

# A Framework for Designing a Dynamic Academic Ecosystem in Higher Education Under Digital Transformation

Nguyen Thanh Thuy, Pham The Hung

Faculty of Political Education and Educational Management, Dong Thap University, Vietnam

Email address: phamthehung@dthu.edu.vn

**Abstract**— This study develops a theoretically robust framework that elucidates the structural interrelationship between the education–entrepreneurship ecosystem and the generative artificial intelligence (AI) ecosystem, conceptualizing their convergence as a digitally mediated knowledge ecosystem for contemporary higher education. The proposed model is organized around a triadic architecture—platform infrastructure, operational configuration, and evolutionary reflection—which collectively explains how technological systems, pedagogical processes, and institutional governance co-evolve within an adaptive academic environment. The paper further delineates the core structural components of a dynamic teaching ecosystem, grounded in internationally recognized standards of digital competence and digital culture that define the professional capacities of educational actors. By integrating ecosystem theory, digital transformation scholarship, and policy-oriented perspectives on university reform, the framework advances a systemic understanding of the learning university as a reflexive, innovation-driven institution capable of sustained development in AI-mediated knowledge economies.

**Keywords**— Learning university; education–entrepreneurship ecosystem; generative AI ecosystem; dynamic teaching environment; evolutionary reflection; digital culture.

## I. INTRODUCTION

Digital transformation is reshaping the structural and epistemic foundations of higher education through the convergence of artificial intelligence (AI), big data, and digitally mediated knowledge governance (OECD, 2021). This shift extends beyond technological adoption, requiring a systemic reconfiguration of academic culture, institutional governance, and knowledge production toward an open and innovation-driven knowledge society (UNESCO, 2018).

Recent scholarship conceptualizes this transition through the notion of the digital knowledge ecosystem—a dynamic configuration in which technological infrastructures, data architectures, human competencies, and policy frameworks co-evolve to generate academic value (Altman, 2022). Studies on digital learning ecosystems emphasize adaptive institutional design and faculty digital competence as strategic determinants of sustainable transformation (Anderson & Whitelock, 2020; Bates & Sangrà, 2020).

In Vietnam, although digital transformation has been institutionalized through national strategies, higher education institutions largely remain at the stage of fragmented informatization, lacking integrated ecosystem-based

governance structures (Nguyen & Tran, 2022). International assessments identify persistent gaps in digital infrastructure, human capital, and policy coherence necessary for the advancement of smart and learning-oriented universities (British Council, 2025; World Bank, 2024).

Addressing this gap, the present study proposes a systemic framework for a dynamic teaching environment structured around three interdependent dimensions—Platform (technology, data, institutional infrastructure), Operation (teaching, research, governance), and Evolution (assessment, evidence, innovation). Informed by ecosystem and helix-based innovation theory (Carayannis & Campbell, 2009), the framework advances a theoretically grounded model for the development of a digitally mature learning university in Vietnam.

## II. RESEARCH METHODS

This research employs the methods of document analysis and synthesis, building upon previous studies such as (Nguyen & Le, 2021), Tran (2022), and Vu & Pham (2020) to gain a deeper understanding of digital transformation and international integration in the implementation of higher education activities. This study presents one of several proposals within a broader research project aimed at developing a modern university teaching and learning environment for Vietnamese students.

Furthermore, the study utilizes a comparative method, benchmarking Vietnamese higher education curricula against international standards. By identifying the gaps through this comparison, the research proposes solutions for building a dynamic university teaching environment that is tailored to the specific conditions and context of higher education in Vietnam.

## III. THEORETICAL FRAMEWORK

### 3.1. Generative AI

Generative AI traces its origins to Alan Turing’s early conceptualization of machine intelligence (C, M. I, 1950). Scientists began experimenting with this capability based on the aforementioned procedure throughout the period from 1965 to 1970, concluding that generative AI represented the first generation of AI systems. Its presence in the field of education became most prominent following the UNESCO Courier reports in the 1980s and 1990s, which introduced the concept of “learning machines.”

