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Education for Sustainable Development in Higher Education in Southeast Asian Countries: A Systematic Literature Review

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Abstract

This study is a Systematic Literature Review (SLR) that examines the state of Sustainability in Higher Education (SHE) research across Southeast Asia. Guided by the PRISMA framework, the review systematically analyzed peer-reviewed articles published between 2022 and 2026 retrieved from the Education Resources Information Center (ERIC) database. From an initial pool of 6,120 articles, 69 studies met the inclusion criteria, drawn from five countries: Indonesia (n=21), Thailand (n=17), Malaysia (n=12), Vietnam (n=10), and the Philippines (n=9). The study was guided by three research questions addressing the characteristics, dominant themes, and educational development contributions of SHE in the region. Thematic analysis identified five dominant themes: Digital Transformation, Pedagogical Innovation, Sustainability Values and Character Development, SDGs Integration, and Educational Development Research Trends. Digital Transformation emerged as the most pervasive theme, present across all five countries and encompassing AI adoption, blended learning, Learning Management Systems (LMS), and MOOCs. The reviewed studies report potential contributions of SHE at three interconnected levels: individually, through practices associated with critical thinking, ethical awareness, and resilience among students and educators; institutionally, through curriculum reform, governance improvement, and green campus initiatives; and systemically, through their relevance to national educational policies and Southeast Asia's emerging role as a contributor to global sustainability discourse. A recurring pattern across the reviewed literature is that implementation responsive to local cultural, social, and historical contexts is more frequently associated with positive outcomes, suggesting a distinctive characteristic of the Southeast Asian approach. These findings carry potential implications for communities and societies across the region, as the reviewed studies suggest that universities embedding sustainability principles may better prepare graduates to address social, environmental, and economic challenges.

Keywords: Sustainability in higher education (SHE), Higher education, Southeast asia, Systematic literature review, SDGs, Digital transformation

Introduction

Sustainable development has become one of the most pressing global agendas of the twenty-first century. Across sectors, from economy and technology to environment and education, there is a growing recognition that the systems that have been built must be fundamentally rethought if they are to serve both present and future generations. In education, this recognition has taken on particular urgency. As UNESCO (2017) has consistently argued, education is not merely a response to sustainable development, it is one of its most powerful enablers. When education is designed well, it does more than transmit knowledge; it cultivates the values, dispositions, and capacities that make sustainable living possible. For the purposes of this review, Sustainability in Higher Education (SHE) is operationalized as any curricular, pedagogical, institutional, or policy practice within higher education that explicitly integrates the principles of environmental, social, or economic sustainability, encompassing but not limited to Education for Sustainable Development (ESD) as formally defined by UNESCO.

This understanding is not new. Dewey (2004) long argued that education is fundamentally a social process, one through which individuals are initiated into the values and practices that a society needs in order to sustain and renew itself. What is new, however, is the scale and urgency of the challenge. The intersecting crises of climate change, social inequality, technological disruption, and global uncertainty have placed unprecedented demands on educational institutions at every level. Higher education, in particular, finds itself at a crossroads: expected to produce economically productive graduates while simultaneously cultivating the ethical awareness, ecological literacy, and civic responsibility that sustainable societies require. As Rimanoczy (2021) has noted, what is ultimately needed is a sustainability mindset, a set of values and orientations that positions individuals as active, responsible participants in the co-creation of a better world.

Within this global momentum, Southeast Asia represents a region with its own distinctive educational histories, cultural frameworks, and development priorities. As member states pursue national education reforms alongside their commitments to the Sustainable Development Goals (SDGs), higher education institutions across the region, from Indonesia and Thailand to Malaysia, Vietnam, and the Philippines, have increasingly engaged with sustainability agendas through curriculum reform, institutional policy, and pedagogical innovation.

Despite this growing engagement, understanding of SHE research in Southeast Asian higher education remains fragmented. Existing studies tend to be single-country investigations or institution-specific case studies, published across a wide range of disciplinary outlets. Prior efforts to synthesize this field have largely taken the form of global bibliometric reviews. Hallinger & Chatpinyakoo (2019) for instance, mapped the growth trajectory and geographic distribution of higher education for sustainable development research across nearly 1,500 Scopus-indexed publications, finding that the field's knowledge base remains dominated by scholars based in developed regions. Similarly, Grosseck et al. (2019) traced the evolution of Education for Sustainable Development scholarship through a bibliometric analysis of over 1,800 Web of Science-indexed papers, identifying landmark studies, emerging trends, and transformative ideas that have shaped the field over nearly three decades. Both reviews, however, operate at a global scale: neither disaggregates its findings by region, and neither distinguishes how SHE research contributes at the individual, institutional, and system levels within a specific geographic context. This leaves a gap that is twofold. First, at the regional level, no synthesis currently exists that brings together the fragmented, country-specific findings on SHE in Southeast Asian higher education into a coherent, region-wide picture. Second, at the analytical level, the multi-level lens through which SHE contributes to

individuals, institutions, and systems, so far applied only implicitly across scattered single-country studies, has yet to be systematically examined within a dedicated regional synthesis. The present study addresses both dimensions of this gap. Focusing on the 2022–2026 period further addresses a temporal gap: both Hallinger and Chatpinyakoo (2019) and Grosseck et al. (2019) capture scholarship only up to the late 2010s, leaving the most recent, post-pandemic wave of research on SHE in the region synthesized.

To address this gap, the present study adopts a Systematic Literature Review (SLR) as its methodological framework. SLR is particularly well-suited to this kind of inquiry because it goes beyond the simple accumulation of existing studies; it subjects them to systematic scrutiny. By applying explicit, transparent, and replicable criteria for identifying, selecting, and analyzing published research, SLR allows researchers to construct a coherent and evidence-based picture of what a field knows, how it has developed, and where its significant gaps remain (Page et al., 2021). For a study concerned with mapping a geographically dispersed, thematically diverse, and still-emerging field of research, SLR is not simply one methodological option among many; it is the approach best equipped to deliver the kind of regional, synthetic understanding this gap requires.

Through this process, a total of 69 peer-reviewed articles were identified and analyzed, drawn from five Southeast Asian countries: Indonesia (n=21), Thailand (n=17), Malaysia (n=12), Vietnam (n=10), and the Philippines (n=9). Together, these studies offer a substantive and varied body of evidence about how SHE is being understood, practiced, and developed across the region's higher education institutions. To structure our analysis and ensure that the review addressed both descriptive and interpretive dimensions of the literature, the study was guided by three research questions:

1. What are the key characteristics of SHE research in Southeast Asia?
2. What themes dominate SHE research in Southeast Asia?
3. How does SHE contribute to educational development in Southeast Asia?

The first question establishes the empirical foundation of the study, mapping who is researching SHE in this region, how they are doing it, and from what institutional and disciplinary vantage points. The second question moves from description to analysis, identifying the thematic clusters that give the field its intellectual shape and tracing the directions in which it is developing. The third question addresses the most consequential dimension of the inquiry: what difference SHE is actually making, to individuals, to institutions, and to the broader educational systems of the region. Taken together, these questions are designed not merely to summarize the field, but to understand it and in doing so, to offer insights that are useful not only to researchers, but to the educators, institutional leaders, and policymakers who are working to make higher education in Southeast Asia more equitable, more forward-looking, and more genuinely sustainable.

Objectives

Guided by the research questions above, this study aims to: 1) characterize the key features of SHE research conducted in Southeast Asian higher education between 2022 and 2026, in relation to RQ1; 2) identify the dominant thematic patterns emerging across this body of research, in relation to RQ2; and (3) examine the contributions of SHE to educational development at the individual, institutional, and systemic levels within the region, in relation to RQ3. Theoretically, this review contributes a regionally grounded, multi-level (individual, institutional, systemic) framework for understanding how SHE is enacted in Southeast Asian higher education, extending existing global bibliometric accounts of the field.

Methodology

Search Strategies

This study employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method to identify, screen, and select relevant studies related to sustainable development in higher education. PRISMA is a systematic review framework designed to ensure transparency, rigor, and systematic reporting throughout the review process, including the stages of identification, screening, eligibility assessment, and article inclusion (Page et al., 2021). We collected the data specifically from the Education Resources Information Center (ERIC) database because it provides extensive scholarly publications in the field of education. The search was conducted between 1–15 May 2026, using the term “Education for Sustainable Development,” matched against ERIC’s controlled vocabulary (descriptor) terms and refined using the database’s built-in filters for publication type (peer-reviewed journal articles), publication date (2022–2026), and geographic/location scope. To ensure the quality and reliability of the sources, we limited the inclusion criteria to peer-reviewed journal articles with full-text availability. Articles that did not meet the inclusion criteria, such as non-peer-reviewed publications, incomplete texts, or studies unrelated to higher education contexts, were excluded from the review process.

Inclusion and Exclusion Criteria

The inclusion criteria in this study were determined to ensure the relevance and quality of the selected articles. We conducted the search process in the Education Resources Information Center (ERIC) database using the keyword “sustainable development” along with several filters, including peer-reviewed publications, full-text availability, and publication dates ranging from 2022 to 2026. The initial search yielded 6,120 articles. Following the identification stage, we screened the articles based on their titles and abstracts, excluding those outside the scope of higher education ($n = 3,107$) or outside the Southeast Asian context ($n = 2,596$), which resulted in 417 articles retained for full-text eligibility review. During the eligibility assessment, a further 348 articles were excluded for not focusing on universities or other higher education institutions. As a result, 69 articles met all inclusion criteria and were selected for the final analysis in this systematic literature review. These studies served as the primary data for examining characteristics, trends, themes, and contributions of sustainable development research in higher education within the Southeast Asian context.

Data Coding and Analysis

After selecting 69 eligible articles, we conducted a data coding process to organize and analyze the information relevant to the research questions. The coding process was carried out by systematically recording important information from each article to identify patterns and thematic trends in sustainable development research within higher education using Excel. To ensure the quality of the included studies, we assessed each of the 69 articles against a self-developed checklist covering study relevance, methodological clarity, and reporting completeness. The data coding process was conducted by one author and independently verified by a second author to reduce individual bias in categorization. We used thematic categories as the primary framework for coding the data. The thematic categories were developed based on the recurring themes and dominant topics that frequently appeared across the selected studies. These categories included sustainability education, curriculum integration, environmental awareness, sustainable campus practices, policy implementation, student engagement, and other themes related to sustainable development in higher education contexts. In addition to identifying the thematic categories, we also recorded the number of



articles within each theme to determine the most dominant research trends. This process enabled us to examine which topics were most frequently discussed and which areas received less scholarly attention in sustainable development research within Southeast Asian higher education institutions.

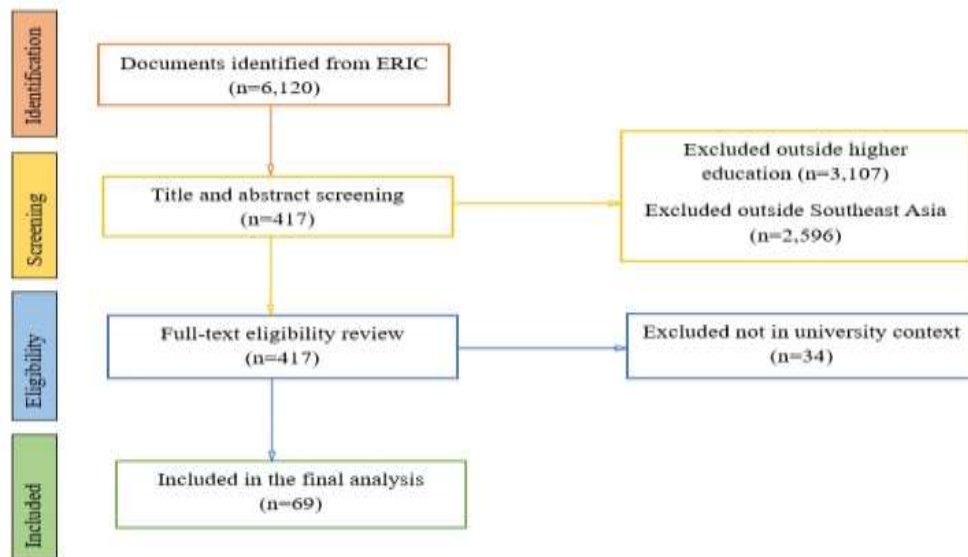


Figure 1 Flow diagram of the systematic review paper selections process

Results

RQ 1: What are the key characteristics of SHE research in Southeast Asia?

The final selection consisted of 69 articles related to sustainable development in higher education within the Southeast Asian context. To identify the geographical distribution of the studies, we categorized the articles based on the countries where the research was conducted.

The findings showed that Indonesia contributed the highest number of publications, with 21 articles focusing on sustainable development in higher education. This indicates that the field has become an increasingly significant topic within Indonesian universities, particularly in relation to educational transformation, sustainability awareness, and institutional practices. The second highest number of studies came from Thailand with 17 articles, followed by Malaysia with 12 articles. Meanwhile, Vietnam contributed 10 articles, and the Philippines contributed 9 articles. These findings demonstrate that research on sustainable development in higher education has gained considerable attention across Southeast Asian countries, although the distribution of publications varies among countries. The dominance of Indonesia and Thailand suggests a growing academic interest in integrating sustainability principles into higher education systems and university practices within these countries.

It is important to clarify the geographic scope of these findings. Although the review targeted Southeast Asia as a whole, eligible articles were retrieved from only five of the eleven countries in the region: Indonesia, Thailand, Malaysia, Vietnam, and the Philippines. No peer-reviewed articles meeting the inclusion criteria were retrieved from Singapore, Brunei Darussalam, Myanmar, Laos, Cambodia, or Timor-Leste within the ERIC database using the study's search strategy for the 2022–2026 period. The findings reported below should therefore be read as characterizing SHE research in Southeast Asian higher education as represented in ERIC, rather than as a complete regional picture. This limitation, along with the study's reliance on a single database, is revisited in the Limitations section.

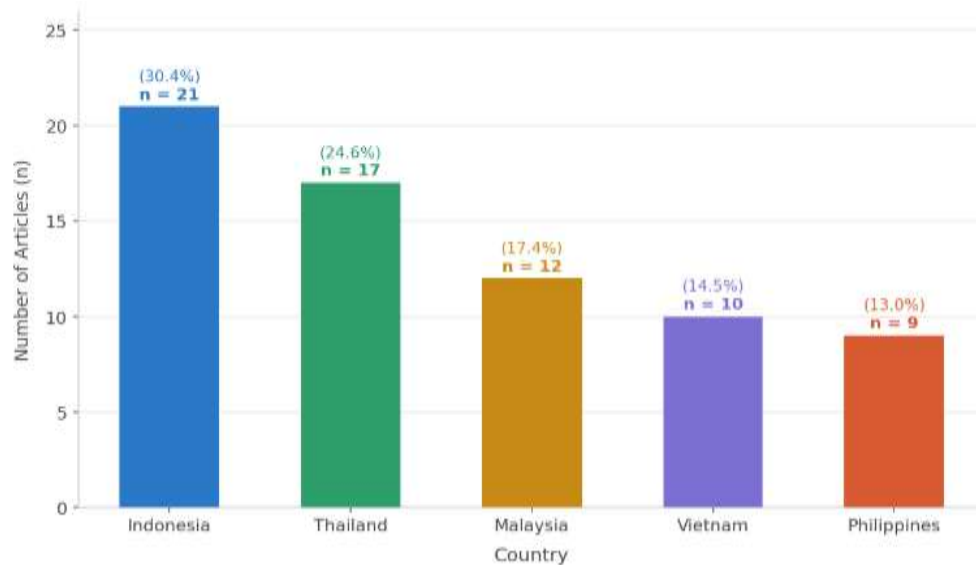


Figure 2 Distribution of Publication by Country

In addition to geographic distribution, several further characteristics were examined among the 69 included studies to fully characterize this body of research (see Table 2). The reference list includes only those studies directly cited in the narrative discussion; the descriptive statistics reported in Table 2 are computed from the full set of 69 coded studies. Publication output shows a distribution weighted toward the more recent years of the search period: 30.40% of the studies were published in 2025, followed by 26.10% in 2022 and 24.60% in 2024, while 2023 (13.00%) and 2026 (5.80%, reflecting the partial year at the time of search) accounted for the smallest shares. In terms of methodology, mixed-methods designs were the most common approach (24.60%), followed by qualitative (21.70%) and quantitative (15.90%) designs, with systematic-review/bibliometric studies (11.60%), research-and-development studies (10.10%), and experimental or quasi-experimental designs (7.20%) also well represented; conceptual or non-empirical literature reviews made up a smaller share (7.20%). Regarding sample composition, most studies drew on multi-stakeholder samples combining students with lecturers or other staff (27.50%) or on students alone (23.20%), while a further 15.90% took published articles themselves as the unit of analysis (systematic reviews and bibliometric studies), 14.50% sampled lecturers, staff, or experts only, and 10.10% relied on documents or other secondary data with no primary human sample. Disciplinary spread confirms that language education and applied linguistics (29.00%) and educational technology or AI in education (21.70%) were the dominant fields, with smaller but consistent clusters in business, economics and management education (10.10%), teacher education (7.20%), and other fields including STEM/health, educational management and policy, and religious education. In terms of institution type, 47.80% of studies were conducted across multiple institutions or did not specify a single institutional sector, 42.00% were based in public institutions, and 10.10% in private institutions. Finally, the great majority of studies (84.01%) were grounded in an explicitly named theory or conceptual model, while 11.60% did not draw on an explicit theoretical framework and 4.30% relied on a framework synthesized by the authors themselves. Taken together, these characteristics indicate that SHE research in Southeast Asian higher education is methodologically diverse, increasingly recent, concentrated in language education and educational technology, and predominantly theory-driven.

