DEVELOPING A DIGITAL TRANSFORMATION MODEL FOR HIGHER EDUCATION IN ASEAN: A MULTIDIMENSIONAL APPROACH BASED ON DIGITAL MATURITY

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Abstract: ***Digital transformation has become a strategic priority in higher education, but in ASEAN its progress remains uneven because of differences in policy, institutional capacity, and digital readiness. This study develops a context-sensitive digital transformation model for ASEAN higher education based on a digital maturity approach. Using qualitative methods, including conceptual analysis, comparative policy review, and secondary data, the study examines six countries: Singapore, Malaysia, Thailand, the Philippines, Indonesia, and Vietnam. The findings show major variations in governance, infrastructure, human capacity, and teaching practices, indicating that universal models are unsuitable. In response, the study proposes a multidimensional model integrating macro, meso, and micro governance levels with six strategic pillars to support digital maturity assessment, context-specific planning, and more effective policymaking and regional cooperation in ASEAN higher education.***

• Keywords: *digital transformation; digital maturity; higher education; ASEAN; digital governance; education policy.*

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1. Introduction

1.1. Global and ASEAN Context of Digital Transformation in Higher Education

Digital transformation has become a strategic force in higher education worldwide, reshaping governance, teaching, research, and knowledge ecosystems beyond simple IT adoption. The COVID-19 pandemic further accelerated this shift.

Linked to SDG 4, digital transformation is seen by UNESCO (2025) as a driver of access, quality, innovation, and sustainable development, while fostering more open and collaborative knowledge creation.

In ASEAN, this agenda is particularly important due to rapid growth, a young population, and uneven digital capacity. Through ADM2025 and MPAC2025, digital transformation in higher education is framed as essential for innovation, regional integration, and narrowing development gaps.

1.2. Research Gaps

Despite growing interest in digital transformation in higher education, three major gaps remain. Most studies still focus on isolated issues rather than viewing digital transformation as a systemic, multidimensional process across governance levels. Existing models are largely based on developed-country contexts and do not reflect ASEAN's diverse conditions. In addition, although digital maturity is increasingly discussed, it is rarely used to build a comprehensive framework for ASEAN higher education. UNESCO and ASEAN reports also remain mainly descriptive, without a strategic conceptual model for the region's institutions.

1.3. Research Objectives and Contributions

This study compares digital transformation in higher education across selected ASEAN countries, proposes a digital maturity model at macro, meso, and micro levels, and suggests policy implications for sustainable transformation. It contributes by integrating ASEAN policy analysis with digital maturity frameworks into a flexible model that also supports institutional self-assessment and strategic planning.

2. Literature review and theoretical foundations

2.1. Distinguishing Digitalization and Digital Transformation in Higher Education

In higher education, digitalization and digital transformation are related but distinct.

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Digitalization uses digital technologies to improve existing processes for efficiency and cost reduction, whereas digital transformation is a broader strategic process that reshapes governance, culture, teaching, and knowledge creation. Thus, digitalization is the foundation, while digital transformation enables universities to adapt effectively to change.

2.2. Digital Transformation in Higher Education and Its Relationship with Digital Maturity

Digital maturity is a key framework for guiding digital transformation in higher education. It refers to the extent to which universities integrate digital technologies into strategy, processes, structures, and culture to create sustainable value. It requires not only technology adoption but also strategic alignment. Research shows that many universities, especially in developing countries and ASEAN, remain at early stages with gaps in resources, governance, and digital skills. This approach helps institutions assess their stage, set priorities, and avoid copying advanced models without considering local conditions.

2.3. Digital Maturity Models in Higher Education

In recent years, many digital maturity models for higher education have viewed digital transformation as a staged process from initial adoption to deeper integration and innovation (Dương Thị Thái et al., 2021; Fernández et al., 2022). Common pillars include strategy and leadership, infrastructure, digital competencies, teaching innovation, and data governance (Dương Thị Thái et al., 2021). However, most models remain descriptive and are not well linked to specific policy or institutional contexts (Dương Thị Thái et al., 2021). Research also shows that many universities pursue digital transformation without a clear maturity roadmap, resulting in only partial and limited strategic impact (Fernández et al., 2022). Therefore, more integrated models are needed to connect strategy, implementation, and evaluation.