The development of neural networks and deep learning in the 2000s marked significant breakthroughs. The generative AI releases of GPT-2 (2018). A more advanced version was released with GPT-3 in 2020, which aimed to reshape multiple sectors, from the economy and healthcare to education. With the remarkable pace of AI development, it has created both significant opportunities and considerable challenges for Vietnam's education and research systems by 2025.

In Vietnam, AI supports personalized learning, automated lesson planning, intelligent assessment, and academic research. AI functions as an “academic assistant,” capable of processing large datasets and generating pedagogical insights (GlebTsiursky, 2025).

### 3.2. Ecosystem Theory

The AI ecosystem refers to a technological system in which machines perform tasks that typically require human intelligence. The use of educational technology (EdTech) in schools is becoming increasingly widespread, and the collaboration between humans and AI technologies brings numerous benefits to education.

An AI ecosystem can also be understood as an interconnected network of technology, data, people, and AI-driven operational processes. It enables lecturers and students to automate repetitive tasks in teaching and learning, thereby generating optimized solutions to enhance their effectiveness and overall success.

A digital knowledge ecosystem integrates people, technology, data, and policy into a dynamic environment for knowledge creation, sharing, and restructuring (Altman, 2022).

The Quadruple–Quintuple Helix model positions universities as knowledge hubs within innovation ecosystems (Carayannis & Campbell, 2009). Educational ecosystems thus include both living actors (faculty, students, administrators) and non-living elements (infrastructure, technology, policy) interacting to foster flexible and sustainable learning environments.

Emerging from the intersection of knowledge management theory, innovation ecosystems, and digital transformation in education, research on the educational entrepreneurship ecosystem (EdTech Ecosystem) highlights the collaboration among higher education institutions, government agencies, and innovative startup enterprises to support the commercialization of educational ideas and new educational solutions aimed at improving the quality of teaching, learning, and educational management (Nguyen, 2023).

Based on the analysis of these concepts, the author conceptualizes the education ecosystem as a model connecting biotic elements living entities collectively referred to as educational actors (such as lecturers, students, and administrators) and abiotic elements (including infrastructure, technology, and policy). Together, these components form an academic environment for student learning, characterized by interactions among individuals and between individuals and the objects of the teaching learning process. The goal of the education ecosystem is to foster flexible, modern, and sustainable learning conditions that enhance effectiveness and promote personalized learning in higher education.

### 3.3. International Frameworks for Digital Competence and Knowledge Governance

International organizations have developed numerous theoretical frameworks and policies to shape the digital knowledge ecosystem in higher education. These can be categorized into groups such as individual digital competence, organizational capacity, institutional policy, and global open knowledge.

#### 3.3.1. Digital knowledge Governance

According to DigCompEdu the European Framework for the Digital Competence of Educators digital competence for educators comprises six areas: digital lesson design (instructional planning), the use of digital learning tools, data-driven assessment, knowledge exchange to support learners, and digital professional development. DigCompEdu considers digital competence as the foundation for developing the “digital teacher/learner,” who stands at the center of the digital knowledge ecosystem (Redecker, 2017).

According to the OECD, higher education institutions are viewed as learning organizations in which knowledge is continuously reconstructed through data analysis and ongoing feedback. Universities commonly use data from Learning Management Systems (LMS) and quality assurance (QA) mechanisms to enhance educational quality. The focus is not merely on technology but on evidence-based knowledge governance aligned with the PDCA (Plan–Do–Check–Act) cycle for continuous improvement.

The European Commission has launched the Digital Education Action Plan aimed at fostering “inclusive, flexible, and sustainable digital education.” This plan emphasizes three core pillars: open data infrastructure, digital competence, and cross-border collaboration. It serves as a system-level policy framework to enhance interoperability among European higher education institutions and to facilitate the development of transnational knowledge networks (European Commission, 2023).

Promoting open knowledge and knowledge equity, grounded in the three principles of “openness, collaboration, and sustainability,” and supported by two key instruments defining “open knowledge,” constitutes a fundamental condition for ensuring fairness, transparency, and universal access to knowledge. At the same time, it calls upon universities to collaborate as co-creators of shared knowledge commons (UNESCO, 2021 & 2023).

