broader societal and economic impacts within an increasingly knowledge-based economy.

The structural bottlenecks discussed above do not exist independently. Institutional constraints affect individual motivation; resource limitations weaken governance capacity; and governance quality, in turn, determines the effectiveness of resource utilization. Unless these issues are addressed in an integrated manner, the innovation ecosystem will struggle to achieve a self-sustaining state.

Importantly, most of these challenges have been recognized for many years. The real difficulty lies not in understanding the problems but in implementing structural reforms an undertaking that requires not only political commitment but also patience and consistency in policy design and execution.

Breakthrough Solutions and Policy Recommendations

If the preceding discussion has identified the structural bottlenecks, the subsequent question is no longer whether improvement is necessary but rather how improvement can be achieved without repeating cycles of partial and ineffective reform. The following recommendations do not constitute an exhaustive policy agenda; instead, they focus on strategic leverage points capable of generating broader systemic effects if implemented consistently.

Institutional Reform: From Control Oriented Governance to Enabling Governance

A fundamental prerequisite for fostering innovation in universities is the clarification of intellectual property ownership and exploitation rights. The experience of the United States following the enactment of the Bayh Dole Act demonstrates that granting ownership rights to universities significantly increased patenting and technology transfer activities (Mowery et al., 2015). The key lesson, however, lies not merely in decentralizing ownership but in establishing transparent mechanisms for sharing benefits among universities, researchers, and stakeholders.

In Vietnam, legally recognizing intellectual property ownership for host institutions should be accompanied by detailed guidelines regarding valuation, transfer procedures, and benefit sharing arrangements. Otherwise, there is a risk of replacing a permission-based system with an unregulated and fragmented environment.

Simultaneously, the introduction of policy sandboxes for education and technology could create essential spaces for experimentation. Countries such as Singapore and South Korea have successfully employed sandbox models to test educational technologies and innovative training approaches before scaling them nationally (OECD, 2022). Importantly, policy sandboxes are not merely technical instruments; they reflect the extent to which governance systems are willing to tolerate risk and innovation. When designed appropriately, they provide opportunities for novel initiatives to develop without being constrained by rigid regulations from the outset.

Investing in Intellectual Infrastructure and AI: From Technology Adoption to Data Ecosystem Leadership

Investment in high performance computing infrastructure and open data platforms is no longer a strategic luxury; it has become a fundamental prerequisite for research and innovation. Countries such as Japan and Germany have established national supercomputing systems that support not only scientific research but also industrial innovation and higher education (World Bank, 2021). These systems function as shared infrastructure, reducing technological barriers for universities and businesses alike.

In Vietnam, the central question is not whether investment should occur but how it should be structured to avoid fragmentation. A shared open data ecosystem, designed with standardized connectivity protocols and transparent data sharing mechanisms, could generate substantial network effects. However, achieving this goal requires extensive cross-sectoral coordination, which remains challenging within existing governance structures.

Similarly, the concept of “digital literacy for all” in the age of AI should extend beyond basic technological skills. UNESCO (2023) emphasizes that digital competence encompasses the ability to understand, evaluate, and responsibly utilize data. Without such broader competencies, AI adoption risks producing a workforce dependent on technology rather than capable of mastering and directing it.

Talent Strategies: Facilitating Two Way Knowledge Flows

Talent attraction policies often focus on bringing highly skilled individuals back to their home country. International experience, however, suggests that a more effective strategy is to facilitate two way knowledge flows. The dual affiliation model, widely adopted in several countries, allows researchers to hold appointments simultaneously at institutions in different countries (OECD, 2021). This approach reduces relocation costs while preserving connections with international research networks.

For such models to function effectively, administrative barriers must be addressed in substantive ways. Processing times, funding mechanisms, and academic autonomy are often underestimated factors, yet they profoundly shape researchers’ experiences and decisions.

Another frequently overlooked dimension concerns working environments and social recognition. Countries that successfully retain talent often cultivate a strong societal appreciation of scientific careers. Consistent and transparent recognition of scholarly achievements contributes not only symbolically but also to the broader development of an academic culture that values excellence and innovation.

Promoting Regional Triple Helix Models: From Fragmented Partnerships to Local Innovation Ecosystems

Previous analyses indicate that university industry government linkages in Vietnam have emerged but remain insufficiently integrated. One promising approach involves developing regional innovation clusters that closely connect universities with high-tech zones and local business ecosystems.