2.4. International Theoretical and Policy Frameworks: JISC, OECD, and the World Bank

Beyond academic models, international organizations such as JISC, OECD, and the World Bank have also provided important frameworks for digital transformation in higher education. JISC emphasizes the interaction of leadership, culture, human capacity, technology, data governance, and student experience. OECD approaches digital transformation from a policy and system perspective, linking it to equity, innovation, and competitiveness. The World Bank focuses more on digital readiness in developing countries, stressing the importance of infrastructure, legal frameworks, institutional capacity, and alignment with labor market and innovation ecosystems.

2.5. Theoretical Implications for the Study

The literature suggests three main implications: digital transformation in higher education should be seen as a strategic, multidimensional process; digital maturity is a useful tool for assessing institutional position and guiding progress; and existing models remain limited, especially in reflecting ASEAN realities. These insights provide the basis for proposing a digital maturity-based model tailored to ASEAN higher education.

3. Research methodology

3.1. Overall Research Approach

This study adopts a qualitative design using conceptual research, comparative policy analysis, and document review. This approach is suitable for developing a digital maturity-based model of higher education digital transformation in ASEAN, where diverse contexts require a flexible but conceptually strong framework. Instead of testing causal relationships, the study synthesizes literature and policy documents to propose a strategic conceptual model consistent with Scopus-oriented conceptual and policy research.

3.2. Conceptual Research

Conceptual research is the core method for building the proposed model. It clarifies and integrates key concepts such as digital transformation, digital maturity, and digital ecosystem in higher education. The process includes three steps: synthesizing major theories, placing them in the ASEAN policy context through ADM2025 and MPAC2025, and reorganizing them into a multidimensional, multi-level framework. This approach avoids mechanically applying developed-country models and supports a more context-sensitive model for ASEAN higher education.

3.3. Comparative Policy Analysis

This study also uses comparative policy analysis to examine how ASEAN countries approach higher education digital transformation. It reviews ASEAN frameworks, especially ADM2025 and MPAC2025, together with national strategies and UNESCO's 2025 report. The analysis focuses on three criteria: the state's role, the integration of education and digital strategies, and the emphasis on capacity, pedagogical innovation, and collaboration. Rather than ranking countries, it identifies different policy approaches to inform a regionally grounded digital maturity model.

3.4. Document Analysis

Document analysis supports the study's conceptual and policy aims by examining secondary data from academic, UNESCO, ASEAN, and regional strategy documents. Through directed content analysis, these sources are coded into key themes such as governance, infrastructure, human capacity, teaching innovation, and collaboration. This method enhances transparency, verifiability, and generalizability, while fitting policy-oriented research in Scopus-indexed journals.

3.5. Methodological Reliability and Limitations

Although the study uses no primary data, reliability is strengthened through triangulation of academic, policy, and regional strategic sources.

However, its reliance on secondary data may not fully capture institutional differences among higher education institutions. This limitation suggests the need for future empirical studies to test and refine the proposed model.

4. The state of digital transformation in higher education in asean: a comparison of six key countries

4.1. Regional Landscape: "Heterogeneity" in Digitalization Stages and Levels of Digital Transformation

UNESCO shows that higher education digital transformation in Southeast Asia is uneven due to gaps in strategy, infrastructure, and institutional capacity. COVID-19 accelerated change but exposed weaknesses in skills, finance, and preparedness. DTxHE is defined as a multidimensional transformation beyond online teaching, while radar charts across ASEAN provide an empirical basis for comparing digital maturity and governance priorities.