From the theoretical foundation of the digital knowledge ecosystem, structured across three knowledge levels the micro level (individual digital competence, DigCompEdu), the meso level (data-driven organizational governance, OECD and EU), and the macro level (global open knowledge policies, UNESCO, 2023) the coordinated operation of these levels generates a “multi-level feedback loop,” which forms the basis of an evolutionary knowledge ecosystem (Voda, Gheorghe, & Băcilă, 2023). For education in Vietnam, this provides the theoretical foundation for designing the “platform – operation – reflection” model, ensuring systemic coherence and international integration (Voda et al., 2023).

#### 3.3.2. The study proposes an AI competence framework for university lecturers including:

Based on the roadmap for developing an artificial intelligence curriculum for general education, the AI competency framework for students was completed in 2024, and the guidelines for using AI in teaching and learning were finalized in 2025 (Le, A.V., 2025). Drawing on the key features of the adaptive personalized learning theoretical model, as well as the AI competency frameworks for students and teachers (UNESCO, 2024), the author proposes several recommendations for an AI competency framework for university lecturers as follows:

*a. Curriculum development perspective:*

Aligned with the guiding principles of the 2018 General Education Curriculum, and taking into account the specific requirements of AI within the current Vietnamese and global context, AI-related competencies for lecturers may include: (1) human-centered pedagogical thinking competence; (2) AI ethics competence; (3) technical and applied AI competence; (4) AI-integrated instructional design competence.

*b. Levels of AI utilization:*

First, the *familiarization level*, at which lecturers need to understand AI clearly and help students become aware of AI, recognize its impacts, and interact with it effectively. Second, the *foundational level*, where lecturers guide students in developing AI-related thinking skills, foundational competencies in AI ethics, technical application skills, and the ability to analyze AI's societal impacts. *Third, the creative level*, which allows students to use AI innovatively. At this stage, students should understand basic AI design principles and develop the capacity to critically examine issues related to human rights and broader social concerns (Unesco, 2021).

*In summary*, to meet practical teaching demands in the era of digital education, lecturers' digital competence plays a pivotal and decisive role in the effective use of AI in education and other areas of life. To employ AI as a supportive teaching and professional tool, lecturers must understand its nature and apply its functions flexibly. This represents both an opportunity and a challenge for those who have not yet adapted to change.

IV. RESEARCH FINDINGS AND DISCUSSION

4.1. Key Findings

4.1.1. *Benefits of AI in Higher Education*, the benefits brought by AI technology include the ability to analyze learning data, recommend appropriate content, and create personalized learning pathways for each individual, as well as provide intelligent assessment and feedback. AI technology can support lecturers in designing lesson plans, developing instructional scenarios, creating interactive learning materials, and automatically grading students' assessments. It can also identify knowledge gaps during the learning process and provide timely feedback. The author recognizes that the emergence of artificial intelligence represents a significant driving force for educational innovation in the current period.

4.1.2. *Education as a Nurturing and Shaping Environment for Artificial Intelligence*

Education serves as a nurturing and shaping environment for artificial intelligence (AI). The education sector is a reliable context for training AI human resources for the nation. In particular, universities and research institutes play a crucial role

in educating and supplying professionals capable of developing, managing, and advancing AI technologies for societal progress.

The educational environment functions as a large scale laboratory for testing AI applications, refining AI functionalities, and improving AI technologies. Therefore, education also establishes ethical standards for AI and guides its development not only within education but also across other domains of social life.