Table 1 Summary of Study Characteristics (n = 69)

Characteristic	Category	n	%
Publication Year	2022	18	26.10%
	2023	9	13.00%
	2024	17	24.60%
	2025	21	30.40%
	2026	4	5.80%
Methodology	Mixed Methods	17	24.60%
	Qualitative	15	21.70%
	Quantitative	11	15.90%
	Systematic Review / Bibliometric	8	11.60%
	R&D / Design & Development	7	10.10%
	Experimental / Quasi-Experimental	5	7.20%
	Conceptual / Literature Review (non-empirical)	5	7.20%
	Other / Unclassified	1	1.40%
Sample	Students + Lecturers/Staff (multi-stakeholder)	19	27.50%
	Students only	16	23.20%
	Article/document corpus (unit of analysis = publications)	11	15.90%
	Lecturers/Staff/Experts only	10	14.50%
	Documents / Secondary data (no human sample)	7	10.10%
	Other / Mixed	6	8.70%
Discipline	Language Education / Applied Linguistics	20	29.00%
	Educational Technology / ICT / AI in Education	15	21.70%
	Other / Interdisciplinary	9	13.00%
	Business, Economics & Management Education	7	10.10%
	Teacher Education / Pedagogy	5	7.20%
	Sustainability / Other Discipline-Specific	4	5.80%
	STEM / Health & Medical Education	4	5.80%
	Educational Management, Policy & Governance	3	4.30%
Institution Type	Religious / Islamic Education	2	2.90%
	Public & Private (multiple institutions)	33	47.80%
	Public institution	29	42.00%
Theoretical Framework	Private institution	7	10.10%
	Explicit named theory/model cited	58	84.10%
	No explicit theory (atheoretical/descriptive)	8	11.60%
	Author-developed / synthesized framework	3	4.30%

RQ2: What themes dominate SHE research in Southeast Asia?

Based on a systematic analysis of 69 articles drawn from five Southeast Asian countries, Indonesia (n=21), Thailand (n=17), Malaysia (n=12), Vietnam (n=10), and the Philippines (n=9), five dominant themes were identified across the literature. These themes reflect the overarching priorities and trajectories of SHE research in the region's higher education institutions.

Digital Transformation

Digital Transformation emerged as the most pervasive theme across all five countries, representing the broadest cluster of studies in the reviewed literature. This theme encompasses the adoption and integration of digital technologies, including Learning Management Systems (LMS), Massive Open Online Courses (MOOCs), Artificial Intelligence (AI), blended learning models, and ICT-based instruction, into higher education practice. In Indonesia, studies such as *Digital-Based Smart Campus at Telkom University* (Qurtubi, 2022) and *AI Implementation as Support for Successful Green Campus Implementation* (Rokhmah et al., 2025) illustrate how digital infrastructure is being developed not only for pedagogical purposes but also for institutional sustainability. In Vietnam, research on *Digitalization of Higher Education* (Thu, 2024) and *Innovation in Vietnamese Higher Education for Society 5.0* (Nguyen, 2024)

positions digital transformation as a national strategy aligned with future societal demands. Malaysia's literature similarly addresses digital readiness through studies on MOOCs acceptance (Albelbisi et al., 2022) and digital literacy for the 21st-century workforce (Khan et al., 2022). Thailand and the Philippines round out this theme with research on virtual exchange programs (Higgins, 2024), AI-assisted learning (Peungcharoenkun & Waluyo, 2023); (Meepung, 2025), and technology-supported flexible delivery modalities (Molina, 2025).

Across the region, digital transformation is consistently framed not merely as a technological upgrade, but as a fundamental restructuring of how education is delivered, accessed, and sustained, making it the most dominant theme in the Southeast Asian SHE landscape.

Pedagogical Innovation

The second dominant theme reflects a regional shift away from teacher-centered instruction toward pedagogical models that prioritize student agency, active learning, and contextual relevance. Studies under this theme feature approaches such as Project-Based Learning (PBL), experiential learning, problem-based learning, collaborative learning, peer assessment, and learner autonomy frameworks. Indonesia's research highlights the use of simulation-based learning in cultural subjects (Zulfa et al., 2022) and contextual e-learning design (Alfiriani et al., 2022; Firmansah, 2022; Hermawan et al., 2025), while Thailand's literature examines self-regulated learning (Suphabwongsakul et al., 2025), learner needs analysis (Kanokpermpoon, 2023), and problem-based self-development among teacher education students (Polyiem & Nuangchalerm, 2022). Vietnam contributes research on peer review systems powered by AI that facilitate reflective and collaborative learning (Nguyen et al., 2025), while the Philippines presents evidence on critical thinking enhancement through computer-aided assessment across multiple learning modalities (Molina, 2025). Across these accounts, a consistent pattern emerges despite differences in specific pedagogical models: all four countries represented in this theme, Indonesia, Thailand, Vietnam, and the Philippines, frame pedagogical innovation as a vehicle for cultivating student agency and critical engagement, even as the particular instructional strategies through which this is pursued diverge by national context.

Sustainability Values and Character Development

The third theme addresses the integration of values, ethics, resilience, and character development into higher education curricula and institutional cultures. Unlike the first two themes, which are largely methodological or technological in nature, this theme is fundamentally normative, concerned with *what kind of graduate's* higher education institutions aspire to produce. In Indonesia, studies explore the role of counselors in building adversity quotient (Kusmanto et al., 2024; Tohirin & Mardiana, 2025), the embedding of moderation and legal literacy into digital pedagogy (Dewi et al., 2024; Iskandar et al., 2022; Manu et al., 2025), and the alignment of the Indonesian language curriculum with resilient values derived from the SDGs (Astawa et al., 2024; Roestamy et al., 2025; Rokhmah et al., 2025). In Thailand, research examines multicultural literature (Tangkitjaroenkun et al., 2022) and intercultural sensitivity development (Nattheeraphong et al., 2025). Vietnam's literature emphasizes ESG (Environmental, Social, and Governance) integration into the accounting curriculum as a form of responsible education (Vu, 2025), while the Philippines focuses on resilience and adversity quotient in educational leadership (Dayagbil, 2023; Jose & Cabual, 2025), particularly among institutional leaders navigating post-pandemic challenges. This theme underscores a growing regional consensus that SHE must go beyond knowledge transmission to actively cultivate ethical citizenship, cultural sensitivity, and personal resilience in students and educators alike.

SDGs Integration

The fourth theme captures explicit efforts to align higher education practices with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities), and SDG 17 (Partnerships for the Goals). Malaysia leads this theme with a comprehensive study on *Sustainability in Malaysian Higher Education* that maps institutional sustainability practices and recommends future directions (Kumaran & Idris, 2025; Muftahu, 2023), alongside research on micro-credentials as a tool for human capital development (Raghavan et al., 2025) and inclusive access through indigenous community outreach (*Bei Muij Universiti*) (Awang et al., 2023). Vietnam explicitly connects sustainability to curriculum reform through *Integrating ESG and Sustainability Reporting into Accounting Curriculum* (Vu, 2025), while Indonesia's literature documents the presence of SDGs-aligned values within EFL learning (Astawa et al., 2024; Roestamy et al., 2025) and the Indonesian language curriculum (Iskandar et al., 2022). The Philippines addresses SDGs integration through the lens of educational continuity and graduate employability (Pentang et al., 2022), and Thailand situates global citizenship and lifelong learning within SDGs-related discourses (Piriyaachagul & Nanthawong, 2025; Suphabwongsakul et al., 2025). This theme reflects an emerging institutionalization of sustainability within Southeast Asian higher education, moving from isolated initiatives to systemic curricular and governance-level commitments.

Educational Development Research Trends

The fifth theme encompasses macro-level research focused on governance reform, institutional policy, quality assurance, internationalization, curriculum review, and the emergence of new educational credentials such as micro-credentials. This theme is distinguished by its systems-level perspective, examining how higher education institutions in Southeast Asia are evolving in response to global pressures and regional development agendas. In Vietnam, studies on *Factors Determining Governance Effectiveness in Vietnamese Universities* and the implementation of Decree No. 86/2018 on internationalization reveal the structural dimensions of educational reform (Nguyen et al., 2025). Malaysia and Thailand contribute research on quality assurance frameworks, CEFR-aligned language assessment, work-integrated education, and cooperative learning management (Cheewasukthaworn, 2022; Jaroensombut et al., 2023; Khan et al., 2022). The Philippines documents curriculum revision grounded in tracer study data (Pentang et al., 2022), while Indonesia maps two decades of STEM education research and EMI practices through bibliometric and systematic review methodologies (Lubis et al., 2025). This theme reflects the growing sophistication of educational research in the region, as scholars move from individual classroom studies toward systemic analyses of institutional effectiveness and policy impact.

Table 2 Summary of Research Theme Distribution

Theme	Key Focus	Countries Most Active
Digital Transformation	LMS, AI, MOOCs, blended learning, ICT	All 5 countries
Pedagogical Innovation	PBL, learner autonomy, critical thinking	Indonesia, Thailand, Vietnam, Philippines
Sustainability Values & Character	Resilience, ethics, ESG, intercultural	Indonesia, Thailand, Vietnam, Philippines
SDGs Integration	SDG alignment, inclusion, employability	Malaysia, Vietnam, Indonesia
Educational Development Trends	Governance, QA, internationalization, micro-credentials	Vietnam, Malaysia, Thailand

The analysis reveals that Digital Transformation is the most dominant theme in SHE research across Southeast Asian higher education, present in all five countries and across diverse institutional contexts. This is closely followed by Pedagogical Innovation and Sustainability Values and Character Development, which together indicate a regional move toward holistic, values-driven education. SDGs Integration and Educational Development Trends, while less numerically prominent, represent the most structurally significant themes, as they operate at the policy and institutional levels that ultimately shape the direction of SHE across the region.

Taken together, these five themes reveal both consistency and divergence across the region. A consistent pattern is that Indonesia, Thailand, Vietnam, and the Philippines each pursue SHE through some combination of technological and pedagogical innovation at the classroom level, while Malaysia and Vietnam more often anchor their contributions at the policy and governance level, suggesting a regional division of emphasis rather than a single uniform model of SHE. A further divergence is that while Digital Transformation and Pedagogical Innovation are reported across nearly all five countries, Sustainability Values and Character Development and SDGs Integration are more unevenly distributed, appearing prominently in some national literatures (Indonesia, Vietnam) and only marginally in others (Malaysia), pointing to uneven regional attention to the normative and policy dimensions of sustainability relative to its technological and pedagogical dimensions.

Discussions

What distinguishes this review from prior scholarship is not merely its regional focus, but its attempt to trace how SHE operates simultaneously at the individual, institutional, and systemic levels within a single analytical frame, rather than treating these as separate strands of inquiry. This multi-level synthesis is the review's central contribution: it allows patterns that would otherwise appear as isolated, country-specific findings, a classroom pedagogy here, a governance reform there, to be read instead as part of an interconnected regional phenomenon.

RQ 3 How does SHE contribute to educational development in Southeast Asia?

When we look closely at the 69 articles we reviewed from five Southeast Asian countries, several patterns suggest that SHE is not just an academic concept, but is reported to be reshaping how universities in this region think, teach, and operate. The reviewed literature suggests that these contributions unfold at three levels: the individual, the institutional, and the systemic. These contributions appear notable in part because they seem interconnected: what happens in a classroom is described as rippling outward to shape entire institutions and national policies.

Growing Individuals

Perhaps the most immediate contribution reported for SHE is its effect on the people inside the classroom: students, teachers, and educational leaders alike. A recurring pattern in the literature is that SHE is associated with building critical thinking and real-world problem-solving skills. In the Philippines, research reported that when students were given non-routine problems through computer-aided assessment across blended, online, and face-to-face settings, their higher-order thinking was observed to improve. In Thailand, teacher education students who went through problem-based learning were described as growing into reflective practitioners who could think on their feet. These are the kinds of graduate outcomes that the reviewed literature associates with a sustainable society.

The literature also reports associations between SHE and the cultivation of sustainability literacy and ethical awareness: the capacity to understand one's responsibilities

toward society and the environment. Vietnam's work on integrating ESG (Environmental, Social, and Governance) reporting into accounting education is one example. Students were reported to be learning not only accounting content but also to think like responsible professionals. Similarly, Indonesia's efforts to embed SDG-related values into the language curriculum suggest that sustainability does not have to be confined to science or policy courses; when it is woven into other disciplines, students are described as beginning to see themselves as part of a larger global story.

The literature further reports associations between SHE and resilience and emotional intelligence. The Philippines' research on adversity quotient among university deans found that leaders with stronger resilience frameworks were associated with navigating institutional crises more effectively. Thailand's work on multicultural literature and intercultural sensitivity development points to a similar pattern: students exposed to values-driven education are described as developing a richer emotional and social vocabulary. In a region as diverse as Southeast Asia, this pattern is noted as particularly relevant.

Transforming Institutions

Moving from individuals to institutions, the reviewed literature suggests that SHE is described as an important lever for curriculum reform across the region. In Indonesia, several studies report universities redesigning curricula to embed SDG-aligned values, not as an add-on but as a structural feature of what students are expected to learn. The Philippines' research takes an evidence-based approach, using tracer study data to identify gaps between what graduates can do and what the labor market needs, and revising curricula accordingly. Malaysia's studies describe institutions going further still, challenging conventional degree structures by developing micro-credential frameworks within Open Distance Learning institutions. The literature frames this as reflecting a broader rethinking of what universities are for.

The reviewed literature also reports SHE as associated with quality assurance and governance reforms at the institutional level. Both Thailand and Malaysia have produced research examining how lecturers perceive course quality and how institutions might build more accountable pedagogical systems. Vietnam's investigation into governance effectiveness in universities points to something notable: SHE outcomes are described as depending not only on classroom practice but also on the quality of leadership, the strength of institutional culture, and openness to international collaboration. In other words, the literature suggests that SHE prompts institutions to examine how they are run.

Another contribution reported in the literature is the greening of the campus itself. Indonesia's research on AI-powered green campus implementation at Telkom University is presented as an example of a university aligning sustainability not only in its curriculum but also in the systems that run the campus. This kind of institutional coherence, where what is taught aligns with how the institution operates, is described in the literature as characteristic of genuine educational sustainability.

Shaping Systems and Policies

At the broadest level, the reviewed literature suggests that SHE is beginning to leave a mark on national education policy and regional governance across Southeast Asia. Vietnam offers perhaps the most direct evidence of this. The analysis of Decree No. 86/2018 on the internationalization of Vietnamese higher education is presented as documenting a government's effort to translate sustainability principles, equity, access, quality, into law. The research does not only highlight successes; it also examines where the decree has fallen short, offering policymakers across the region lessons to consider. Vietnam's engagement with

Society 5.0 as an educational framework is presented as a further example of a country seeking to future-proof its education system against technological and social disruption.

Malaysia contributes a different kind of macro-level insight. The comprehensive analysis of sustainability in Malaysian higher education offers a national-level snapshot of where universities stand and where they may need to go. The *Bei Muij Universiti* study is presented as a reminder that macro-level sustainability is not only about policy frameworks; it is also about reaching people who have historically been left behind. Its account of outreach programs bringing higher education awareness to indigenous communities is offered as an illustration that SHE, at its most meaningful, is connected to justice and inclusion.

One pattern worth noting is that, across the region, Southeast Asian researchers and institutions are described as not merely implementing sustainability frameworks designed elsewhere, but generating their own. The governance and management literature, shared between Vietnam and Malaysia within the Commonwealth of Asia framework, is presented as positioning this region as a knowledge producer in its own right, with distinctive insights to offer the global education community.

Local Roots, Global Vision

A recurring pattern across the literature is how SHE in Southeast Asia consistently finds ways to honor local context while reaching toward global standards. Indonesia brings Islamic values into sustainability pedagogy. Thailand uses regional and healing literature to build social consciousness. Malaysia reaches toward indigenous communities to ensure that no one is left behind. The Philippines grounds curriculum reform in the real employment outcomes of its graduates. Vietnam aligns its educational vision with both national development goals and global technological transitions.

The design of the present review was inspired by the global bibliometric work of Hallinger and Chatpinyakoo (2019) and Grosseck et al. (2019), which mapped the growth and evolution of sustainability-in-education scholarship at a worldwide scale. Rather than replicating their global scope, this study applies a comparable systematic lens to a single, geographically bounded region, Southeast Asia, to examine how SHE research manifests when studied on its own terms rather than as a subset of a larger global dataset. In this sense, the present SLR is best understood as a regionally focused counterpart to these earlier global reviews, undertaken in the same spirit of systematic synthesis but with a deliberately narrower and more contextually grounded scope.

Conclusion and suggestions

The analysis of 69 articles across five Southeast Asian countries indicates that SHE within this region is associated with contributions across multiple levels; this claim should be used cautiously, however, as the present study did not conduct a meta-analysis or systematically assess the quality of evidence across the included articles. The reviewed literature consistently reports potential contributions of SHE at the individual, institutional, and policy levels. At the individual level, students and educators engaging with sustainability-oriented curricula and pedagogy are described in the literature as more capable, ethically grounded, and resilient in the face of complex challenges. At the institutional level, SHE is associated with greater accountability, pedagogical innovation, and social equity in university operations and curricula. At the national and regional level, several studies suggest that SHE enables Southeast Asian countries to articulate and assert their own contributions to the global sustainability discourse, rather than merely adopting frameworks developed elsewhere. The evidence further suggests that these reported contributions tend to be most pronounced when

implementation is sensitive to the cultural, social, and historical specificities of each national context. The diversity that characterizes Southeast Asia, far from being reported as an obstacle to regional coherence, is instead portrayed in the literature as a condition that supports the legitimacy and relevance of SHE initiatives in the region. This contextual responsiveness is what several authors identify as distinguishing Southeast Asian SHE as a model worthy of broader scholarly and policy attention.