4.2. Comparative Framework (Aligned with the Digital Maturity Approach)

Based on a digital maturity perspective, this section compares five countries across six criteria: (i) policy orientation, (ii) digital infrastructure, (iii) digital teaching, learning, and assessment, (iv) faculty and learner capacity, (v) data governance, digital security, and ethics, and (vi) ecosystem collaboration.

Table 1. Comparative Matrix of the Digital Transformation of Higher Education (DTxHE) in Selected ASEAN Countries by Digital Maturity Level

Nation	Direction/ Policies	Digital Teaching and Learning & Digital Assessment	Digital Competencies (Faculty and Students)	Digital Infrastructure and Platforms	Data Governance, Privacy, and Cybersecurity	Overall Digital Maturity Level	Main Limitations
Singapore	Consistent National Strategies and Long-Term Investment	High level of integration with discipline-specific digital competencies; extensive use of AI and advanced learning analytics	Clear and Standardized Digital Skills Framework	Advanced Infrastructure and the "Smart Universities" Model	High level of standardization with strong data governance and AI capabilities	(Advanced - Transformational)	Challenges related to data ethics, security, and AI governance
Malaysia	Clear strategic direction and policy frameworks; strong promotion of blended learning	Diverse delivery models, including LMS and MOOCs, aligned with TNE and labor market needs	Faculty development as a central priority	Simultaneous investment in infrastructure and human capacity to reduce the digital divide	Emphasis on ethical principles and responsible use of digital technologies	Advanced	Uneven implementation with reliance on public funding and external partners
Thailand	Education 4.0: Autonomous and Flexible Learning Models	Expanding Learning Management Systems (LMS) and blended learning models; non-synchronous digital assessment mechanisms	Greater support for implementation is necessary	Making effective use of existing infrastructure.	The absence of a standardized assessment framework.	At a Developing Level (Moderate Performance)	The transformation remains largely focused on the digitalization of teaching.
Indonesia	Digitalization aligned with open universities and Open and Distance Learning (ODL); reducing regional disparities; in line with UNESCO and ASEAN orientations.	While Open and Distance Learning (ODL) and MOOCs are being developed, digital assessment has yet to be standardized.	Uneven digital competencies among faculty and students	Despite rapid infrastructure expansion, significant regional disparities remain.	Frameworks for quality assurance (QA), information security, and digital ethics have yet to be fully developed.	Developing (Moderate - foundational systems are expanding	Digital transformation has not yet been deeply integrated into governance and innovation."
Vietnam	The objective is to expand online learning by 2030	Digital transformation accelerated in the post-COVID-19 period, with growing public-private differentiation.	Despite ongoing improvement efforts, initiatives remain fragmented and siloed.	Progress has been made, but remains uneven.	Quality assurance (QA), privacy, and cybersecurity should be prioritized	At a Developing level, currently in transition.	There is a lack of a digital maturity assessment model, while digital culture remains uneven.
Philippines	Flexible learning approaches, Open and Distance Learning (ODL), and Open Educational Resources (OER).	Strong in Open and Distance Learning (ODL) to expand access; disparities across institutions."	A lack of digital skills and digital pedagogical training	Infrastructure and equipment remain unstable.	Emphasizing data privacy	Moderate (Early-Developing)	A significant digital divide; uneven implementation quality.

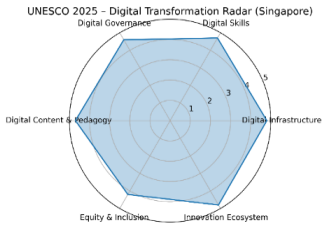
Source: Author's compilation.

(This summary table synthesizes key findings and policy themes from UNESCO documents, the Malaysia policy seminar materials, national reports from the Philippines, and reports published by the British Council Vietnam.)