4.1.3. *The Relationship Between the Education Ecosystem and the AI Ecosystem*

The education ecosystem represents the integration of technology, pedagogical methodologies, and institutional policies. In the context of digital transformation, it is increasingly becoming a critical structural component that creates spaces for AI-supported personalized learning and for implementing strategies that foster student engagement, while recognizing individual characteristics and cognitive differences. The relationship between the education ecosystem and the AI ecosystem is a bidirectional and highly interactive one. They exert strong mutual influence within the digital transformation era. Fundamentally, this relationship can be understood as follows:

TABLE 1. Implications Derived from the Relationship

	Benefits of the Relationship	Challenges of the Relationship
1	Improved teaching effectiveness and quality	Overdependence on technology
2	Optimized management through learning analytics	Creates risks related to personal data security and learners' privacy.
3	Promotion of lifelong learning and educated method innovation	Widens the digital divide among regions and different population groups within the community.
4	Development of AI-driven human capital	Exerts widespread impacts across most areas of social life, requiring the organization of retraining programs and professional development courses to enhance teachers' AI usage skills.

Building on the benefits that AI brings, education is undergoing profound changes in teaching and learning methods, with AI becoming a knowledge partner within the education ecosystem. The role of AI in this ecosystem extends beyond mere application; it also involves knowledge retention, reflection, and creation. AI and educational actors (lecturers and students) share certain forms of linguistic and logical intelligence.

However, social-emotional intelligence, motor skills, aesthetic sensibility, and self-awareness are uniquely human capacities that develop through lived experience and authentic human interaction. As analyzed above, the challenges AI poses to education particularly when overused may lead to risks such as an illusion of competence, reduced student motivation for self-directed learning, diminished social interaction, and ethical concerns arising from excessive dependence on technological tools.

Integrating AI into education should aim to help students learn more deeply, cultivate intellectual skepticism and critical

thinking, and develop perseverance in overcoming difficulties not to make learning easier in a superficial sense or to allow AI to replace human effort. The relationship between the AI ecosystem and the education ecosystem should be supportive in nature: AI must serve and enhance the cognitive processes of students and lecturers, rather than substitute for them. The use of AI in education should help reduce cognitive overload in learning and research practice, sustain research motivation, and encourage social interaction. Education should regard AI as a knowledge partner responsible for “fast and broad” functions such as data processing and idea generation, while education itself remains responsible for “deep” dimensions emotional thinking, ethical reasoning, and critical reflection.

**4.1.4. Relationship Between Education and Entrepreneurship Ecosystems**

Education serves as the foundational condition for entrepreneurship. It equips learners with relevant knowledge, skills, and entrepreneurial competencies for specific professions, providing them with in-depth disciplinary expertise, soft skills, critical thinking, and creativity essential and solid foundations for entrepreneurial endeavors. Education is the source of high-quality human resources, preparing qualified individuals with innovative startup ideas. It also nurtures entrepreneurial initiatives through startup clubs, business idea competitions, and business incubators that support startup projects.

Entrepreneurship, in turn, drives educational innovation. Enterprises influence training programs, as the demands of the startup market require education systems to adapt their content and teaching methods, integrating innovation skills and entrepreneurial thinking into curricula.

The diffusion of entrepreneurial culture into education makes learners more dynamic and encourages a mindset of initiative and action among students. Businesses need to connect with universities to develop startups, collaborate in testing new solutions and products such as EdTech applications, AI, or IoT in order to build new ecosystems.

TABLE 2. Implications Derived from the Relationship Between the Education Ecosystem and the Entrepreneurship Ecosystem

NO	Benefits of the Relationship	Challenges of the Relationship
1	Education cultivates a generation of students with innovative thinking, creativity, and entrepreneurial orientation	It requires the workforce to possess both strong academic knowledge and practical skills.
2	Strengthens linkages among universities, businesses, and society.	Many educational institutions lack experience in organizing entrepreneurship training and providing startup support
3	Education and entrepreneurship promote the development of the knowledge economy and the digital economy.	The risk of startup failure may discourage young people and reduce their motivation to strive.
4	Accelerates the transfer of research products into practical applications.	There is a lack of coherent financial and legal policies, as well as timely support mechanisms, to enable individuals within the education sector to engage in entrepreneurship

The impact of education on the entrepreneurship ecosystem has attracted considerable scholarly attention. Entrepreneurship-oriented training programs have been shown to positively influence participants’ attitudes toward entrepreneurial activities. Education and entrepreneurship can shape students’ perceptions and entrepreneurial intentions (Pittaway & Cope, 2007). Learners’ attitudes, together with the development of appropriate learner-centered curricula, can transform entrepreneurial spirit and help assess whether individuals hold positive or negative orientations toward entrepreneurship as an economic pursuit (Harris & Gibson, 2008). Therefore, educators should design curricula that not only include disciplinary knowledge but also integrate entrepreneurial skills training within specific professional fields.