South Korea's experience with innovation clusters demonstrates that when stakeholders operate within the same geographic and policy environment, interactions increase substantially (World Bank, 2022). However, such outcomes cannot be achieved solely through physical infrastructure development. Government coordination in directing research agendas and supporting strategic sectors such as semiconductors and green energy plays a decisive role.

In Vietnam, several regional cooperation initiatives have been launched, yet many lack continuity. Long-term training contracts aligned with industry needs and local development strategies could reposition universities from service providers to co creators of regional development.

Internationalization Beyond Academic Exchange

Internationalization is often understood primarily through student exchange programs and transnational educational partnerships. Such interpretations, however, capture only part of the process. Highly internationalized higher education systems cultivate open academic ecosystems in which faculty members, students, researchers, and businesses engage naturally across national boundaries.

Singapore provides a notable example through its positioning as a regional education hub that attracts not only students but also international universities and research centers (OECD, 2022). Importantly, this strategy is closely aligned with visa policies, living conditions, and post-graduation employment opportunities.

For Vietnam, the aspiration to become a regional education hub is achievable but requires a more comprehensive approach. Efforts to attract international faculty and students must be accompanied by improvements in research quality, academic culture, and curriculum internationalization. Otherwise, internationalization may remain a matter of numerical indicators rather than substantive value creation.

Ultimately, these recommendations are not entirely new. What distinguishes successful reform is not the novelty of individual policies but the coherence of their implementation. Innovation ecosystems cannot emerge from isolated interventions; they develop through the interaction of institutions, people, technology, and organizational culture.

Perhaps the greatest challenge is not designing solutions but maintaining consistency throughout implementation. When reforms occur in successive short term waves, institutions often experience continuous adjustment without accumulating long-term capabilities. Conversely, if policies are implemented with sufficient strategic vision and persistence, structural transformation becomes attainable.

CONCLUSION

The analyses presented throughout this study indicate that innovation ecosystems within Vietnamese universities have evolved beyond the stage of conceptual aspiration and have entered a phase that tests their capacity for effective operation. As higher education is increasingly repositioned as a center for knowledge creation and knowledge valorization, its role extends far beyond the traditional function of workforce training. From this perspective, a nation's strength is measured not solely by economic scale or natural resources but by its capacity to generate, apply, and sustain knowledge.

Encouragingly, the foundational conditions for such an ecosystem have begun to emerge. Policy frameworks are becoming more enabling, digital infrastructure has expanded significantly, research capacity shows signs of improvement, and university industry linkages are gradually strengthening. Nevertheless, as the preceding

sections have demonstrated, these developments remain fragmented. Critical components have yet to converge into a coherent system capable of self regulation and endogenous growth.

Based on both observation and participation in various research collaborations, it may be argued that the primary challenge lies not in the absence of solutions but in the manner of their implementation. When reforms are pursued as isolated initiatives, systems risk becoming trapped in a state of movement without meaningful progress. Conversely, when policies, resources, and academic practices are aligned within a common strategic logic, even modest interventions can generate significant cumulative effects.

An innovation ecosystem cannot flourish without the active participation of three key actors: the state as facilitator and coordinator, industry as the absorber and applicator of knowledge, and universities as the central interface connecting research with societal needs. Such collaboration must extend beyond symbolic agreements and be institutionalized through mechanisms that distribute benefits, responsibilities, and risks among stakeholders.

In the long-term, the ambition of bringing Vietnamese higher education closer to internationally advanced systems is entirely achievable. The necessary conditions in terms of policy support and resource mobilization are gradually converging. The sufficient condition, however, lies in the capacity to maintain a consistent reform trajectory, embrace carefully managed experimentation, and, above all, cultivate an academic culture that values creativity, integrity, and collaboration.

Comparative experiences from South Korea, Singapore, China, and Malaysia further demonstrate that sustainable innovation ecosystems are built not merely through increased investment but through coherent governance, effective university–industry collaboration, and long-term strategic commitment. These international lessons reinforce the argument that Vietnam's higher education reforms should focus on strengthening institutional capacity and organizational integration rather than relying solely on policy expansion.

When these elements converge, the objective will no longer be merely to catch up with or emulate external models. Instead, Vietnam will be positioned to forge its own developmental pathway one in which knowledge is generated not only for publication but also for solving societal challenges and contributing meaningfully to global scholarship. At that point, Vietnamese intellectual capacity will not merely be present on the world scientific map; it will be recognized as a substantive and influential force.

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