4.3. Singapore: An "Exemplar Case" of Successful Digital Transformation

UNESCO presents Singapore as a leading case of higher education digital transformation due to its long-term, systematic investment in infrastructure and human capital since the 1980s, reinforced by initiatives such as Smart Nation and SkillsFuture. Its Media and Information Literacy Framework helps align digital competencies with labor market needs. From a digital maturity perspective, Singapore demonstrates high maturity through policy coherence, sustained investment, and strong coordination among government, universities, and industry, enabling innovations such as AI, VR, flexible learning, and learning analytics.

Figure 1. Digital Maturity Level of Singapore Across the Six UNESCO Pillars



Source: Author's synthesis based on the reviewed literature.

Key Characteristics: A leading DTxHE ecosystem in the region

Digital infrastructure and governance: Very high

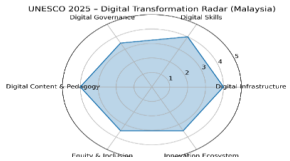
Innovation ecosystem: ASEAN-leading

Equity and inclusion: High, though less central due to strong existing foundations

4.4. Malaysia: Digital Transformation Anchored in Blended Learning, Faculty Development, and the Reduction of Digital Inequality

UNESCO presents Malaysia as a strong case of higher education innovation under the Higher Education 4.0 agenda. Its policy priorities include online and blended learning, faculty adaptation, digital equity, and sustainable financing. The Digital Education Policy also focuses on digital skills, content, faculty capacity, leadership, infrastructure, and partnerships. From a digital maturity perspective, Malaysia shows a balanced model linking infrastructure, pedagogy, and equity, while aligning national reform with ASEAN frameworks.

Figure 2. Digital Maturity Level of Malaysia Across the Six UNESCO Pillars



Source: Author's synthesis based on the reviewed literature.

Key Characteristics: A Balanced and Integrated Model

- Digital Skills and Pedagogy: High

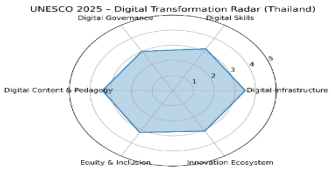
- Governance and Ecosystem: Relatively strong

- Position within ASEAN: Consistent with an "upper-middle digital maturity" profile

4.5. Thailand: Emphasizing "Education 4.0," Self-Directed Learning in Digital Environments, and the Expansion of Digital Assessment

UNESCO presents Thailand as a case emphasizing self-directed learning through digital platforms under Education 4.0. While progress has been made in digital assessment through OHEC tools, challenges remain in faculty training, technology investment, and implementation support. From a digital maturity perspective, Thailand is relatively strong in digital teaching and learning, but still needs improvement in assessment, implementation capacity, and strategic alignment.

Figure 3. Digital Maturity Level of Thailand Across the Six UNESCO Pillars



Source: Author's synthesis based on the reviewed literature.

Key Characteristics: Education 4.0-Oriented Development with Fragmentation

- Pedagogy and Digital Content: Improved significantly in the post-COVID-19 period

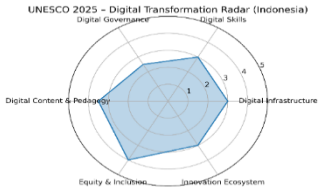
- Governance and Ecosystem: At a moderate level

- Overall Pattern of Digital Transformation: Predominantly focused on teaching and learning, with more limited diffusion into governance and institutional management

4.6. Indonesia: Digital Transformation Driven by Open Universities and Distance Learning Expanding Access amid Limitations in Integrated Governance and Digital Pedagogical Capacity

UNESCO portrays Indonesia's higher education digital transformation as mainly access-oriented, using open universities, distance education, MOOCs, and national platforms to reduce regional disparities and support lifelong learning. From a digital maturity perspective, Indonesia remains at a developing stage: participation has expanded, but weaknesses persist in governance, digital pedagogy, data governance, and quality assurance. The key challenge is to move from access-driven digitalization to more strategic, system-level transformation.

Figure 4. Digital Maturity Level of Indonesia Across the Six UNESCO Pillars



Source: Author's synthesis based on the reviewed literature.