In light of these findings, several directions warrant serious consideration for researchers, practitioners, and policymakers alike. Future research should prioritize longitudinal and comparative studies that track the sustained impact of SHE initiatives across institutional and national boundaries, moving beyond the predominantly descriptive and cross-sectional designs that currently characterize the field. There is a particular need for studies that examine the long-term outcomes of sustainability-oriented curricula on graduate behavior, professional practice, and civic engagement, dimensions that the existing literature has yet to address with adequate depth. At the institutional level, universities across the region are encouraged to develop more coherent and integrated sustainability frameworks that align pedagogical innovation, governance reform, and campus operations within a unified strategic vision, rather than treating these as separate institutional agendas. Policymakers, for their part, should invest in creating regional platforms for knowledge exchange that enable Southeast Asian institutions to learn from one another's sustainability experiences, recognizing that the most relevant models for any given country are likely to be found within the region itself, rather than imported from Western higher education contexts. Finally, given the underrepresentation of the Philippines and Vietnam in the current literature relative to their population size and higher education scale, targeted research capacity-building initiatives in these countries would contribute meaningfully to a more balanced and representative body of knowledge on SHE in Southeast Asia.

Limitations

This study is subject to several limitations. First, the review relied exclusively on the ERIC database; relevant studies indexed in Scopus, Web of Science, or other regional databases may therefore have been omitted, and the findings should be read as characterizing SHE research as represented in ERIC rather than the field as a whole. Second, as noted earlier, eligible articles were retrieved from only five of the eleven Southeast Asian countries, leaving the experiences of Singapore, Brunei Darussalam, Myanmar, Laos, Cambodia, and Timor-Leste unrepresented in this synthesis. Third, this review did not conduct a meta-analysis or a formal, tool-based quality appraisal beyond the self-developed checklist described in the Methodology; consequently, claims about the reported contributions of SHE should be read as patterns observed across the literature rather than as effects established with statistical rigor. Finally, because data coding was conducted by one author and verified by a second rather than through fully independent double-coding with a calculated reliability statistic, some degree of subjective judgment in thematic categorization cannot be ruled out.

Policy Implications

These findings carry several actionable implications for higher education ministries and institutional policymakers across Southeast Asia. First, given the pervasiveness of Digital Transformation as a theme across all five countries reviewed, ministries are encouraged to formalize national or institutional digital-sustainability strategies, ones that treat AI adoption, blended learning, and LMS infrastructure not as isolated IT initiatives but as integral components of sustainability policy. Second, because SDGs Integration was most often reported as embedded through curriculum reform rather than standalone policy mandates, ministries may consider incentivizing curriculum-level SDG integration directly, for example

through accreditation criteria or funding schemes that reward interdisciplinary sustainability content. Third, the evidence that contextually grounded models, such as Indonesia's integration of Islamic values or Malaysia's indigenous outreach programs, are associated with more durable outcomes suggests that regional policy frameworks should avoid one-size-fits-all mandates and instead allow institutions flexibility to adapt sustainability initiatives to local cultural and social contexts. Finally, given the underrepresentation of some countries in the current evidence base, regional bodies such as ASEAN's education sector could play a role in supporting research capacity-building so that policy decisions across the region are informed by a more balanced body of evidence.

New knowledge and the effects on society and communities

This study contributes new knowledge through a comprehensive, multi-country systematic mapping of SHE research in Southeast Asian from 2022 to 2026. A key finding is that Digital Transformation, encompassing AI adoption, blended learning, LMS, and MOOCs, emerged as the most prominent theme across all five countries reviewed, suggesting a close relationship between sustainability efforts and digital restructuring in higher education. Also notable is the finding that Southeast Asian institutions are described in the literature as not merely adopting externally produced sustainability frameworks but as generating contextually grounded models that integrate local cultural values, indigenous outreach, and nationally specific governance reforms into SHE practices. This is presented as positioning the region as a knowledge producer in the global sustainability discourse, offering a counter-narrative to the uncritical importation of Western higher education models and suggesting that contextual sensitivity may be less a limitation than a condition associated with more durable SHE initiatives.

The central novelty of this review lies in its multi-level (individual, institutional, systemic) lens for reading SHE research. To the authors' knowledge, based on the literature search conducted for this review, no prior study has applied this same multi-level analytical approach to SHE research in Southeast Asian.

The effects of these findings may extend meaningfully to society, local communities, and higher education institutions across the region, although these connections are inferred from the reviewed studies rather than directly tested. At the societal level, universities that embed sustainability principles are reported to produce graduates described as having stronger critical thinking, ethical awareness, and resilience, competencies that the literature associates with workforce quality, social cohesion, and community capacity to address environmental and economic challenges. Marginalized communities may benefit particularly from inclusion-oriented initiatives such as indigenous outreach programs and employability-driven curriculum reform, which the reviewed studies associate with more equitable pathways into higher education and productive employment. For higher education institutions specifically, this study suggests a need to move beyond isolated sustainability initiatives and toward integrated institutional strategies that align curriculum design, pedagogical innovation, governance reform, and campus operations within a unified sustainability vision. Institutions that do so may be better positioned to fulfill their academic mission and to strengthen their relationship with the communities they serve, as agents of equitable and sustainable regional development.

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Consumer Behavior, Marketing, and Supply Chains of Fermented Foods and Health Supplements in Southeast Asia and India

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Abstract

Fermented foods and health supplements are deeply embedded in the dietary traditions of Southeast Asia and India and are increasingly positioned within expanding functional food and preventive health markets. This narrative review aimed to synthesize evidence on four interrelated domains: consumer behavior, marketing dynamics, supply-chain systems, and regulatory and certification issues associated with fermented foods and health supplements in these regions. Peer-reviewed literature was searched primarily through Scopus and Web of Science, with supplementary searches in ScienceDirect, SpringerLink, Emerald Insight, and Taylor & Francis Online, with no year restriction. Studies were screened for relevance to fermented foods and/or health supplements in Southeast Asia and India and were synthesized using thematic and interpretative analysis. The review found that health consciousness, perceived efficacy and safety, cultural familiarity, affordability, physician recommendations, and product credibility are major determinants of consumer acceptance and purchase intention. Digital marketing, e-commerce, social media engagement, influencer communication, and branding increasingly shape market access and consumer trust, particularly among younger and urban populations. Supply-chain development is constrained by limited cold-chain infrastructure, inconsistent standardization, dispersed sourcing, and variable quality control, whereas transparency, traceability, digital logistics, and omnichannel coordination can enhance efficiency and market responsiveness. Regulatory inconsistencies and differences in certification and labeling requirements remain important barriers to consumer confidence and cross-border market expansion. Conceptually, the review proposes a reciprocal ecosystem model in which consumer trust functions as a cross-cutting mechanism linking perceived health value, marketing credibility, certification, product quality, and supply-chain transparency, while regulatory, cultural, and technological factors condition these relationships. Greater regulatory harmonization, scientific validation of health claims, improved supply-chain

infrastructure, and comparative cross-country research are recommended to support sustainable market growth and strengthen benefits for consumers, local producers, and communities.

Keywords: Fermented foods, Health supplements, Marketing dynamics, Consumer perception, Supply chain, Southeast Asia, India

Introduction

Fermentation is an ancient method that helps improve the shelf life and nutritional value of ingredients (Sivamaruthi et al., 2024). Analysis shows that fermented foods made from cereals, vegetables, and fruits in Southeast Asia have higher microbial diversity and nutritional value than non-fermented foods (Surya, 2024). Asian foods are also rich in bioactive compounds that help prevent disease. Probiotics present in these foods significantly contribute to daily nutrition requirements (Doo et al, 2024). The microorganisms in fermented foods were shaped by regional geography, practices, and traditional fermentation knowledge (Tamang et al., 2016; Sivamaruthi et al., 2018a). Cultural identity in local diets is reflected in Nepal's fermented foods, which are processed with rich microbial ecosystems shaped by geography and tradition (Gautam et al., 2025). Most people in Southeast Asian countries have fermented foods in their diet. People of countries like Vietnam have fermented fish products as a primary ingredient of their daily diet. These products reflect their cultural heritage and the unique fermentation techniques of the region (Surya, 2024). Fermented fish products are high in micronutrients and protein, and attention to their safety is needed (Atun et al., 2024). Fermented foods of Asia offer numerous health benefits. The scientific documentation of the fermentation process and technological innovation will enable the products to reach and be accepted globally. Parallel to fermented foods, the health supplements sector has expanded rapidly, supported by growing preventive health awareness (Sivamaruthi et al., 2018a; Chaiyasut et al., 2018).

Combining traditional knowledge with modern food science improves the nutritional benefits of fermented foods and enhances their adaptability (Anal et al, 2019). The fermentation process enhances nutrition and increases the therapeutic value of foods, which positions fermented foods as an important component of preventive nutrition (Farnworth, 2008). Peptides derived from fermented foods have been shown to reduce hypertension, while the antioxidant properties of these foods have immunomodulatory potential. This suggests that fermented foods are a natural therapeutic source (Kleekayai et al., 2015). Regular consumption of fermented foods reduces inflammation, lowers risk factors for metabolic disorders, and aids in managing lifestyle-related diseases (Paul et al., 2023). Clinical trials have provided strong evidence for the role of fermented foods in managing gastrointestinal disorders (Mukherjee et al., 2025). Fermented foods influence host physiology through microbial activity and extend their impact beyond gut health to disease prevention (Sivamaruthi et al., 2018b; Sivamaruthi, 2018; Chaiyasut et al., 2021). The global fermented foods market is anticipated to increase from USD 259.27 billion in 2025 to USD 398.78 billion by 2034, with a compound annual growth rate (CAGR) of 4.9% during the forecast period from 2025 to 2034 (Coherent Market Insights, 2026). This expansion is driven by the escalating consumer inclination towards gut health and probiotic-enriched diets, which has heightened demand for natural and functional foods, and by the growing integration of fermented goods into beverages, dairy, bakery, and plant-based alternatives (Borah et al., 2025).

Southeast Asia is a culturally rich and commercially vibrant region for fermented foods, with traditional items such as tempeh, fish sauce, and fermented rice products constituting a substantial portion of daily diets. The Asia-Pacific region accounts for approximately 40% of the worldwide fermented food market. The region is undergoing heightened urbanization and dietary shifts, rising middle-class incomes and health consciousness, and a proliferation of

functional and plant-based fermented foods. The anticipated increase is bolstered by conventional consumer trends and contemporary retail developments, positioning Southeast Asia as a pivotal centre for innovation and commercialization (Surya, 2024). India is among the rapidly expanding markets for fermented foods, owing to its robust traditional food culture, which encompasses items such as idli, dosa, yoghurt, and pickles. The Indian market size is expected to expand from USD 22.8 billion in 2024 to USD 41.9 billion by 2033, reflecting a compound annual growth rate (CAGR) of about 7%. The probiotic foods market, valued at USD 5.1 billion in 2025, is projected to attain USD 19.8 billion by 2034, with a CAGR of approximately 15.8%. Probiotic beverages and nutritional supplements are experiencing rapid expansion, with double-digit growth rates. The primary factors contributing to this increase are heightened health awareness and understanding of immunity, the proliferation of urban shopping and e-commerce, and the growing desire for functional, clean-label food products. The fermented food sector significantly impacts both macroeconomic and microeconomic systems. The sector encompasses extensive international production of dairy products, beverages, and supplements, as well as high-value exports including yoghurt and kombucha. Fermented foods bolster small-scale and cottage businesses at regional and local levels, improve rural lives and indigenous food systems, and create employment throughout value chains (Rawat et al., 2018; Sathe and Mandal, 2016). In India and Southeast Asia, fermented foods connect traditional knowledge systems with contemporary market economies, generating prospects for value enhancement and commercialization.

The supply chain of fermented foods encompasses both formal and informal industries. Key phases include raw material procurement, conventional or industrial fermentation, processing and packaging, and distribution through local markets, supermarkets, and digital platforms. The sector encounters obstacles, including restricted shelf life, absence of standardization in conventional products, cold-chain constraints, and regulatory and quality assurance complications. Technological innovations and industrial progress are progressively enhancing supply chain efficiency (Niyigaba et al., 2025). Consumer perceptions are swiftly transforming due to shifting lifestyles and heightened health consciousness. Significant trends encompass an intensified emphasis on gut health and microbiome consciousness, a desire for natural, minimally processed, clean-label meals, a rising demand for plant-based fermented goods, and a revitalized interest in classic cuisine rebranded for contemporary appeal. Urban consumers, especially millennials and Generation Z, are driving demand for fermented foods worldwide, including kombucha and kefir, demonstrating a willingness to pay premium prices for functional health benefits (Hossain et al., 2025). Marketing analysis is essential for fermented foods because of market fragmentation between traditional producers and industrial manufacturers, varied regional preferences, and supply chain inefficiencies. It assists in identifying target consumer segments, optimizing product positioning, formulating pricing strategies, enhancing branding, and supporting policy and export promotion efforts, so strengthening global competitiveness (Zhao et al., 2025). Digital transformation is essential for the growth of the fermented food business. Digital marketing enhances consumer awareness of the benefits of probiotics and strengthens brand identity. E-commerce platforms broaden market access, facilitate direct-to-consumer methods, and promote niche and artisanal products. Social media influencers advocate for fermented foods within healthy lifestyles, enhance consumer trust via reviews and demonstrations, and popularize traditional meals among younger demographics. These channels are crucial for startups and small-scale producers, facilitating the scaling of indigenous products and enhancing awareness of obscure fermented foods.

Fermented foods are gaining momentum as global consumers shift toward functional health products. People are becoming aware of gut health, the importance of probiotics and preventive healthcare, which has contributed to steady market growth. The market for

fermented foods has expanded significantly due to rising demand for natural, minimally processed foods with clean labels (Grand View Research, 2026; Market Research Future, 2026). The sector is characterized by a mix of small-scale traditional production and big industrial operations. Urbanization and rising income have resulted in the growth of functional food and supplement sectors (Indian Brand Equity Foundation, 2026). Marketing analysis of them is needed since they contribute significantly to rural and indigenous livelihoods through value chains (FAO, 2018). A clear market analysis provides recommendations to address the challenges the market faces in reaching global markets. Digital platforms, including e-commerce and social media, play an important role in expanding the market by enhancing consumer awareness (Deloitte Insights, 2026).

Previous reviews have substantially advanced knowledge of the nutritional properties, microbial diversity, health effects, traditional processing, and safety of fermented foods, while other studies have examined consumer attitudes, functional food acceptance, digital marketing, or supply chain issues in more specific contexts. However, these strands of evidence remain largely fragmented. In particular, limited research has examined how consumer perceptions and trust are simultaneously shaped by marketing practices, product availability, supply chain transparency, certification, regulatory assurance, and cultural familiarity. Similarly, the relationships between commercialization strategies and operational constraints, such as standardization, cold-chain infrastructure, traceability, and cross-border regulatory differences, remain insufficiently integrated in the existing literature. This fragmentation limits understanding of how market growth actually occurs across the full fermented food and health supplement ecosystem.

An integrated review is therefore needed because consumer behavior, marketing, supply chains, and regulation are mutually dependent rather than isolated domains. Consumer demand influences product positioning and distribution strategies, while marketing communication shapes awareness, perceived value, and trust. At the same time, supply-chain performance determines product availability, consistency, safety, and traceability, whereas regulatory frameworks and certifications influence both market access and consumer confidence. These interactions are particularly important in Southeast Asia and India, where traditional food cultures coexist with rapidly expanding functional food, supplement, e-commerce, and modern retail markets. The present review addresses this gap by synthesizing these interconnected dimensions within a unified conceptual framework.

The overall objective of this review was to synthesize existing evidence on the consumer interface, marketing dynamics, supply-chain systems, and regulatory environment of fermented foods and health supplements in Southeast Asia and India. Specifically, the review aimed to: 1) identify the major factors influencing consumer perceptions, trust, and purchase decisions; 2) examine the roles of digital marketing, e-commerce, social media, branding, and cultural positioning in market development; 3) evaluate key supply-chain characteristics and challenges, including production, logistics, cold-chain management, distribution, transparency, and traceability; and 4) assess how regulatory frameworks, certifications, labeling, quality assurance, and scientific validation influence consumer confidence and market expansion.

The proposed framework conceptualizes the fermented foods and health supplements market as an interconnected ecosystem in which consumer interface, marketing dynamics, and supply chain systems operate through reciprocal rather than linear relationships. Consumer factors, including health awareness, cultural familiarity, perceived value, and product positioning, shape product demand and responses to marketing activities. In turn, digital marketing, e-commerce, social media engagement, branding, and trust influence consumer awareness, perceived value, and purchase intention. These market–consumer interactions generate requirements for production capacity, logistics, cold-chain management, retail

distribution, transparency, and traceability, while supply chain performance affects product availability, quality, safety, and ultimately consumer trust. The entire ecosystem is further conditioned by external drivers, particularly regulatory requirements, certifications, cultural context, and technological enablement, which influence the strength and direction of relationships among consumers, marketing activities, and supply chain operations. Thus, Figure 1 represents a dynamic feedback system in which changes in one component can influence and be influenced by the other components.

Methodology

This study was conducted as a narrative review with a structured literature-search approach, rather than as a formal systematic review or meta-analysis. Peer-reviewed literature was searched primarily in Scopus and Web of Science, with supplementary searches conducted through ScienceDirect, SpringerLink, Emerald Insight, and Taylor & Francis Online. No restriction was imposed on the year of publication; therefore, publications available from database inception up to the final search date were eligible for consideration. Searches were restricted to English-language publications. The search strategy combined terms relating to the two principal product categories and the major domains of interest, including “fermented food,” “fermented product*,” “health supplement*,” “dietary supplement*,” “consumer behavior,” “consumer perception,” “purchase intention,” “marketing,” “digital marketing,” “e-commerce,” “supply chain,” “logistics,” “traceability,” “regulation,” “certification,” “Southeast Asia,”* and “India.” Boolean operators (AND/OR) were adapted according to the search functions of each database.