**4.1.5. The Interaction Between the Entrepreneurship Ecosystem and the AI Ecosystem**

Entrepreneurship serves as a driving force for the application and commercialization of AI, moving AI from laboratories into commercial markets. Startups are particularly agile in transforming AI technologies into practical products and services, creating diverse markets across sectors such as healthcare, education, logistics, and finance.

These demands require AI to continuously improve and respond to real-world economic challenges. Entrepreneurship contributes to the development of the AI ecosystem by generating new datasets, innovative applications, and novel use cases, thereby enriching and diversifying the AI ecosystem.

Conversely, AI accelerates entrepreneurial development by enabling new business models such as chatbots, big data analytics, image and speech recognition, and automation systems. AI assists startups in market analysis, demand forecasting, cost reduction, marketing optimization, and productivity enhancement. It also supports faster design, testing, and production processes, thereby shortening time-to-market.

However, entrepreneurship and AI-driven business implementation still face challenges, including shortages of highly qualified AI professionals, risks related to data ownership and privacy, and high research and development costs associated with AI technologies.

**4.2. Discussion and Recommendations**

**4.2.1. Assessment of Research Results**

Researching the relationship between educational, entrepreneurial, and AI ecosystems aims to create a Digital Knowledge Ecosystem. This includes a system of professional knowledge and skills, combining strategic entrepreneurial knowledge with the robust support of Generative AI. Higher education programs in Vietnam are designed based on this digital knowledge ecosystem, integrated with the “Platform - Operation -Evolutionary Reflection” model mentioned in the theoretical framework. This creates a dynamic academic environment that meets the career development aspirations of lecturers and the learning needs of students within the context of comprehensive and modern higher education reform.

From the results, the author notes that Vietnamese higher education institutions need to raise awareness regarding the

critical role of developing curricula in tandem with fostering entrepreneurial potential for students. It is essential to collaborate with employers to design course modules that align with labor market trends, ensuring that training content achieves dual objectives. The design of university academic environments should adhere to the following structure: “Platform”, the foundation of the digital knowledge ecosystem, consisting of digital infrastructure, digital data, data security, and ISO-compliant interoperability; “Operation”, Focusing on curriculum development, scientific research, and digital governance. “Evolutionary Reflection”, performing the functions of evaluation, feedback, and refinement. Following the PDCA (Plan-Do-Check-Act) management cycle in Vietnam, this allows the digital knowledge ecosystem to self-adjust, update policies, and evolve its operational models.

4.2.2. Lessons Learned and Recommendations

a. *Pedagogical Capacity and Digital Culture in Higher Education*, Redecker (2022) asserts that the digital competence of teaching staff is the foundational condition of a digital knowledge ecosystem. In Europe, the DigCompEdu framework for educators has become the standard for assessing digital pedagogical competence, providing universities with a basis for curriculum development, accreditation, and digital professional development. UNESCO emphasizes that an open learning culture and knowledge collaboration are factors that create not just a Digital University, but a Learning University in the era of integration.

However, Vietnamese universities developing a digital knowledge ecosystem must rely on digital technology while combining infrastructure transformation with a shift in human

perception. This aims to foster a culture of data sharing and intellectual reflection within the academic environment.

b. *Knowledge Management*, although Vietnam has issued policies on digital transformation, most higher education institutions have yet to establish a knowledge management framework or data reflection mechanisms. Educational projects primarily focus on technological infrastructure rather than the digital knowledge layer and learning institutions (Nguyen & Tran, 2022).