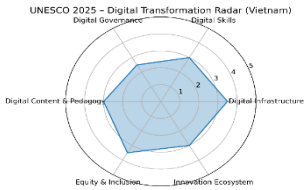
Radar Profile Characteristics: An Access-Oriented Model Centered on ODL and MOOCs

- Equity and Inclusion: High, driven by open universities and distance learning
- Digital Governance: Relatively weak
- Digital Pedagogy: Developing, but uneven across institutions

4.7. Viet Nam: Accelerated Post-COVID-19 Digitalization amid Resource Fragmentation and the Need to Prioritize Quality Assurance and Digital Safety

British Council notes that Viet Nam expanded digital technology use strongly during COVID-19, supported by investment in online teaching and the goal of expanding online higher education by 2030. However, progress remains fragmented due to siloed resources and uneven support across institutions. The report therefore recommends stronger policy communication, broader training, deeper collaboration, and greater attention to quality assurance, inclusion, data protection, cybersecurity, and leadership. From a digital maturity perspective, Viet Nam is in a transitional stage, moving from teaching-focused digitalization toward more governance-driven transformation.

Figure 5. Digital Maturity Level of Viet Nam Across the Six UNESCO Pillars



Source: Author's synthesis based on the reviewed literature.

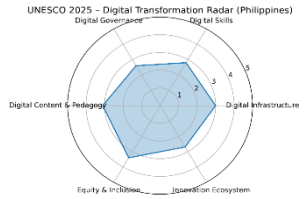
Key Characteristics: Post-COVID-19 Acceleration with a Need to Strengthen Quality Assurance and Digital Safety

- Digital Infrastructure and Content: Rapidly expanding
- Governance and Quality Assurance: Lagging behind the pace of expansion
- Digital Capacity: Fragmented across different types of higher education institutions

4.8. The Philippines: The "Flexible Learning" Framework, OER Platforms, and Infrastructure-Capacity Bottlenecks

In the Philippines, higher education digital transformation has been driven mainly by Open and Distance Learning and COVID-19 responses. CHED promoted flexible learning and learning continuity plans, while PHL CHED Connect expanded access to digital resources. These efforts show relative strength in policy and support platforms. However, weak ICT infrastructure, limited device access, and low faculty digital pedagogical capacity still constrain wider transformation. From a digital maturity perspective, the Philippines has progressed more in policy support than in the foundational conditions for balanced system-wide change.

Figure 6. Digital Maturity Level of the Philippines Across the Six UNESCO Pillars



Source: Author's synthesis based on the reviewed literature.

Key Characteristics: A Strong Emphasis on Digital Inclusion and ODL

- Equity and Inclusion: Relatively high, driven by ODL and flexible learning approaches

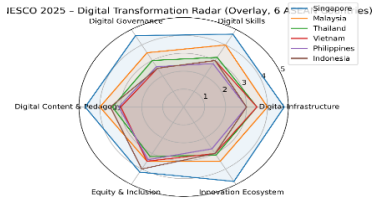
- Governance, Skills, and Infrastructure: Remain limited

- Primary Orientation of Digital Transformation: Focused mainly on expanding access to education

- DTxHE Ecosystem: Positioned at a region-leading level

4.9. Comparative Radar Chart Analysis Across Selected ASEAN Countries

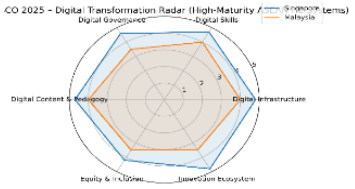
Figure 7: Overlay radar chart comparing digital transformation maturity across six ASEAN higher education systems



Source: authors' analytical synthesis based on UNESCO framework and ASEAN digital policy documents, 2024-2025.

Group 1: Singapore and Malaysia: represent high-maturity ASEAN higher education systems. Both show strong integration across most digital transformation pillars. Singapore stands out in digital governance and innovation, while Malaysia presents a more balanced profile in digital skills, pedagogy, and infrastructure. Together, they form the upper tier of digital maturity in ASEAN higher education.