Studies were considered eligible when they: 1) addressed fermented foods and/or health or dietary supplements; 2) examined at least one relevant dimension of consumer behavior, consumer perception, marketing, commercialization, supply-chain management, logistics, regulation, certification, labeling, quality assurance, or related market factors; 3) contained evidence relevant to Southeast Asia and/or India; 4) were published in English; and 5) provided sufficient information to contribute to the thematic synthesis. Publications were excluded when they were unrelated to the geographical scope or review domains; focused exclusively on laboratory, microbiological, clinical, or technological characteristics without relevance to consumer, market, supply-chain, or regulatory aspects; were duplicates; or did not provide sufficient information for thematic interpretation.

Studies were included when they met the following criteria:

- Peer-reviewed journal articles.
- Articles published in English.
- Studies focused on Southeast Asia and/or India.
- Studies related to fermented foods and/or health supplements.
- Studies addressing at least one of the principal review domains, including marketing, consumer behavior, supply-chain systems, or regulatory issues.
- Empirical studies or high-quality conceptual studies that provided sufficient information relevant to the objectives of the review.

Studies were excluded when they met one or more of the following criteria:

- Non-peer-reviewed materials such as blogs, news articles, and magazine articles.
- Conference abstracts for which a full paper was unavailable.
- Studies outside the selected geographical scope of Southeast Asia and India.
- Studies focusing exclusively on biomedical, microbiological, biochemical, clinical, or therapeutic aspects of fermented foods or health supplements without relevance to marketing, consumer behavior, supply-chain systems, or regulatory issues.
- Duplicate publications.

Industry and market reports identified during supplementary searching were used primarily to provide contextual information concerning market development, commercialization, and industry trends and to facilitate reference tracing. They were not treated as equivalent to peer-reviewed studies in the methodological quality appraisal or primary thematic evidence synthesis.

The database searches identified 132 records, and an additional 27 were found through industry reports and reference searches, yielding 159 records in total. After removal of 31 duplicate records, 128 records remained for title and abstract screening. Of these, 44 records were excluded because they did not meet the predefined scope and eligibility criteria. Consequently, 84 full-text publications were assessed for eligibility; all met the criteria and were included in the final thematic analysis.

Because this work was designed as a narrative and interpretative review rather than a systematic review of intervention effectiveness, a formal risk-of-bias or quantitative quality-scoring instrument was not applied. Instead, priority was given to peer-reviewed scholarly literature indexed in established academic databases, and studies were evaluated for relevance to the research objectives, methodological clarity, contextual relevance, and usefulness for thematic synthesis. This limitation and the narrative nature of the evidence appraisal have now been explicitly acknowledged in the revised manuscript.

The synthesized themes were interpreted across evidence originating from Southeast Asia and India to identify recurrent patterns and context-specific observations. The review was not designed as a formal comparative analysis between the two regions because of heterogeneity in study populations, product categories, study designs, and country-level market and regulatory environments.

Results

1. Consumer Perception of Fermented Foods and Health Supplements

Across the reviewed studies, three recurring groups of determinants emerged as central to consumer acceptance and purchase of fermented foods and health supplements: 1) health-related motivations and perceived efficacy, 2) cultural and social familiarity, and 3) perceived value, credibility, and trust. Health consciousness, preventive-health orientation, perceived effectiveness, and physician recommendations consistently encouraged product adoption, whereas unfamiliarity, sensory concerns, unclear labeling, and perceived risk acted as barriers. Cultural familiarity with traditional fermented foods and herbal products further facilitated acceptance, while affordability, credible brands, scientific validation, and transparent product information strengthened perceived value and purchase confidence (Sulaiman et al., 2025; Huang et al., 2020; Soon et al., 2024; Shrestha et al., 2021; Jadhav et al., 2023; Yeo et al., 2023; Ang et al., 2023; Kim et al., 2021; Ariffin et al., 2021).

Health awareness positively increases acceptance of functional foods, and there is a need for consumer-targeted communication. Unfamiliarity and sensory concerns of the products act as barriers (Sulaiman et al., 2025). The combination of cultural heritage and scientific proof supporting the health benefits of traditional fermented foods improves consumer engagement and market expansion (Lee et al., 2024). The perception of health benefits and flavour may influence purchase intention, and there is a need for balanced product design (Huang et al., 2020).

Consumers usually associate fermented foods with digestion and immunity benefits. Poor and unclear labels, as well as misinformation, affect consumer decision-making (Soon et al., 2024). The consumption of traditional fermented foods has declined with urban lifestyles, but it is now being revived by growing health awareness and modern retail formats (Surya, 2024). Fermented foods like yoghurt are widely accepted due to cultural familiarity

(Tharmabalan et al., 2025). There has been an increase in the consumption of fermented foods among young customers due to social awareness and Wellness initiatives (Waché et al., 2018).

A positive attitude towards fermented foods, strong social influence and religious compliance are important in halal health supplement marketing (Idaman et al., 2024). Even though the use of health supplements is increasing, it remains moderate among consumers. Consumers use these health supplements due to health concerns and physician recommendations. Hence, there is a need for consumer education on the supplements (Shrestha et al., 2021). Due to the increase in health issues caused by different lifestyles, there is a strong drive towards supplement adoption. Credible brands and physician recommendations shape purchasing decisions for health supplements in the Indian market (Jadhav et al., 2023). Repeated purchase of nutritional health supplements is primarily influenced by affordability, while preventive health knowledge and perceived efficacy are potential drivers (Yeo et al., 2023). Beyond demographic factors, health motivation predicts supplement use, highlighting the role of individual health beliefs in consumer decision-making (Ang et al., 2023).

The perceived value of the supplements mediates the relationship between product attributes and purchase intention (Phan & Le, 2023). Among university students, health consciousness and academic stress contribute to the usage of the supplements. This highlights young adults as a growing target market (Yap et al., 2014). Health supplements are perceived as Lifestyle any blood rather than medical products, which denotes the habitual behavior of consumption (Chan et al., 2024). The perceived effectiveness of supplements is an important determinant of loyalty, underscoring the importance of evidence-based claims about the product (Kim et al., 2021). Herbal supplements benefit from cultural familiarity, but they require scientific validation to increase consumer trust (Ariffin et al., 2021).

2. Marketing of Fermented Foods and Health Supplements

Across the marketing literature, three interrelated mechanisms consistently emerged: digital accessibility, trust-building communication, and culturally relevant product positioning. E-commerce and social media expand market reach and facilitate engagement, particularly among younger consumers, whereas platform authenticity, credible branding, transparent influencer communication, and evidence-based health claims determine whether such exposure translates into consumer trust and purchase intention. At the same time, culturally congruent positioning enables traditional fermented foods and health supplements to retain their cultural identity while adapting to modern functional-food markets (Falahat et al., 2019; Ong et al., 2023; Wan Mohd Khair, 2023; Chuah et al., 2023; Hussin et al., 2024; Desembrianita et al., 2024; Dharma et al., 2024; Rodzi & Lee, 2021; Sudaryanto et al., 2021). In detail, supplements have expanded through e-commerce among young consumers, and authenticity and regulation support this (Seow et al., 2026). The purchase intention of Malaysian consumers is strongly influenced by perceived product authenticity on online platforms, underscoring the importance of secure digital commerce (Falahat et al., 2019). Active digital engagement strengthens the brand-consumer relationship and positively influences consumers' purchase intention in competitive online markets (Ong et al., 2023). Even though regulations and quality assurance remain important for consumer trust and market expansion, commerce accelerates market expansion better in Asia (Choi & Mai, 2018). The rise of health awareness and cultural revival is supporting the expansion of the market for fermented foods in East and Southeast Asia (Marco et al., 2017). Social media influencers enhance consumer engagement through brand recall, but transparency is necessary to maintain trust in the health products (Wan Mohd Khair, 2023).

Interactive and informative social media content significantly increases brand awareness and influences purchase intention among health-conscious consumers (Chuah et al., 2023). The higher the engagement level in dietary supplement e-commerce, the higher the

purchase frequency. This indicates the significance of user-centred digital platforms (Hussin et al., 2024). Strong digital branding enhances consumer trust and purchase intention, particularly among digitally active customers (Desembrianita et al., 2024). Endorsement of an authentic influencer for supplement consumption significantly shapes Gen-Z purchase intentions (Dharma et al., 2024). To reach the global market, Asia needs to close the commercialization gap, even though it leads in innovation in traditional fermented foods (Waché et al., 2018). To enhance the global competitiveness of fermented foods, Asia should modernization and undergo scientific validation (Rodzi & Lee, 2021). The market for functional fermented beverages is rapidly expanding, even though scientific substantiation of health claims remains important (Cong et al, 2020). Culturally congruent marketing messages significantly improve consumer response and brand acceptance (Sudaryanto et al., 2021). Sustained growth in health supplements in Southeast Asia is driven by rising disposable incomes, preventive health awareness and digital retailing (Euromonitor International, 2022). Preventive health products like vitamins, protein supplements and herbal products dominate the market, with consumer priorities shifting toward immunity and Wellness (Statista, 2025).

3. Supply chain of Fermented foods and Health supplements in Southeast Asia and India

Localized supply chains for fermented foods improve sustainability. Scalability and standardization challenges should be addressed to support wider distribution of the products (Yee et al, 2025). Supply chain systems for fermentation improve value addition and resilience. They also support rural livelihoods and sustainable food production (Wache et al., 2018). The optimization of e-commerce logistic strategies improves customer satisfaction and increases the competitive advantage of products online (Kawa & Zdrenka, 2023). High supply chain integration improves efficiency and product quality in nutraceutical product markets (Datta et al., 2023). Digital transport tools improve transparency and efficiency. It also supports supply chain resilience (KPMG, 2023). Offline and online channel integration strategies increase consumer reach, and channel coordination improves consistency in brand and customer experience (Luin & Bahri, 2025). Supply chain resilience depends on effective risk management that integrates technology, reflecting the need for adaptive logistics techniques in distribution (Annamala et al., 2025). A transparent supply chain enhances consumer trust and reduces safety challenges (Nguyen & Nguyen, 2025). Supply chain management using big data analytics improves efficiency and market responsiveness (Virgineta et al, 2025). Complex product categories need strong coordination and trust between the retailers and suppliers.

4. Regulations and Certifications

There is a need to balance efficiency with preservation of fermented foods, even though industrialization improves safety (Anal et al, 2020). Though scientific validation and standardization are needed to increase the global market, Southeast Asian fermented foods are culturally accepted (Chaiyasut et al., 2018). Fermented meat products provide numerous bioactive compounds, but they require strict quality control to mitigate safety risks and balance health benefits. Fragmented regulations and multiple intermediaries increase operational complexity. There is a need for integrated governance and policy alignment (Kassahun et al., 2023). Even if regulatory inconsistencies create compliance challenges for companies, robust regulation improves consumer protection and market credibility (Waché et al., 2018). Among Muslim consumers, halal certification increased purchasing intention. This indicates the product's positioning through religious compliance (Wiyono et al., 2022). There is a need for transparent labelling and regulatory assurance since perceived risk negatively affects consumer purchase intention (Grunert et al., 2011). Recognized certifications increase the confidence of purchase in a consumer and positively influence purchase decisions (Ashari, 2025). Consumer adoption of health-related Technology platforms, as explained by the Unified Theory of

Acceptance and Use of Technology framework, explains the use of trustworthy digital health platform ecosystems (Wei et al., 2025).

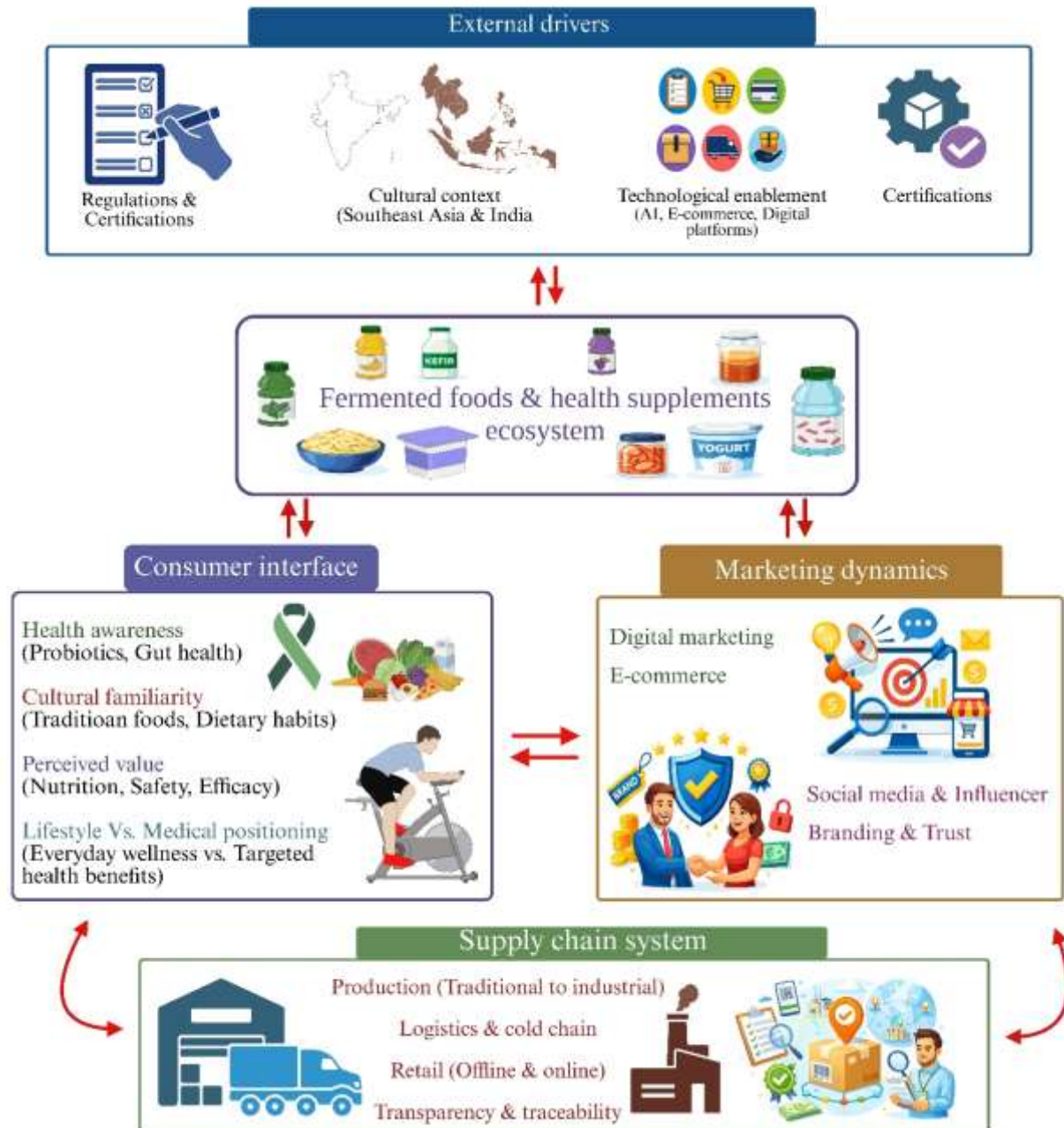


Figure 1 Integrated framework of fermented foods and health supplements ecosystem. The figure presents the dynamic interactions among consumer behavior, marketing strategies, and supply chain systems, moderated by regulatory, cultural, and technological factors in Southeast Asia and India.

Discussions

The review reveals that there are only a few longitudinal studies which analyze the consumer behavior towards fermented foods and health supplements, and there is a lack of interdisciplinary frameworks. The impact of regulations is under-researched, and there is insufficient empirical data regarding it. Quantitative modelling of supply chain efficiency remains limited, and cross-country comparative studies within Southeast Asia remain unexplored.

The reviewed evidence indicates that health consciousness, perceived efficacy, cultural familiarity, and consumer trust are the most consistently supported primary determinants of consumer acceptance. Affordability, physician recommendation, branding, certification, digital engagement, and product accessibility appear to function more as secondary or moderating influences. Evidence regarding health motivation and trust was relatively consistent across contexts, whereas findings on influencer marketing, certification effects, and regulatory influences were more context-dependent and less uniformly supported. These distinctions suggest that market development is driven primarily by perceived health value and trust, while marketing, certification, and supply-chain conditions determine whether these motivations translate into actual purchase and repeated use.

The findings of this literature review denote that traditional foods are deeply rooted in the regional diets of Southeast Asia, and consumption remains strong. Indian consumers exhibit increasing interest in preventive nutrition. Health motivation is the major determinant of consumer behavior. Consumers prefer gut health, comfortable digestion, improved metabolism, and immunity. Health supplements are largely adopted for disease prevention rather than for treatment. In alignment with the consumer value theory, the analyzed literature indicates that physician recommendation, awareness towards preventive health and product efficacy influence the purchase intention of the consumer. Digital platforms enable market expansion and improved product accessibility. Young and urban consumers are influenced by digital and influencer marketing. E-commerce has improved the market level in both regions of the study. The authenticity of digital platforms, social media influencers, and interactive content increases consumer engagement. Supply chain faces challenges in scaling the fermented food market. Even though local production improves rural livelihoods, scalability is hindered by limited cold-chain infrastructure, dispersed sourcing, diverse regulations, and inconsistent product quality control.

In contrast, health supplements exhibit strong vertical integration and a transparent supply chain. A transparent supply chain improves consumer trust, and the review highlights the importance of digital logistics management and omnichannel coordination. Regulatory frameworks are inconsistent across Southeast Asia and India. Robust regulations will enhance consumer protection and market credibility. Halal certifications and recognized quality standards increase consumer confidence towards the purchase. Diverse regulations limit regional harmonization and primarily affect the cross-border expansion of the market. There is a need for standard labeling systems and scientific validation of health claims. Proper cross-country coordination of regulations and enforcement of strict digital marketing guidelines will increase consumer trust in the products.