Therefore, Vietnamese higher education must construct “Theory-Integrated Technology-Policy” framework to connect the three-tier “Platform-Operation-Reflection” model into the digital knowledge ecosystem. It is also necessary to establish a legal framework to ensure sustainability and confident integration, encompassing data groups, technology, digital competence, and open knowledge to create a dynamic academic environment for students.

c. *Quality Assurance (QA)*, as an activity within the data feedback loop of the “operation-Reflection” process of the digital knowledge ecosystem (OECD, 2021), quality assurance in Vietnam should shift toward data-driven QA. It is necessary to build a national accreditation network at the meso and macro levels, creating a link between higher education institutions and the Ministry of Education and Training (MoET). This “platform” will serve as the roadmap for system interconnectivity during the 2026–2030 period.

4.3. Structure of a Dynamic Learning Environment

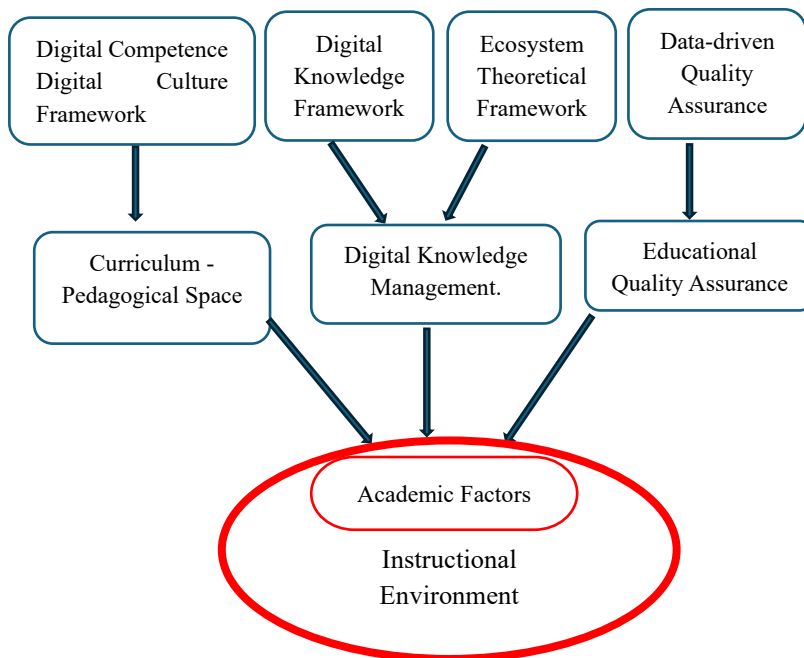


Diagram 1. Simulation of the Academic Model.

## V. CONCLUSION

This study has articulated a theoretically integrated digital knowledge framework that synthesizes ecosystem theory, digital competence standards for higher education lecturers, and internationally recognized models of digital culture. By systemically aligning a three-tier digital knowledge architecture with technological infrastructures and institutional governance, the framework provides a strategic pathway for transforming the conventional Vietnamese university model into a learning-oriented university capable of adaptive, innovation-driven development.

From a theoretical standpoint, the conceptualization of a Digital Knowledge Ecosystem advances current scholarship by explicating the structural interdependencies among educational, entrepreneurial, and generative AI ecosystems. This integrative perspective contributes to the architectural design of higher education as a dynamic, reflexive system rather than a static institutional structure. In doing so, it establishes a foundational component of the broader dynamic teaching and learning environment under investigation, aimed at enhancing academic quality, institutional agility, and systemic coherence in Vietnamese universities.

Beyond the implementation of digital platforms or governance mechanisms, the proposed ecosystem framework foregrounds the cultivation of digital knowledge culture and institutional learning capacity as long-term strategic priorities. Such an orientation supports the reconfiguration of universities as nodes within a broader digital knowledge society, thereby strengthening their role in national innovation systems and sustainable development trajectories (Voda et al., 2023).

Overall, this reference framework offers a theoretically grounded and policy-relevant approach to rethinking university academic architecture, digital governance, and open knowledge practices within the context of Vietnam's global integration and AI-mediated transformation.

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