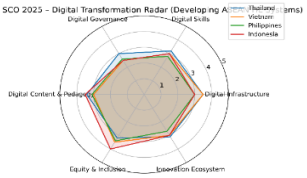
Figure 8. High-maturity ASEAN HE systems



Source: authors' analytical synthesis based on UNESCO framework and ASEAN digital policy documents, 2024-2025.

Group 2: Thailand, Indonesia, Viet Nam, and the Philippines: represent developing ASEAN higher education systems with differentiated strengths. Indonesia and the Philippines perform better in equity and inclusion through ODL and flexible learning, while Viet Nam and Thailand show notable post-COVID-19 gains in digital pedagogy and infrastructure. However, digital governance, quality assurance, and data security remain common weaknesses. Overall, this group reflects a developing or transitional stage of digital maturity in ASEAN higher education.

Figure 9. Developing ASEAN HE systems



Source: authors' analytical synthesis based on UNESCO framework and ASEAN digital policy documents, 2024-2025.

5. A multidimensional digital transformation model based on digital maturity levels

5.1. Novelty and Academic Contribution

The study's main contribution is a multidimensional model of digital transformation in ASEAN higher education that combines three governance levels, six strategic pillars, and a digital maturity pathway. Unlike earlier fragmented or institution-focused frameworks, it offers an integrated matrix for assessment, comparison, and implementation across diverse ASEAN contexts. Grounded in the ASEAN Conceptual Framework, the model highlights digital transformation as a strategic, holistic, and multi-level process with feedback loops among policy, institutions, and practice.

5.2. Overall Structure of the Model: Three Levels and Six Pillars

The proposed model is a two-dimensional matrix combining three governance levels—Macro (policy and investment), Meso (institutional strategy and governance), and Micro (teaching, research, and operations) with six strategic pillars: Governance and Strategy, Infrastructure, Human Capacity and Culture, Teaching and Learning, Knowledge and Innovation, and External Ecosystem. Their interaction shapes the depth, coherence, and sustainability of digital transformation in ASEAN higher education.

5.3. Three Level of management in the model

5.3.1. Macro Level: National and Regional Policy Contexts

At the Macro level, digital transformation is shaped by national policies, regulations, public investment, and ASEAN initiatives such as ADM2025 and MPAC2025 that promote connectivity, access, and digital skills. In the

ASEAN Conceptual Framework, this level is both a top-down driver and a recipient of feedback from the Meso and Micro levels, with digital maturity reflected in policy coherence, institutional adaptability, and cross-sectoral coordination.

5.3.2. Meso Level: Institutional Strategy and Governance

At the Meso level, digital transformation is translated into action through institutional strategy, governance, resource allocation, and quality assurance. The ASEAN Framework emphasizes that universities should co-create solutions suited to their missions and capacities, with digital maturity shown in strategic integration, cross-unit coordination, and continuous improvement.

5.3.3. Micro Level: Teaching-Learning Practices, Research, and Everyday Operations

At the Micro level, digital transformation is experienced directly by faculty, students, and staff through digital pedagogy, assessment, research data management, and digital competencies. The ASEAN Framework also sees this level as a source of feedback to the Meso and Macro levels, with digital maturity reflected not only in technology use but also in changes in behavior, culture, and human capacity.

5.4. Six Strategic Pillars of the Model

5.4.1. Governance and Strategy

This pillar forms the backbone of the proposed model. At the Macro level, it covers policy frameworks, regulations, and coordination mechanisms; at the Meso level, institutional strategies, governance structures, and data-informed decision-making; and at the Micro level, digital operations and a culture of compliance. A key contribution of the model is its view of governance not simply as administration, but as an adaptive capacity that enables universities to progress across levels of digital maturity.