Conclusion and suggestions

After examining the marketing dynamics, consumer interface, and supply chain of fermented foods and health supplements in Southeast Asia and India, this review highlights increasing health consciousness, the cultural significance of fermented foods, and digital marketing as key drivers of market growth. Consumer trust is strongly influenced by perceived health benefits, product safety, regulatory measures, and credible certification, while supply chains continue to face persistent challenges, particularly limited cold-chain infrastructure, inconsistent quality control, and regulatory differences across countries. By synthesizing evidence from diverse studies, this review provides a holistic understanding of the sector and demonstrates the interconnected roles of consumers, marketing, supply chains, and regulatory systems. Nevertheless, the review is limited by its inclusion of only English-language publications, which may have excluded relevant regional-language studies, and by differences in regulatory and market environments across Southeast Asian countries, which also constrained direct cross-country comparisons.

To address these challenges, governments, industry stakeholders, and community producers should collaborate to strengthen product standardization, transparent labeling, scientific validation of health claims, certification systems, and regulatory harmonization across countries. Greater investment in cold-chain infrastructure, digital logistics, traceability systems, and omnichannel distribution is also recommended to improve supply chain efficiency, market competitiveness, and consumer confidence. Future research should emphasize longitudinal and comparative cross-country studies within Southeast Asia and between Southeast Asia and India, together with empirical assessments of regulations, certifications, consumer trust, and quantitative supply chain performance. Such evidence would improve the generalizability of the findings and support the development of more effective policies and market strategies to promote the sustainable growth of fermented foods and health supplements.

New knowledge and the effects on society and communities

The new knowledge generated by this review is the integrated understanding that consumer behavior, marketing dynamics, supply chain systems, regulation, culture, and technology should not be viewed separately but as interconnected components of a single fermented food and health supplement ecosystem. The framework presented in the study shows that consumer trust acts as an important link among perceived health benefits, product quality, credible marketing, certification, and supply chain transparency. It also highlights how traditional fermented foods can be transformed from locally consumed cultural products into higher-value functional foods when traditional knowledge is combined with scientific evidence, modern processing, branding, and digital commercialization.

For society and communities, these findings may contribute to greater consumer awareness, safer product choices, stronger preventive health practices and more responsible communication of health benefits. At the community level, improved market access and value chain development can support farmers, traditional producers, small enterprises, and rural communities by creating income, employment, and value-added opportunities while helping to preserve indigenous food knowledge and cultural identity. Digital platforms and e-commerce may further enable community-based producers to reach wider markets, provided that they receive adequate support in quality assurance, certification, logistics, and regulatory compliance.

The principal conceptual contribution of this review is the identification of consumer trust as a cross-cutting mechanism linking health-value perceptions with marketing credibility, certification, product quality, and supply-chain transparency.

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Accessibility of Entitled Discount Privileges of Persons with Disabilities in Panabo City, Philippines: An Explanatory Sequential Analysis

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Abstract

The Magna Carta for Persons with Disability, or Republic Act No. 7277, aims to uphold the rights and welfare of persons with disabilities, ensuring protection, social fairness, and equal treatment against discrimination. This study examined the utilization of persons with disabilities' discount privilege in Panabo City, Philippines, to determine the extent of accessibility and the challenges encountered in implementing the law. An explanatory sequential mixed-methods design was employed to integrate quantitative and qualitative findings. A total of 150 respondents were recruited for the quantitative phase via a self-administered questionnaire, and five were selected for the qualitative phase via a semi-structured interview guide. Findings revealed low to moderate utilization of discount privileges across the following categories: establishments, medical services, drugstores and pharmacies, transportation, and basic and prime commodities. It was also found that environmental constraints, procedural, and compliance challenges exist. Hence, there is a gap between the law and implementation mechanisms. Additionally, it is recommended to focus on adopting policies grounded in the practical application and the timely need.

Keywords: Discount privilege, Persons with disabilities, Explanatory sequential mixed-methods, Public administration, Panabo city, Philippines

Introduction

Globally, persons with disabilities are estimated to be around 1.3 billion, which represents approximately 16% of the global population (World Health Organization, 2023). In the Philippines, there are 2,692,605 registered persons with disabilities as of April 30, 2026 (National Council on Disability Affairs, 2026). Persons with disabilities faced persistent health inequities that is more evident for those living in low- and middle-income countries (Smythe et al., 2024; World Health Organization, 2023). Given this, assistance lessens the burden that persons with disabilities carry and improves their overall well-being by making daily needs and essential services more accessible. The government supports them through programs and policies that provide these benefits.

In Indonesia, persons with disabilities continue to face significant challenges when claiming their rights and privileges (Paikah, 2024; Ndhlovu & Mudzingwa, 2022). Similarly, rural areas of Sri Lanka reported that access to auxiliary services for persons with disabilities is inefficient due to discriminatory practices in health and transport services (Liyanage, 2022). In Nigeria, Animashaun & Chitimira (2022) revealed that persons with disabilities experience societal attitudes and systemic discrimination that continue to impede their rights.

In the Philippines, Republic Act No. 7277 or the Magna Carta for Persons with Disability is a landmark legislation of disability laws. Its enactment opened the window to empower and strengthen social protection, welfare, and the rights of persons with disabilities—to participate in education, employment, public services, and access to social services. As years passed, the Magna Carta for Persons with Disability has undergone three major amendments: Republic Acts No. 9442, 10754, and 10747 to continually improve and expand social protection, accessibility to services, and adapt to timely challenges. Notably, under Republic Act No. 9442 and 10754, persons with disabilities are entitled to discount privilege of at least 20% to basic services, including discounts from all establishments recognized by the government to operate, purchase medicine, medical and dental privileges in government and private facilities, and land, air, and sea transportation privileges. These services can be availed by presenting Person with Disability Identification Card or PWD ID issued by the Local Government Unit.

Despite the reforms, the country is still far from becoming inclusive as policies for persons with disabilities are not effectively enforced (Basa et al., 2020). According to studies, the major problems lie in the implementation of policy as persons with disabilities are unaware of the 20% discount they are entitled to due to the poor information dissemination efforts (Respicio & Co., 2024). Moreover, some areas in Northern Samar, Eastern Samar, Samar, and Masbate do not fully comply with the 20% and only offered 10% or applied it only to large establishments and pharmacies (Plan International, 2022). Meanwhile, persons with disabilities of Talaingod, Davao del Norte, reported that they face barriers to governmental services, health care, and general accessibility (Olivar, 2024). Even though there have been multiple laws already in existence, the lack of effective program evaluation and generally inclusive planning further excludes persons with disabilities from enjoying the full benefit of what already exists (Cruz et al., 2021).

This study is anchored in the Human Rights-Based Approach (2003). This framework establishes international human rights as the foundation in planning and implementing policies or programs and focuses on key principles, including participation, accountability, non-discrimination, empowerment, and legality (PANEL). In the context of disability rights, the approach underscores the role of persons with disabilities as right-holders. At the same time, government institutions and service providers are the duty-bearers responsible for ensuring their rights are fulfilled.

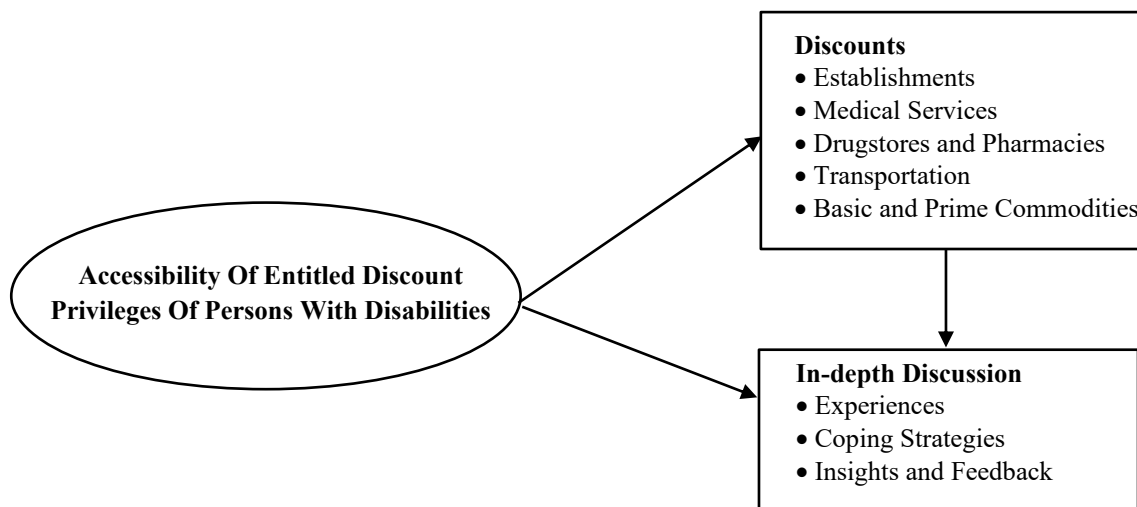


Figure 1 Conceptual framework of the study

Figure 1 demonstrates the concept of the study. The quadrant in the upper-right indicates the discount privileges available to persons with disabilities under the Magna Carta for Persons with Disability. Moreover, the lower-right quadrant represents three indicators: experiences, coping strategies, and insights and feedback. The oval shape integrates both analyses to generate a more comprehensive discussion of the study.

Despite diverse studies in disability policies globally, the practical implementation of policies, especially the discount privilege in the Philippines and how it influences the lives of persons with disabilities remained understudied. There is still limited evidence on disability laws' effectivity, particularly how it is put into practice in low- and middle-income countries; as a result, persons with disabilities who live in these countries continue to face ongoing health and social inequities (World Health Organization, 2022). Additionally, Cruz et al. (2021) noted that these coverage gaps are evident in limited resources, poor targeting of beneficiaries, and unequal access between rural and urban communities. Hence, these gaps highlight the need for a comprehensive analysis that captures the extent of implementation, including the underlying factors influencing accessibility and utilization of discount privileges.

Accordingly, the study aimed to answer the following questions: 1) What is the range of persons with disabilities' discount privileges availment? 2) What are the challenges of persons with disabilities in accessing their discount privileges? 3) What alternatives or other means do persons with disabilities use in availing their discount privileges? and 4) What are the lapses in the implementation of discount privileges and how can it be improved?

In addition, the objective of this study is to: 1) Determine the numbers of persons with disabilities exercising the right to discount privilege across different categories; 2) Examine the lived experiences of persons with disabilities, particularly in exercising their rights to discount privilege; 3) Identify their coping strategies in availing their discount privileges; and lastly, 4) Gather practical insights and feedback from persons with disabilities that affects the implementation of discount privileges. The current study evaluates the policy and implementation of the rights and privileges of persons with disabilities. The results, by explaining the strengths and limitations, inform specific reforms to promote fairer access to the benefits.

Methodology

Study Participants

This study was limited to registered and bona fide persons with disabilities residing in Panabo City aged 18 to 59. In cases where a person with disabilities was unable to respond due to their condition, a legal guardian responsible for using their discount privileges and custody completed the survey on their behalf to ensure data integrity and validity. Moreover, individuals who were not registered or bona fide residents of Panabo City, aged below 18, or aged 60 and above were excluded from the study.

In determining sample sizes in the quantitative phase, the researchers also established a total of 150 respondents, which is more meaningful than an unthinkingly selected large sample (Golzar et al., 2022; Memon et al., 2020). Moreover, in quantitative phase, the researchers employed a mixed sampling technique, random purposive sampling. The technique involves taking a random sample of units in the purposefully selected target population (Kemper et al., 2003), which is characterized as gathering of highly policy-relevant data (Puma et al., 1997) as cited by (Kemper et al., 2003). Initially, the researchers purposively established the criteria for respondents and requested the assistance of local health officials to narrow the list of persons with disabilities in their jurisdiction. Afterwards, the researchers randomly selected anyone on the list.

Moreover, in the qualitative phase, purposive sampling was used to select informants recognized as persons with disabilities leaders purposefully to gather a broader perspective, including the perspective of their respective persons with disabilities members. Polkinghorne (1989), as cited in Alase (2017), recommended that interview-based research include 5-10 participants with similar life experiences. Purposive sampling was highly effective in exploring lived experiences related to an intuitive approach (Dudovskiy, 2017). There were five selected key informants in this phase, they represented different barangays and held leadership roles in the city.

Materials and Instruments

The researchers employed separate instruments for quantitative and qualitative phases to gather comprehensive data. In the quantitative phase, a survey questionnaire was used to gather statistical information about people's attributes, attitudes, or actions by administering standardized questions to a subset or to all members (Buckingham & Saunders, 2004). The survey questionnaire was self-administered, in accordance with the Implementing Rules and Regulations of Republic Act No. 9442, to directly determine the status of the discount privilege.

The questionnaires were pilot-tested and assessed for internal consistency using Cronbach's Alpha; the results indicated an overall score of 0.639. It indicates strong reliability; however, some items were inconsistent due to differences in coding schemes. According to Pallant (2001), as cited in Daud et al. (2018), an Alpha Cronbach value above 0.6 indicates acceptable reliability. Thus, the instrument was found to be acceptable, provided the researchers implemented it with caution.

For the qualitative phase, a semi-structured interview guide questionnaire was established based on the findings from the quantitative analysis. The questionnaire aimed to unravel and elaborate on the experience, overcoming challenges, and insights of persons with disabilities. Key informant interviews were used to select individuals likely to provide the necessary information, ideas, and insights on a particular subject (Creswell & Creswell, 2023).

Design and Procedure

The researchers employed an explanatory sequential mixed-methods design, combining both qualitative and quantitative data collection and analysis in a single study (Clark, 2017). This is to provide statistical evidence on the status of person with disabilities discount privileges and to explore the underlying factors related to the implementation and utilization of discount privileges. This design applied the first phase of quantitative data collection, followed by the second phase of qualitative data collection. It concluded with the third phase, which integrated data obtained from the two separate methods (Toyon, 2021).

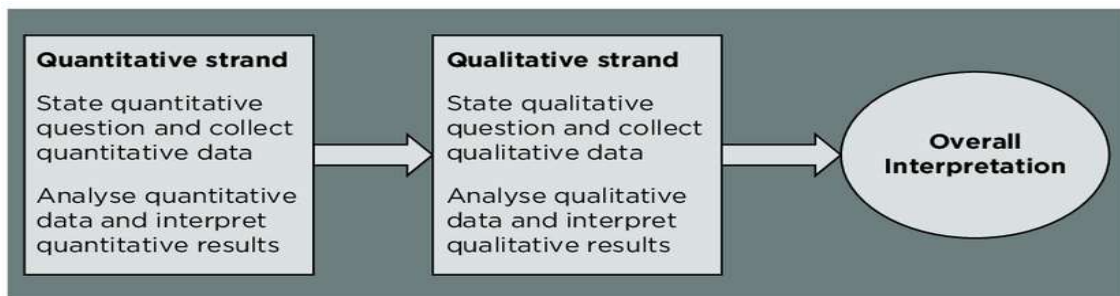


Figure 2 Explanatory Sequential Mixed-Methods Research Design (Okafor, 2018)

Figure 2 presents a visual representation of the study's sequential process model. This design was used to gather quantitative data based on availment of discount privileges to empirical evidence and discover new findings and serve as basis in establishing in-depth questions on qualitative phase. In the quantitative phase, the study assessed respondents' demographics and their varying use of discount privileges. The collected data was analyzed and interpreted descriptively to determine the sample's central tendencies. Descriptive analysis presents current circumstances, behavior, or attributes through a systematic, objective description (Jansen, 2024). After the quantitative phase, the researchers assimilated the quantitative findings to establish qualitative questions.

In the qualitative phase, interview guides are provided to informants before the interview. The data were then analyzed and transcribed to identify similarities and uncover recurring themes in their responses regarding the accessibility of the discount privileges (Jansen, 2024). Afterward, quantitative and qualitative data were integrated and interpreted to yield empirical, conclusive results that informed discussions, remarks, and recommendations. In addition, the study ensured trustworthiness using Lincoln and Guba's (1985) four-factor framework: credibility, dependability, confirmability, and transferability, as cited in Stahl & King (2020).

Ethical Consideration

As standard protocol, participants were informed of the study's purpose and their role, including the right to withdraw at any stage of the study and the responsibilities of researchers in protecting and securing their personal information. Afterwards, the researchers asked the participants if they were still willing to participate in the study. Moreover, in accordance with the Data Privacy Act of 2012, participants' identities and information are concealed to ensure safety and confidentiality. Consent agreement forms were primarily issued to confirm voluntary participation and to ensure that all collected data is used solely for the study and that personal information is securely stored to prevent breaches of confidentiality.

Furthermore, the participants' preferences regarding interview locations were given serious consideration. To ensure their safety and comfort, they were given the prerogative to choose an area that was comfortable and accessible. Making them comfortable demonstrated

the researchers' sensitivity to their individual needs and provided them with a stress-free environment.

In consideration of the feelings and conditions of persons with disabilities, the researchers switched to different modalities to conduct the interview and ensure that persons with disabilities participated by meeting their capabilities. Also, virtual interviews were considered based on the preferences, availability, and condition of persons with disabilities. Additionally, instruments were translated into the native language to ensure respondents and informants could understand the questions clearly. Lastly, after the data is used for their specific purpose, all traces of data from the persons with disabilities survey or interviewed are erased.

Results

Quantitative Findings on Persons with Disabilities Discount Availment Availment of Discount Privilege on Establishments

Table 1 shows a near-equal distribution between respondents who availed and those who did not for the 20% discount privilege on establishments. Out of 150 responses, 78 or 52% of respondents affirmed that they availed the discount privilege, while 72 or 48% did not avail the discount privilege.

Table 1 Availment of Discount Privilege on Establishments
(Recreation Centers, Restaurants, Resorts, and Lodging Establishments)

Establishments			Respondents		Percentage	
Yes			78		52%	
No			72		48%	
Total			150		100%	
Yes - Frequency			No - Reasons			
Frequency	Respondents	%	Reasons	Respondents	%	
Always	21	27%	Lack of awareness	21	29%	
Often	6	8%	Physical difficulties	18	25%	
Sometimes	32	41%	Tediousness	14	19%	
Rarely	19	24%	Do not need the discount	7	10%	
Never	0	0%	No PWD ID and/or booklet	7	10%	
Total	78	100%	Service remains unaffordable	5	7%	
			Total	72	100%	

The distribution showed that out of 78 respondents who availed the discount, sometimes scored the largest with 41%, relatively followed by always with 27% and rarely at 24%. The lowest frequency score is often with 7%. On the other hand, out of 72 respondents who did not avail the discount, lack of awareness scored the highest with 29% closely followed by physical difficulties and tediousness with 25% and 19%, respectively. Moreover, respondents who do not need the discount and no PWD ID and/or booklet are tied at 10%, and the lowest score is due to the service remaining unaffordable at 7%.

Availment of Discount Privilege on Medical Services

Table 2 demonstrates a near-equal distribution of responses to availment of 20% discount on medical services. Medical services refer to services provided for a medically related disability to address the medical needs of a patient, including a physical examination, evaluation, management, and monitoring in public and private facilities. Out of 150 responses, 74 or 49% of respondents expressed that they availed the discount privilege, while 76 or 51% did not avail.

Table 2 Availment of Discount Privilege on Medical Services
(Dental, Diagnostic, and Laboratory Services)

Medical Services			Respondents		Percentage
Yes			74		49%
No			76		51%
Total			150		100%
Yes - Frequency			No - Reasons		
Frequency	Respondents	%	Reasons	Respondents	%
Always	22	30%	Lack of awareness	19	25%
Often	4	5%	Physical difficulties	17	22%
Sometimes	20	27%	Tediousness	15	20%
Rarely	28	38%	No PWD ID and/or booklet	10	13%
Never	0	0%	Do not need the discount	9	12%
Total	74	100%	Service remains unaffordable	6	8%
			Total	76	100%

The distribution revealed that out of 74 respondents who availed the discount, rarely scored the largest with 38%, followed by always and sometimes with 30% and 27%, respectively, while often scored the lowest at 5%. In contrast, out of 76 respondents, lack of awareness scored the highest with 25%, relatively followed by physical difficulties with 22%, and tediousness with 20%. At the same time, no PWD ID and/or booklet and do not need the discount scored almost equal, accounting for 13% and 12% of responses. Notably, service remains unaffordable is the lowest at 8%.

Availment of Discount Privilege on Drugstores and Pharmacies

Table 3 reveals a more positive trend to availment of 20% discount on drugstores and pharmacies. Out of 150 respondents, 85 or 57% asserted to avail the discount privilege, and 65 or 43% answered not availing the discount privilege.

Table 3 Availment of Discount Privilege on Drugstores and Pharmacies

Drugstores and Pharmacies			Respondents		Percentage
Yes			85		57%
No			65		43%
Total			150		100%
Yes - Frequency			No - Reasons		
Frequency	Respondents	%	Reasons	Respondents	%
Always	43	51%	Physical difficulties	14	22%
Often	2	2%	Tediousness	13	20%
Sometimes	24	28%	Do not need the discount	11	17%
Rarely	16	19%	Denied of discount	8	12%
Never	0	0%	Service remains unaffordable	7	11%
Total	85	100%	Lack of awareness	7	11%
			No PWD ID and/or booklet	5	8%
			Total	65	100%

The results indicate that out of 85 respondents who availed the discount, respondents always availed the discount at large with 51%, followed by sometimes at 28% and rarely at 19%, while often scored the lowest at 2%. Furthermore, for 65 respondents who did not avail the discount, physical difficulties, tediousness, and do not need the discount relatively scored 22%, 20%, and 17%, respectively. This is followed by denied of discount at 12%; while service remains unaffordable and lack of awareness scored equally with 11%. Most importantly, the no PWD ID and/or booklet scored the lowest at 8%.

Availment of Discount Privilege on Transportation

Table 4 illustrates a negative trend to availment of 20% discount on transportation. Out of 150 respondents, 66 or 43% affirmed to avail the discount privilege, and 84 or 57% responded to not availing the discount privilege.

Table 4 Availment of Discount Privilege on Transportation
(Bus, Taxis, Ferries, and Airplanes)

Transportation			Respondents		Percentage
Yes			66		43%
No			84		57%
Total			150		100%
Yes - Frequency			No - Reasons		
Frequency	Respondents	%	Reasons	Respondents	%
Always	24	36%	Physical difficulties	27	32%
Often	4	6%	Do not need the discount	17	20%
Sometimes	22	34%	Personal vehicle	15	18%
Rarely	16	24%	Lack of awareness	12	14%
Never	0	0%	Denied of discount	9	11%
Total	66	100%	No PWD ID and/or booklet	4	5%
			Total	84	100%

The survey revealed that among the 66 respondents who availed the discount, always and sometimes almost scored equally at 36% and 34%, respectively, followed by rarely with 24%, while often scored the lowest at 6%. In comparison, out of 84 respondents who did not avail the discount, physical difficulties scored the largest at 32%, followed by do not need the discount for 20%, and personal vehicle at 18%. Moreover, lack of awareness scored 14% and denied of discount with 11%. Notably, no PWD ID and/or booklet scored the lowest at 5%.

Availment of Discount Privilege on Basic and Prime Commodities

Table 5 shows a total downslope to availment of 5% discount on basic and prime commodities. Basic necessities refer to everyday essential goods, including, but not limited to, rice, bread, cooking oil, and other food items needed for daily living. Prime commodities, on the other hand, include goods such as coffee, milk, sugar, flour, and construction materials that are needed but not as frequently as basic necessities. Out of 150 respondents, 47 or 31% claimed to avail the discount privilege, and 103 or 69% responded to not availing the discount privilege.

Table 5 Availment of Discount Privilege on Basic and Prime Commodities
(Grocery Stores and Supermarkets Goods)

Basic and Prime Commodities			Respondents		Percentage
Yes			47		31%
No			103		69%
Total			150		100%
Yes - Frequency			No - Reasons		
Frequency	Respondents	%	Reasons	Respondents	%
Always	12	26%	Physical difficulties	25	24%
Often	13	27%	Lack of awareness	21	20%
Sometimes	17	36%	Tediousness	18	17%
Rarely	5	11%	No PWD ID and/or booklet	14	14%
Never	0	0%	Service remains unaffordable	9	9%
Total	47	100%	Socially Anxious	7	7%
			Do not need the discount	6	6%
			Denied of discount	3	3%
			Total	103	100%

The survey observed that out of 47 respondents who availed the discount on basic and prime commodities, sometimes scored the highest with 36%, followed by always and often, which almost tied with 26% and 27%, while rarely scored the lowest with 11%. On the contrary, out of 103 respondents who chose not to avail the discount, physical difficulties and lack of awareness scored relatively high at 24% and 20%, followed by tediousness with 17, and no PWD ID and/or booklet with 14%. At the same time, service remains unaffordable, socially anxious, and do not need the discount relatively scored low with ranges of 6-9%, followed by the denied of discount with the lowest score of 3%.

Qualitative Findings on the Experiences, Coping Mechanisms, and Insights of Persons with Disabilities Discount Availment

Experiences of Persons with Disabilities in Availing Discount Privileges Stipulated in Republic Act No. 9442

Table 7 indicates the experience of persons with disabilities regarding the implementation of Republic Act No. 9442. The interviews resulted in five themes as discussed: improper compliance, tedious procedures, weak compliance of priority/reserved lanes and seats, communication challenges, and inaccessible physical establishments and facilities.

Table 6 Experiences of Persons with Disabilities in Availing Discount Privileges Stipulated in Republic Act No. 9442

Major Themes	Descriptions	Significant statements
Denial of full enjoyment to discount privileges	This refers to the failure of establishments or service providers to implement the discount privilege as mandated by the law.	Some establishments/service providers do not fully implement the mandated 20% discount privilege. Some establishment/service providers deceive the persons with disabilities that discount privilege is already applied Some establishment/service providers do not apply discount on discounted items Only half of entitled discount amount are applied Some establishment/ service providers completely refuse to give discount
Tedious Procedures	This refers to the lengthy, inconvenient, and time-consuming steps required to access services or benefits.	Service providers or establishments require numerous documents or letter to avail discount Manual recording of availed items in the PWD booklet Manual recording is time-consuming and physically taxing Availing benefits requires multiple documents and verification, if availed by a guardian.
Weak Compliance of Accessibility Features	This refers to the inadequate enforcement of designated areas for persons with disabilities, such as reserved seats, lanes, or parking spaces.	Reserved seats for persons with disabilities are not properly observed Reserved parking spaces are sometimes occupied by abled people. Some establishments/ service providers do not properly observe the priority lane
Communication Challenges	This refers to barriers hindering information dissemination	Some persons with disabilities are reluctant to participate in assemblies or orientations Some persons with disabilities are living in remote area or no longer residing at their address to attend assemblies or orientations. Some persons with disabilities do not have access to updates made virtually. Some service providers or establishment do not primarily ask the persons with disabilities if they will avail their discount privilege.
Inaccessible Establishments and Features	This refers to establishment and spaces that fail to accommodate basic accessibility features for persons with disabilities.	Some establishments lack basic accessibility features for persons with disabilities. Some establishments are hard to navigate for persons with disabilities due to tightness or close-space design. Some establishments only have stairs without ramps or railings. Some establishments or service providers do not have priority lanes.

Denial of full enjoyment to discount privileges

Improper compliance is among the common problems faced by persons with disabilities today in exercising their privileges; findings reveal that several establishments apply the mandated discount privilege in partially or lesser than what is stipulated in the law. This creates uncertainty during transactions and may result in unintentional denial of benefits. Such practices undermine the purpose of discount privileges, which are intended to reduce the financial burdens of persons with disabilities. According to House Speaker Romualdez, the privileges given to seniors and persons with disabilities should be strictly followed in order to avoid the normalization of poor conduct (Cervantes, 2024). Informants attested to experience instances in which discounts are way below the mandated 20% discount for certain items.

“Dili sila motuman sa 20% discount. 3% ang ihatag.” (KII 3)

Filipino Translation:

Hindi nila sinusunod ang 20% diskwento. 3% lang ang binibigay.

English Translation:

They do not follow the 20% discount; only 3% is given.

As such, the denial of rights, even with a partial discount, is evident. The inconsistent application of discount privileges, based on the experience of informants, demonstrates not only a lack of compliance but also a normalization of neglect that is contrary to the intent of the government. This implies that proper recognition of persons with disabilities' identities thus lacks the public service. Other informants have also experienced indirect denial of discount fare in public transport.

“Kung musakay ka sa bus, ingnon ra ka nga tanan naa discount.” (KII 2)

Filipino Translation:

Kung sasakay ka ng bus, sasabihan ka lang na lahat ay may diskwento.

English Translation:

When you ride the bus, they say everyone gets a discount.

Tedious Procedures

Procedures in discount availment serve as a challenge due to the numerous and strenuous processes needed to be accomplished. Under the Republic Act No. 9442 and Administrative Order No. 8, series of 2017, explicitly indicate the requirement of presenting the PWD ID and the booklet as a prerequisite to avail in purchasing of medicine and basic and prime commodities. However, informants implied that the requirements and procedures further burden their already difficult position, thereby discouraging them from availing. Although the verification process is much needed, it leads to excessive red tape that burdens the ultimate users. Informants affirmed that this is commonly experienced by them and the members.

“Naa na kay reseta ug ID. Ang kulang na lang ang booklet, pero dili gihapon ka tagaan og discount.” (KII 3)

Filipino Translation:

Meron ka ng reseta at ID. Ang kulang lang ay booklet, pero hindi ka pa rin bibigyan ng diskwento.

English Translation:

You already have the prescription and ID. The only missing requirement is the booklet, yet they still refuse to give the discount.

“Ingon sila nga isulat pa sa booklet. It takes time para isulat.” (KII 2)

Filipino Translation:

Sabi nila isusulat pa raw sa booklet. Matagal bago ito maisulat.

English Translation:

They said it still needs to be written down in the booklet. It takes time to write it.

In addition, persons with disabilities who are incapable of availing their discount usually request their guardians to transact it on their behalf, with several conditions required to complete the availment successfully. The informants reported that there are a lot of requirements needed to prepare before guardians can successfully avail the discount privilege, which serves as a burden. The process is rendered even more inaccessible by geographic barriers, as journeys back and forth only increase the costs in terms of financial implications and time. Informants expressed that these processes and procedures are financially and physically burden.

“Kapoy ang proseso. Kinahanglan ko mohimo og authorization letter, kuhaon ang barangay certification, ipakita ang akong valid ID, pirmahan ang tulo ka kopya sa ako ID photocopy, ug apilan og photocopy sa valid ID sa akong igsoon.” (KII 3)

Filipino Translation:

Nakakapagod ang proseso. Kailangan ko pa gumawa ng authorization letter, kunin ang barangay certification, ipakita ang aking valid ID, pirmahan ang tatlong kopya ng aking ID photocopy, at isama ang photocopy ng valid ID ng aking kapatid.

English Translation:

The process is tiring. I had to prepare an authorization letter, get a barangay certification, present my valid ID, sign three photocopies of my ID, and include a photocopy of the valid ID of my sibling.

“Ang nagpuyo sa bukid kinahanglan pa mo-uli aron maghimo og authorization letter, ug mahal ang pamasahi.” (KII 4)

Filipino Translation:

Ang nakatira sa bukid kailangan pang umuwi para gumawa ng authorization letter, at ang mahal pa ng pamasaha.

English Translation:

Those living in the mountains are required to return home to prepare an authorization letter, and the fare is expensive.

Administrative problems deter persons with disabilities from receiving benefits and often prevent them from claiming their entitlements due to inconvenience (Schweitzer et al., 2022). Slow and inefficient processes continue to discourage persons with disabilities from fully accessing their mandated benefits, which forces them to undergo lengthy documentation. These tedious procedures impose emotional and financial strain that is made worse by overdependence on documentation and location difficulties.

Weak Compliance of Accessibility Features

Access to priority and reserved spaces remains difficult for persons with disabilities due to rules that are not strictly followed. Informants unveiled that the weak compliance is rampant and not strictly observed. At the same time, some groceries and supermarkets do not have reserved lanes, while some do not strictly observe the reservation of the lane. Informants added that even when signs for priority lanes or spaces exist, people largely ignore them, and service provider staff do not monitor their proper use. The Department of Justice strongly denounced businesses that resist setting up priority lanes even for limited-quantity sales, but some establishments ignore or refuse to introduce the concept of priority lanes (Bautista, 2024). In such situations, social exclusion becomes apparent as persons with disabilities are unable to fully benefit from accommodation that is intended to support them in public spaces. Informant revealed occurrence in which reserved space were nonexistent.

“Walay special lane ang ubang grocery ug mall para sa mga persons with disabilities.” (KII 1)

Filipino Translation:

Walang special lane ang ibang grocery at mall para sa mga taong may kapansanan.

English Translation:

Some groceries and malls do not have special lanes for persons with disabilities.

Moreover, the problem of transportation accessibility for persons with disabilities is serious. According to informants, persons with disabilities had no opportunity to use the seats dedicated to them. This non-compliance sets an issue in the confidence of the system. Statutory rights are practically unavailable when there is a lack of strict application of the law. Informant addressed that the reality is different from what is supposed to be implemented.

“Sa bus, adunay mga lingkoranan nga para sa mga persons with disabilities, pero pag-abot nimo, gisakyan na sa abled nga pasahero.” (KII 5)

Filipino Translation:

Sa bus, may mga upuan na nakalaan para sa mga taong may kapansanan, pero pagdating mo, inuupuan na ng mga abled na pasahero.

English Translation:

Buses have seats reserved for persons with disabilities, but when you arrive, an able-bodied passenger is already occupying the seat.

Poor enforcement and implementation continue to undermine the intended protection of the rights of persons with disabilities. Ineffective administrative control and public disregard leave persons with disabilities vulnerable to systemic neglect. These findings further strengthen the explanation and provide additional evidence for the difficulties persons with disabilities experience in discount availment in the quantitative phase of this study. Therefore, authorities must improve the monitoring systems and enforce greater accountability among the service providers to ensure the most effective use of available resources (Fiene, 2024).

Communication Challenges

Persons with disabilities face persistent issues in communication that have affected their awareness, understanding, and availment of discount privileges. According to informant, some members are reluctant to attend meetings, and some are residing in remote area, which make it difficult to reach. In the absence of proper communication channels, some persons with disabilities are expected to be unaware of the activities and benefits available to them. Informant described these instances highlighting challenges due to limited means of communication among members.

“Unsaon pagpahibalo sa ilaha? Daghan sa akong mga miyembro ang kapoyan muattend sa among mga meeting.” (KII 3)

Filipino Translation:

Paano ipapaalam sa kanila? Karamihan sa mga miyembro ko ay tinamid pumunta sa mga meeting.

English Translation:

How do will we inform them? Many of my members are reluctant to attend our meeting.

In other realities, accessibility to important announcements and crucial information remains difficult due to availability of communication channels. In this regard, virtual announcements serve as a convenient avenue for easy access. However, for those that do not possess devices to navigate online communication platforms or live far from persons with disabilities' leaders, they cannot effectively utilize their mandated privileges due to the lack of

awareness. As emphasized by KII 5, persons with disabilities that do not have any devices or anyone credible to ask queries remain underserved.

“Sama sa uban walay cellphone or anything para ma-contact, lisod jud sila i-communicate. Labi na tong lagyo ang balay nga halos walay silingan.”
(KII 5)

Filipino Translation:

Kagaya sa iba na walang cellphone or kahit ano para ma-contact, mahirap talaga sila i-communicate. Lalo na yung malalayo ang bahay ni halos wala ng kapitbahay

English Translation:

Others that do not possess cellphones or anything to contact them, it is really hard to communicate with them, especially those that lived far with almost no neighbor.