5.4.2. Infrastructure (Digital and Physical Infrastructure)

Infrastructure includes digital systems such as LMS, ERP, data platforms, and cybersecurity, as well as smart physical facilities like smart campuses. The model emphasizes that these investments must align with academic and institutional goals, not technology alone. In the ASEAN Framework, infrastructure is necessary but not sufficient; digital maturity depends on how well it supports teaching, research, and governance.

5.4.3. Human Capacity and Digital Culture

This pillar places people at the center of digital transformation. At the Macro level, it covers national policies for digital skills; at the Meso level, institutional training, incentives, and change management; and at the Micro level, the digital competencies and innovative mindsets of faculty and students. The model treats digital culture as a key indicator of digital maturity, showing how ready institutions are for change, collaboration, and continuous learning.

5.4.4. Teaching and Learning

This pillar is most visible at the Micro level, though guided by Macro and Meso orientations. It follows a maturity pathway from digitized materials to blended and personalized learning supported by analytics. Its key value is linking digital teaching and learning to quality assurance and learning outcomes, rather than treating online learning as only a temporary solution.

5.4.5. Knowledge and Innovation

This pillar extends digital transformation from teaching to research, innovation, and knowledge sharing. At the Macro, Meso, and Micro levels, it covers open data and innovation policy, institutional knowledge governance, and digital research practices with interdisciplinary collaboration. The ASEAN Framework emphasizes that sustainable digital innovation requires strong knowledge governance and open research ecosystems.

5.4.6. External Ecosystem

The final pillar highlights links among universities, industry, communities, and international partners. At the Macro level, it concerns regional and global connections; at the Meso level, strategic partnerships; and at the Micro level, practice-based learning and research. The model views the external ecosystem as a driver of digital maturity, helping universities move from internal digitalization to open innovation.

5.5. Digital Maturity Pathways and Practical Applicability

The model helps higher education institutions assess their maturity across pillars and governance levels and design context-specific transformation pathways. Rather than requiring the highest maturity in all areas at once, it supports selective,

phased progress aligned with institutional resources, priorities, and national contexts.

5.6. Summary of the Model's Value

In summary, the proposed multidimensional digital transformation model based on digital maturity integrates policy, strategy, and practice across governance levels, is contextualized for ASEAN, and is actionable for institutional self-assessment and strategic planning. These features form its key contributions and provide the basis for the policy and governance implications discussed in the next section.

6. Policy and governance implications

Based on the comparative analysis and the proposed multidimensional digital maturity model, this section highlights key policy and governance implications for governments, higher education institutions, and ASEAN regional cooperation.

6.1. Implications for Governments and Policymakers

Governments should treat higher education digital transformation as a systemic reform, aligning it with national digital strategies and long-term development goals. They should establish clear rules for quality assurance, micro-credentials, data governance, privacy, and cybersecurity, while reducing digital divides through targeted support for infrastructure, devices, and digital capacity, especially for disadvantaged institutions and learners.

6.2. Implications for Higher Education Institutions

Universities should embed digital transformation in core strategy, with leadership guiding vision, resources, and cultural change. They need to assess digital maturity across pillars and levels, prioritize human capacity and digital culture alongside infrastructure, and extend transformation to research, innovation, and external collaboration for greater institutional and social impact.

6.3. Implications for ASEAN Regional Cooperation

At the regional level, ASEAN should strengthen higher education digital transformation through shared frameworks for digital maturity, quality assurance, and recognition of digital credits and qualifications. It should also encourage experience sharing and technical support among member states to help transitional countries and reduce regional digital divides.

7. Conclusion and directions for future research

This study examines digital transformation in higher education across selected ASEAN countries and proposes a multidimensional model based on digital maturity. By combining three governance levels (Macro-Meso-Micro) with six strategic pillars, it provides a comprehensive framework suited to ASEAN diversity. Academically, the study extends digital maturity literature to the ASEAN context; practically, the model supports institutional self-assessment and strategic planning for sustainable transformation. However, the study is limited by the lack of primary empirical data and institutional validation. Future research should focus on empirical testing, scale development, and case studies to refine the model and improve its applicability.

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