Inaccessible Establishments and Features

The non-compliance with accessibility standards continues to limit the mobility of persons with disabilities and their access to essential facilities. Both the government and privately owned establishments are yet to fully adhere to Batas Pambansa Blg. 344, or the Accessibility Law, compelling structures to have facilities that accommodate the mobility of the persons with disabilities (Binghay, 2020). As supported by informants, several establishments lack ramps, accessible comfort rooms, or PWD-friendly features. Hence, persons with disabilities cannot fully navigate most of the buildings and structures in Panabo City. According to KII 1,

“Ang accessibility sa mga building kabahin na sa privilege, pero dili accessible sa mga persons with disabilities.” (KII 1)

Filipino Translation:

Ang madaling pag-access sa mga gusali ay parte ng pribilehiyo, pero hindi ito ganap na naa-access para sa mga taong may kapansanan.

English Translation:

Building accessibility is a privilege, but the buildings are not accessible to persons with disabilities.

That said, poor infrastructure planning is a flaw that results in the exclusion of persons with disabilities in society. There are frustrations with constant problems in the infrastructures, particularly for individuals that have physical mobility issues. Although the majority of facilities satisfy the interests of ordinary citizens, barrier-free access for persons with disabilities is usually ignored and rejected (Bognot et al., 2023). As noted by KII 5,

“Ang mga ramp para sa persons with disabilities among gireklamo. Apil pod ang mga comfort room nga dili PWD-friendly.” (KII 5)

Filipino Translation:

Ang mga rampa para sa mga taong may kapansanan aming inireklamo. Pati na rin ang mga comfort room na hindi PWD-friendly.

English Translation:

We filed complaints about the persons with disabilities ramps. We also raised concerns about comfort rooms that are not PWD-friendly.

More so, the overall implication is that individuals with mobility issues face significant limitations in accessing establishments. People with physical disabilities are unable to explore the surroundings of the built environment. The inaccessibility of buildings becomes a direct path towards social isolation. KII 3 further shared,

“Ingon akong mga physically disabled nga miyembro nga kapoy mosulod tungod sa mga building nga dili accessible.” (KII 3)

Filipino Translation:

Sinabi ng aking mga miyembrong may pisikal na kapansanan na nakakapagod pumasok dahil sa mga gusaling hindi naa-access.

English Translation:

My physically disabled members said it is tiring to enter buildings that are not accessible.

Beyond the most apparent and evident difficulty of persons with disabilities is physical inaccessibility, which is yet to be solved. Despite existing laws, weak enforcement and poor infrastructure planning continue to limit the mobility of persons with disabilities and participation in society. Universal design principles, which consider the physical abilities of all individuals, must be consistently applied to create equitable and inclusive spaces (Centre for Excellence in Universal Design, 2025). Without proactive adoption of these approaches, persons with disabilities remain excluded, and accessibility remains theoretical rather than practical. Authorities and service providers must take immediate action to ensure that built environments genuinely accommodate all users.

Coping Strategies of Persons with Disabilities in Overcoming the Challenges of Availing Discount Privileges Stipulated in Republic Act No. 9442

Table 8 shows the data on mechanisms to overcome challenges of persons with disabilities in the implementation of Republic Act No. 9442. Three themes were derived from the interviews: information dissemination efforts, alternative means of discount privilege availment, and access to institutional support.

Table 8 Coping Strategies to Overcome Challenges of Persons with Disabilities in Availing Discount Privileges Stipulated in Republic Act No. 9442

Major themes	Descriptions	Significant statements
Information Dissemination Efforts	This refers to the organized activities and channels used to inform persons with disabilities about their rights and privileges.	Barangay federation leaders help disseminate information using social media platforms. Information campaigns are conducted in barangays to increase persons with disabilities awareness of their benefits and privileges. Persons with disability leaders conduct house-to-house visit to orient of their rights and privileges, including discount Meetings serve as an alternative method for disseminating information.
Alternative Means in Discount Privilege Availment	This refers to the practices persons with disabilities adopt to cope with challenges in availing discounts.	Authorized representatives may avail of the discount on behalf of persons with disabilities Alternative requirements allow representatives to access benefits for persons with disabilities. Other supporting documents are accepted for discount availment when the booklet is unavailable. Temporary alternatives may be used while official documents are pending release. The use of discount privilege is also available through online stores.
Access to Institutional Support	This refers to the access of persons with disabilities to assistance and intervention from official offices and staff when facing issues with benefits, discrimination, or non-compliant establishments.	Concerns regarding discount implementation can be reported to appropriate government offices. Assistance from establishment personnel helps address concerns during transactions. Complaints regarding denied benefits may be elevated to management for resolution. Incidents of discrimination are reported to responsible authorities or management. Persons with disabilities are able to seek clarification from relevant offices regarding their rights and benefits.

Information Dissemination Efforts

One of the major problems in exercising the entitled discount privileges of persons with disabilities is awareness. The federation presidents and barangay leaders-initiated strategies on information dissemination efforts to reach and combat the lack of awareness and misinformation regarding persons with disabilities rights and privileges. The use of digital platforms enhances the efficiency of information dissemination, which helps address the gap where a significant number of persons with disabilities remain unaware of their discount privileges. According to Lagura (2025) in the digital age, the utilization of e-government websites is crucial to the improvement of public service delivery. Informants shared that updates are shared through social media platforms, group chats, and official disability websites,

“Barangay man gud naa tay mga gitawag nga federation president, and then gina post napud na sya sa mga social media, mga ingana then ma source napud na nila..” (KII 2)

Filipino Translation:

Sa mga barangay, meron tayong tinatawag na federation president, and then nagpopost sila sa mga social media, tapos yan na ang magiging source nila.

English Translation:

In the barangay, we have what we call federation presidents, and then things get posted on social media, and from there, they can use it as a source.

“Naa pud miy groupchat kauban ang mga PWD president sa 40 barangays. Naa pd miy groupchat sa mga federation presidents of each barangay para mag initiate ug meetings..” (KII 1)

Filipino Translation:

Meron din kaming groupchat kasama ang mga PWD president ng 40 barangays. Meron rin kasama nag mga federation presidents of each barangay para mag initiate ng meetings

English Translation:

We have groupchat together with the PWD presidents of 40 barangays. We also have a groupchat with the federation presidents of each barangay to initiate meetings.

Furthermore, to enhance service delivery, the City Social Welfare and Development Office, in collaboration with the person with disability presidents, conducts the same campaign by visiting barangays and house-to-house directly. The local government has acknowledged the fact that persons with disabilities are limited and having difficulties navigating through online platforms and require special assistance, which leads to conduct of face-to-face meetings. Informants shared an experience organizing one of persons with disabilities' assembly meetings.

“Ang City Social Welfare and Development Office nagdumala ug mga assembly meeting. Sa General Assembly, among ipahibalo sa ila ang ilang katungod isip usa ka persons with disability aron maka-avail sa mga diskwento.” (KII 2)

Filipino Translation:

Ang City Social Welfare and Development Office ang nagsasagawa ng mga assembly miting. Sa General Assembly, ipinapaalam namin sa kanila ang kanilang karapatan bilang isang taong may kapansanan nang sa ganon makapakinabang sila sa mga diskwento

English Translation:

The City Social Welfare and Development Office conducts assembly meetings. During the General Assembly, we inform them of their rights as a person with disability to avail of discount privileges.

“Ang mga federation president maoy mobisita ug mosusi sa matag purok ug sa kahintang sa mga persons with disabilities aron makareport sila kanamo ug among ma-follow up ug mabisita.” (KII 1)

Filipino Translation:

Ang mga presidente ng pederasyon ang bumibisita at sumusuri sa bawat purok at sa kalagayan ng mga taong may kapansanan para e-report sa amin para ma follow-up at ma bisita.

English Translation:

The federation presidents visit each purok and assess the condition of persons with disabilities so they can report to us, allowing us to follow up and visit them.

The consistent involvement of persons with disabilities leaders shows that active coordination is crucial for effective information dissemination. The Plan International (2022) recommends an information dissemination campaign through LGUs to enhance awareness of persons with disabilities of their rights and entitlements. The local government unit must enforce proactive measures to institutionalize these practices and guarantee that no PWD is excluded from critical information and services.

Alternative Means in Discount Privilege Availment

It has been revealed that persons with disabilities often resort to alternative means to avail their discounts when the required PWD ID or booklet is not available. Informants have identified practices that enabled them to overcome issues in their discount availment. This demonstrates their resilience and resourcefulness in navigating procedural barriers. KII 2 shared that a guardian avails the privilege instead of persons with disabilities themselves.

“Ang guardian makakuha sa benepisyo basta magdala sila og authorization letter.” (KII 2)

Filipino Translation:

Ang guardian ay makakakuha ng benepisyo basta’t may dala silang authorization letter.

English Translation:

The guardian can avail of the benefit as long as they bring an authorization letter.

On the other hand, some persons with disabilities manage to claim their discount even when they forget to bring their ID or booklet. They present alternative documents that service providers sometimes accept in place of the booklet. This flexibility allows persons with disabilities to access essential services without unnecessary delays or additional travel, which reduces frustration and maintains the practical value of the benefit granted. KII 2 mentioned,

“Kung makalimot ko og dala sa akong booklet, ipakita ra nako ang reseta sa tambal ug ID.” (KII 5)

Filipino Translation:

Kung malilimutan kong dalhin ang booklet ko, ipinapakita ko lang ang reseta nang gamot at ID.

English Translation:

If I forgot to bring my booklet, I just show the medical prescription and ID.

In addition, online alternatives also exist as certain online stores accept proof of having the PWD ID to avail discounts. This improvement enables persons with disabilities to purchase necessities or avail services at the convenience of their personal space. KII 3 stated that,

“Ang mga persons with disabilities mahimong makapahimulos sa susamang mga serbisyo sa online stores pinaagi sa paghatag sa parehas nga mga kinahanglanon nga gikinahanglan sa mga pisikal nga tindahan.” KII 3

Filipino Translation:

Maaaring makapag-avail ang mga taong may kapansanan ng katulad na mga serbisyo sa mga online na tindahan sa pamamagitan ng pagbibigay ng kaparehong mga kinakailangan na hinihingi sa mga pisikal na tindahan.

English Translation:

Persons with disabilities can avail similar services in online stores, providing the same requisites as physical stores.

Access to Institutional Support

The role of the public institutions is to provide services that sufficiently meet the demands, as well as expectations, of the populations they cater (Levara & Gamale, 2025). To combat discrimination and mistreatment, persons with disabilities actively report incidents and seek assistance from authorities or establishment staff. According to Gulla (2024), approximately 2,000 complaints on denied discounts and benefits for persons with disabilities were filed before government agencies. Informants confirmed that they have reported non-compliant establishments and requested guidance from service providers. This shows that persons with disabilities are willing to take action to ensure that their rights are respected. KII 5 addressed that,

“Naay ubang establisyemento nga wala nagsunod sa mandated discount. Ako silang gireklamo sa City Social Welfare and Development Office.” (KII 5)

Filipino Translation:

May ibang establisyementong hindi sumusunod sa mga mandatong diskwento. Akin silang inireklamo sa City Social Welfare and Development Office.

English Translation:

Some establishments do not follow the mandated discount. I filed a complaint with the City Social Welfare and Development Office.

Although the Magna Carta for Persons with Disability explicitly forbids the practice of denial of service to people with disabilities, they still happen to persons with disabilities. The situations are often made worse when the subject of the experience is not only refusal of the services that persons with disabilities are privileged to avail of, but they are also forced to take certain actions themselves to claim or protect their rights due to problems encountered in availment. In that sense, institutional recognition gives back a sense of dignity. KII 1 shared,

“Nakasinati ko nga wala ko gihatagan og discount sa grocery store, maong gireklamo nako sila sa management.” (KII 1)

Filipino Translation:

Naranasan kong hindi mabigyan ng diskwento sa grocery store, kaya inireklamo ko sa kanilang tagapamahala.

English Translation:

I was not given a discount at the grocery store, so I filed a complaint with the management.

Additionally, KII 4 stated that persons with disabilities are aware of the discounts available to them, but not everyone knows how to take advantage of them. This level of unawareness often leads to confusion and indecisiveness when attempting to avail oneself of the benefit. Still, others are willing to be informed and take the initiative to seek clarification.

“Kabalo ta nga naa tay diskwento, pero dili pasabot nga kabalo ta sa tanan. Kung naay kalibugan, moadto ko sa among opisina sa Persons with Disability Affairs Office aron maklaro.” (KII 4)

Filipino Translation:

Alam natin na meron tayong diskwento, pero hindi ibig sabihin na alam natin lahat. Kung merong kalituhan, pupunta ako sa aming tanggapan sa Persons with Disability Affairs Office para linawin.

English Translation:

We know we are entitled to discounts, but that does not mean we know everything. When there is confusion, I go to our Persons with Disability Affairs Office for clarification.

Formal support is essential to ensure the legal rights of persons with disabilities lead to dignity and widespread daily engagement. Through strengthening complaint mechanisms and providing clear guidelines, persons with disabilities are empowered to assert their rights and hold establishments accountable. The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) clearly notes that a person with a disability has inherent dignity (United Nations, 2026). Therefore, effective complaint mechanisms and the detailed education of persons with disabilities about their lawful rights are the essential means to protect their rights and ensure their full involvement in the life of society.

Insights and Feedback of Persons with Disabilities in Exercising their Rights and Privileges Stipulated in Republic Act No. 9442

Table 9 shows the data on insights and feedback of persons with disabilities on the implementation of Republic Act No. 9442. Three themes were derived from the interviews: posting of discount privilege signage, enforcement of penalties, and policymaking.

Table 9 Insights and Feedback of Persons with Disabilities in Exercising their Rights and Privileges Stipulated in Republic Act No. 9442

Major themes	Descriptions	Significant statements
Posting of Discount Privilege Signage	This refers to the clear display of persons with disabilities discounts in stores to inform them about eligible products and guidelines.	Clear guidelines on discount privileges should be made readily available in establishments. Information materials increase awareness of discount privileges among persons with disabilities. Visible informational displays improve access to relevant information and avoid confusion. Providing information in local dialects enhances understanding. Reminders on eligible discounted items facilitate proper implementation of discount privileges.
Enforcement of Penalties	This refers to the strict imposition of fines or sanctions on establishments that do not follow the discount privilege policy to prevent mistreatment and ensure compliance.	Appropriate penalties promote adherence to disability-related laws and regulations. Stronger enforcement measures prevent the mistreatment of persons with disabilities. Sanctions serve as a deterrent against non-compliance with existing policies. Continuous monitoring ensures the effective enforcement of penalties and compliance with disability-related policies.
Policymaking	This refers to revision of policies to improve accessibility, simplify processes, and better address persons with disabilities needs.	New policies should be developed to strengthen support services. Existing provisions should be reviewed and updated to improve their effectiveness. Expanding discount privileges may enhance the benefits available to persons with disabilities. Simplifying documentary requirements makes discount privilege availment more convenient.

Posting of Discount Privilege Signage

Establishments fail to provide clear information or signage of persons with disabilities' discount privilege, which creates confusion and misuse in availing privileges. According to Senator Pangilinan, persons with disabilities remain unaware of their benefits due to non-compliance of businesses with the law, specifically Republic Act No. 7277, as amended by Republic Act No. 10754, Rule 4 Section 6, which requires the visible presentation of the 20-percent PWD discount in conspicuous areas of the establishments (Manalo, 2025). Informants emphasized the need for visible tarpaulins or reminders in stores, translated into the local dialect, to properly guide persons with disabilities on eligible discounted products. KII3 underscored that,

“Unta adunay guidelines ang gobyerno nga ipabutang sa mga store aron makita kung unsang mga produkto ang ma-avail sa mga persons with disabilities.” (KII 3)

Filipino Translation:

Sana ay magkaroon ng mga panuntunan ang gobyerno na mag-aatas sa mga tindahan na maglagay ng mga palatandaan upang makita kung aling mga produkto ang maaaring ma-avail ng mga taong may kapansanan.

English Translation:

There should be government guidelines posted in stores showing which products persons with disabilities can avail themselves of.

According to the report of the City Special Concerns and Coordinating Office in Kalinga, a significant lack of knowledge about Republic Act No. 10754 is observed, indicating that business establishments have disregarded the law and denied people their rights (Serion, 2024). As a result, persons with disabilities are not aware of the certain products or services they are eligible to avail discounts, signage can be strategically displayed in establishments to provide them with clear information on the products. This can increase their awareness, reduce confusion and misuse. KII 2 suggested that,

“Magbutang unta og tarpaulin ang mga establishment. Ibutang sa gawas aron makita dayon nga naay diskwento ang persons with disabilities.” (KII 2)

Filipino Translation:

Maglagay sana ng tarpaulin ang mga establisyemento. Ilagay sa labas para makita agad na mayroong diskwento ang mga taong may kapansanan.

English Translation:

All establishments should put up tarpaulin. Put it outside to show that persons with disabilities can avail themselves of their discount privilege.

Institutionalization of a strong formal discount program for persons with disabilities in the Philippines has been a great challenge, which can be primarily explained by the fact that insufficient businesses have clear regulatory guidelines and inconsistent enforcement habits (Cruz et al., 2021). Testimonies of the persons with disabilities' leaders show a remarkable consensus that there should be better coordination between the local government units and service providers to fill the existing gaps. Therefore, the display of proper signage and adoption of standard rules are essential for the full enjoyment of the rights of the persons with disabilities and should be regularly monitored by responsible agency.

Enforcement of Penalties

Establishments or service providers that fail to comply with disability laws often go unpunished, leaving persons with disabilities vulnerable to continued mistreatment and denial of their rights. Under the Republic Act No. 7277, as amended by Republic Act No. 9442, any person who violates any provisions of this act shall suffer the penalties, including the denial of discount privileges. Informants emphasized the need for stricter and higher penalties or

sanctions, including fines imposed by the City Social Welfare and Development Office or local authorities, to deter non-compliance and protect persons with disabilities who are already in a difficult position. Protection of the rights of persons with disabilities requires clear policies, as well as firm, unwavering enforcement. KII 3 assertive stated that,

“Dapat tagaan og aksyon ug patagmon. Labina sa among opisina sa City Social Welfare and Development Office, kinahanglan tinud-on gyud. Naa may silot o multa.” (KII 1)

Filipino Translation:

Dapat itong aksyonan at ayusin. Lalo na sa aming tanggapan sa City Social Welfare and Development Office, kailangan itong seryosohin dahil may kaukulang parusa o multa.

English Translation:

There must be action and proper enforcement. Our office at the City Social Welfare and Development Office should take it seriously, especially since penalties are in place.

The informants expressed that authorities must realize that if they do not make any concrete efforts, persons with disabilities are left at risk of even further neglect and abuse. Excessive leniency ensues in a permissive environment, where a lack of responsibility creates frequent violations due to little or no punishment. Hence, implementation of the policy is not to exploit or undermine the businesses or establishments from penalties but to simply maintain order and compliance to protect the rights and welfare of persons with disabilities from being limited by society. KII 1 and KII 4 frustratedly express that,

“Dapat nila aksyonan kay luoy mi nga mga persons with disabilities, pirmi lang balewalaon.” (KII 3)

Filipino Translation:

“Dapat nilang aksyonan, kasi kawawa kaming mga taong may kapansanan, lagi lang binabalewala.

English Translation:

They should take action because we persons with disabilities are vulnerable and often disregarded.

“Angay gyud nga silotan ang mga establisyemento nga wala mosunod.” (KII 4)

Filipino Translation:

Dapat talagang parusahan ang mga establisimyentong hindi sumusunod.

English Translation:

Establishments that do not comply should be penalized.

The consistent enforcement of penalties is essential to safeguarding the rights of persons with disabilities and ensuring that legal provisions are not merely symbolic. As has been witnessed in both local and international settings, weak enforcement enables the perpetuation of violations and negates the impacts of protective laws. Informants considered that there is a need to make authorities responsible by imposing suitable punishment on the establishments that do not follow the policy to strengthen the gravity of adherence. Mechanisms to enforce this are already available in laws such as Magna Carta for Persons with Disability, but it is very crucial to implement them in full. Rigorous enforcement conveys the message that discrimination and the neglect of the rights of persons with disabilities are unacceptable.

Polymaking

One of the reasons persons with disabilities are unable to exercise their discount privileges is said to be caused by bureaucratic procedures and requirements. Under the Republic Act No. 7277, as amended by Republic Act No. 9442 and Republic Act No. 10754, and Department of Health Administrative Order No. 8 series of 2017, the persons with disabilities are to present both PWD ID and booklet to avail discounts on purchasing of medicines in drugstores and pharmacies and basic and prime commodities in groceries and supermarkets. Informants expressed their complaint in this regard, suggesting removing these requirements, which will ease the process of availing the discount privilege.

“Tanggala ang mga taong may mga disabilities booklet requirement.” (KII 2)

Filipino Translation:

Tanggalin ang mga taong may disabilities booklet bilang isang requirement.

English Translation:

Removal of the persons with disabilities booklet requirement.

Moreover, informants expressed their dissatisfaction due to lack of participation, suggesting crafting an ordinance for a dedicated technical committee for persons with disabilities to be represented in policymaking. Effective integration of disability rights in policy formulation, planning, and programming requires political will, well-established and funded institutions, and effective implementation of state and non-state organizations (Tigere & Moyo, 2019). Also, creating a hotline for inquiries and receiving complaints, removal of the PWD booklet, and expansion of the discount privileges. According to them, establishing a dedicated committee or office for persons with disabilities will help them, including the persons with disabilities nationwide, to be more included.

“Craft an ordinance for technical committee, and creation of hotline number nga pwede matawagan ng mga taong may disabilities.” (KII 2)

Filipino Translation:

Bumuo ng isang ordinansa para sa teknikal na komite at magtatag ng hotline number na maaaring tawagan ng mga taong may kapansanan.

English Translation:

Craft an ordinance for the technical committee and create a hotline number that persons with disabilities can call.

Given that persons with disabilities have reported significant gaps in accessing their benefits and provided concrete recommendations, there is a clear necessity to amend the current policies. In the Philippines, the central issue is the lack of a holistic national disability policy that will help overcome the barriers that hinder the growth and development of individuals with disabilities (Maboloc, 2020). The evidence from informants highlights procedural barriers, unclear regulations, and the burdensome PWD booklet requirement, all of which hinder the full exercise of their rights. Evidence gained through lived experience must be seen as another tool in the general evidence and be given equal weight to any other element (Williams, 2024). Therefore, policy reform is an urgent need to provide equitable, efficient, and inclusive access for the benefit of all persons with disabilities.

Discussions

The findings revealed that persons with disabilities can significantly access discount privileges; however, the level of availment remains fairly low or far from desirable scale. Despite the initiatives utilized in order to make accessibility to rights and privileges more inclusive, persons with disabilities remain predominantly unable to access their discount privileges. Table 1 shows that the availment of discount privilege on establishments, including but not limited to recreational, restaurant, fast-food chains, hotels and lodgings, “sometimes”

recorded the largest, and relatively followed by “always” and “rarely”, this indicates that persons with disabilities are only occasionally availing their discount privilege.

In tables 2 and 3, higher scores were observed in moderate and occasional availment. For table 2, “rarely” scored the highest, which indicated that persons with disabilities only avail medical services on public and private facilities based on urgency rather than necessity. While in Table 3, “sometimes” and “rarely” scored significantly, suggesting that some persons with disabilities limit their purchase to medicines in drugstores and pharmacies since they have less complicated conditions and they only limit their medication only when it is urgently required. This implies that many persons with disabilities do not participate in preventive care due to barriers and they are less likely able to get routine preventive medical care compared to able-bodied individuals (Kim & Ho, 2023; U.S. Department of Justice Civil Rights Division, 2020).

At the same time, table 2 and 3 also reflected substantial scores on consistent availment of discount privileges. In table 2, the relatively high frequencies on “always” and “sometimes” in medical services, both public and private facilities, highlights the chronic and complex healthcare needs of persons with disabilities, particularly those who undergo medical sessions or procedures that needed careful medical attention and persons with disabilities with chronic disease or conditions. While, in the availment of medicines in drugstores and pharmacies, “always” obtained the largest response. This positively indicates that persons with disabilities highly utilized the discount, meaning most drugstores and pharmacies complied with the law due to its accessibility. In addition, it reflected the necessity for addressing the conditions and complex health needs of persons with disabilities, which in principle make them reliant on medicines. Jairoun et al. (2022) stressed that unmet clinical requirements and insufficient access to quality health care and preventative services contributes to health disparities; thus, it is significant that their access to medical services is properly enforced.

In Table 4, discount on transportation, the result shows that most persons with disabilities are unable to avail the discount privilege. Although “always” and “sometimes” scored the highest relatively. This demonstrates that transportation discounts are highly utilized, which reflects that public transportation serves as the primary mode of transportation for persons with disabilities. In Table 5, discounts on basic and prime commodities obtained the lowest number of utilizations, which reflects that this discount privilege is the most inaccessible for persons with disabilities. Despite that, “always,” “often,” and “sometimes” scored relatively demonstrating a consistent level of availment.

On the contrary, persons with disabilities continue to experience barriers in accessing their discount privileges. Accessibility is a privilege, but establishments are not accessible for persons with disabilities; across tables 1-5, it is highly observed that physical difficulties is the leading reason for persons with disabilities being unable to avail their discount privileges, relatively followed by tediousness, and lack of awareness. Physical difficulty and tediousness are similar in effect—the lack of basic accessibility features proves to be a major problem in accessing their rights and privileges. According to studies, most persons with disabilities find it hard to reach objects such as supermarkets because of height restrictions in large stores and queue up in one area, especially in wheelchairs (Bird & Vogelmann, 2021; Return on Disability, 2023).

At the same time, according to informants, these problems experienced by persons with disabilities are attributed to 1) establishments do not have priority lanes, and if they are not followed properly, 2) some establishments do not have ramps or accessible comfort rooms for persons with disabilities, 3) travelling individually with physiological disability poses to be the most challenging, 4) bureaucratic processes, and 5) entering establishment without accessibility features is tiring. As a result, persons with disabilities are already limited by their condition but also limited by service providers or duty-bearers. This tends to discourage the

persons with disabilities from exercising their privilege due to the cycle of struggles, which is not proportional to the amount of benefit they would receive.

Moreover, the lack of awareness is one of the critical barriers to accessing discount privileges. According to Clemente et al. (2022) underscored that information inaccessibility and unavailability serve as a potential challenge for persons with disabilities with access to health care. This is evidently shown in table 2, this reflects the weaknesses in terms of information dissemination by the local government units; at this rate, if healthcare and security is not accessible to persons with disabilities, it is tantamount to depriving them of their rights and privileges. According to informants, among the reasons why persons with disabilities remained uninformed of their privilege is 1) limited information dissemination efforts about their benefits and privileges, 2) persons with disability members are reluctant to participate, 3) communication barriers, especially those with speech disabilities, and 4) lack of discount signages in all kinds of store.

Moreover, the no PWD ID/booklet, no discount policy is one of the most complained bureaucratic problems faced by persons with disabilities today. As discussed above, persons with disabilities are required to present both PWD ID and booklets in availing discounts on medical services, purchasing medicines, basic and prime commodities. According to informants, manual recording of items is tiring and inconvenient because it causes unnecessary delay, especially if it affects the condition of persons with disabilities, enduring the physical burden while waiting to finish the process. It is important to note that some persons with disabilities lost or damaged their IDs and booklets, making them unrecognizable as proof of identification; some emphasized that their IDs/booklets have not arrived at them. According to informants, there is a shortage of IDs for persons with disabilities due to the rapid increase in membership applications.

Furthermore, establishments or service providers denied the persons with disabilities with full enjoyment of their discount privileges. According to informants, the establishments or service providers have tendencies on why they are denied of their privileges by 1) giving half or less of discount than what is stipulated in the law, 2) refused to provide discount on certain products, particularly, items that is branded, including medicines and other basic necessities, and 3) establishments and service providers do not want to give discounts, arguing that there are too many persons with disabilities availing, which will result to profit loss. This unfair treatment is also the result of why persons with disabilities are discouraged from exercising their rights and privileges. Additionally, persons with disabilities have experienced discrimination and stigma in exercising their discount privileges due to negative attitude or outlook towards them. On the contrary, some establishments or service providers do not provide discounts due to existence of fake PWD IDs. There is rampant use of fixers to obtain a PWD ID, which results in abuse in disability benefits (Tan et al., 2025).

Conclusion and suggestions

The key findings revealed that most persons with disabilities remain unable to fully utilize their discount privileges, and they are facing barriers that continuously affect them from exercising. The surveys revealed that purchasing medicines at drugstores and pharmacies is the highest utilized discount privilege, and establishments such as hotels, restaurants, lodging, and recreational and medical services in public and private facilities indicated near-equal utilization, while transportation and basic and prime commodities scored the lowest utilization. Concurrently, the surveys revealed that lack of awareness, physical difficulty and tediousness are the primary barriers to the exercise of their discount privileges. These were compounded by systemic and environmental barriers that include bureaucratic processes, lack of compliance with accessibility law resulting in a lack of basic accessibility features, and weak

implementation by service providers. In addition, PWD ID and Booklet, denial of discount, and services remain unaffordable, indicated to be more complex factors that limit their capacity to utilize the discount privileges. Hence, disability is not a problem, but it is the design of the policy and society that continuously disable persons with disabilities.

Moreover, the interviews uncovered the underlying problems as to the level of discount utilization. The main problem lies in the implementation of policy, some establishments and service providers do not comply with basic accessibility features or observe proper implementation of accessibility features if existing, some do not fully give full discount on items and services, some denies the mandated discount, and lack of accessibility features, which constitute a violation to the compliance to the mandated 20% discount privilege. The bureaucratic process and requirements such as presenting both PWD ID and booklet, manual listing of items availed, authorization letter and other IDs are among the systemic issues that constraints the persons with disabilities to avail their discount privilege, especially in healthcare. At the same time, information and communication challenges constrain persons with disabilities from equal and full enjoyment of their privileges as recognized members.

As a result, the overall findings suggest adoption of practical and policy changes as it is the role of the government to design and implement policies and programs anchored on international human rights for the benefit of persons with disabilities. It is also their responsibility to protect, empower and take accountability for persons with disabilities from any forms of discrimination, stereotypes, abuse or deprivation of their rights. The local government should start from strictly observing the compliance of basic accessibility features in public and private establishments as required by the law before handling building permits, strengthening information campaigns of local persons with disability leaders and officials by providing more resources, and strict enforcement of penalties to violators that do not comply with the law and denies the persons with disabilities of their rights and privileges.

The national government should strengthen and fast-track the development of digital identification systems to counter fake PWD IDs and to effectively inform persons with disabilities regarding this measure to ensure coordinated utilization, adapt changes in bureaucratic requirements, specifically by removing the booklet and listing of availed items that physically burdens their conditions, adapt a stricter punishment on establishments and service providers by suspending business operation based on the unresolved complaints and degree of violations towards the persons with disabilities, and adaption of technical committee dedicated for persons with disabilities, including hotlines to encourage and ease the process of filing complaints against the violators.

Lastly, for future researchers, due to constraints and existing gaps in this area of study, the study has its limitations, which may not be generalized to all persons with disabilities in all localities in the Philippines. Further investigation and exploration may be done in a different setting having the same purpose, to also find out their experience and insights from a different perspective.

New knowledge and the effects on society and communities

The findings of this study provide empirical evidence on the actual level of utilization of discount privileges entitled to persons with disabilities in the City of Panabo, Philippines, and explored the realities and experiences of persons with disabilities. The findings illustrate that accessibility is not just influenced by what is stipulated in the law, but also the external factors that continue to impede full and equal availment. It was also revealed that challenges encountered by persons with disabilities extend beyond common belief that is due to financial concerns as they also involve practical barriers that have affected their ability to fully enjoy the benefit.

Moreover, the study highlights the important role of the local government unit, persons with disabilities' leaders and officials, and service providers in ensuring that discount privileges are effectively available and accessible to the intended beneficiaries. The overall findings may serve as a basis to strengthen local policies, improvement of monitoring systems, and enhancement of public awareness campaigns with regards to their entitled benefits and privileges. For establishments, the results may serve as a ground to improve compliance with discount regulations. While the government can identify areas where additional enforcement and policy revisions are needed.

For society and communities, the study promotes a deeper understanding of the realities faced by persons with disabilities, specifically in their ability to access their discount privileges. Greater awareness of the challenges they experience encourage community members, service providers, local government officials, and policymakers to adopt inclusive measures and responsive practices. In doing so, accessibility to discount privileges effectively supports persons with disabilities financially, as well as reinforces inclusion and protect their dignity in society.

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Attitude and Utilization of Generative AI as a Learning Tool among Pre-Service Mathematics Teachers

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Abstract

This study examined the attitudes and utilization of generative artificial intelligence (AI) as a learning tool among pre-service mathematics teachers. Employing a descriptive-correlational research design, data were collected from 71 respondents through a structured survey instrument to determine their perceptions of generative AI and the frequency of its use in learning mathematics. Findings revealed that respondents demonstrated a moderately positive attitude toward generative AI across cognitive, affective, and behavioral dimensions. In terms of utilization, participants commonly used generative AI tools for step-by-step explanations, clarification of mathematical concepts, and assistance in solving mathematical problems. However, integration of these tools into regular study routines remained limited. Correlation analysis showed a significant moderate positive relationship between attitudes and frequency of use, indicating that more favorable perceptions are associated with higher levels of engagement with generative AI in academic tasks. Respondents also perceived the curriculum as moderately supportive in developing competencies for effective AI utilization, particularly in enhancing problem-solving skills, critical thinking, and conceptual understanding. Nevertheless, some hesitation was noted in encouraging peer use, reflecting concerns about appropriate and responsible application. In general, the study highlights the need for structured integration of generative AI in mathematics education. It is recommended that teacher education institutions provide targeted training, clear guidelines, and pedagogical strategies to strengthen technological competence, critical thinking, and ethical use of AI. Future research may further examine its long-term effects on learning outcomes and professional readiness.

Keywords: Attitude, Generative AI, Learning tool, Utilization

Introduction

Teachers play a crucial role in guiding students and unlocking their potential through effective instruction. In mathematics education, learning begins with foundational concepts and progresses to advanced topics such as algebra and calculus. Traditional teaching methods, relying on direct instruction and rote memorization, have traditionally focused on manual calculations and standardized assessments. While these approaches provide structure, they may limit opportunities for student engagement, critical thinking, and deeper conceptual understanding. (Ball et al., 2008) With advancements in technology, mathematics education has undergone a significant transformation. Interactive software, online resources, and educational applications now allow students to learn at their own pace, collaborate with peers, and access learning resources beyond the classroom. More recently, the emergence of generative AI has further transformed mathematics education by enabling students to receive immediate feedback, generate step-by-step solutions, and explore mathematical concepts interactively. These capabilities position generative AI as a promising learning tool that can support personalized and student-centered mathematics instruction (Nye, 2015).

In classroom settings, students' attitudes toward mathematics strongly influence their engagement and motivation. Likewise, attitudes toward generative AI shape how learners accept, utilize, and benefit from AI-supported learning environments (Wang & Li, 2025). These attitudes encompass cognitive, affective, and behavioral dimensions that influence students' willingness to adopt emerging technologies. For pre-service mathematics teachers, generative AI serves not only as a learning aid but also as a prospective instructional tool that they may eventually integrate into their own teaching practice. Consequently, understanding their attitudes toward AI is essential for promoting its effective and responsible integration into mathematics education (Liu, 2026). Holmes et al. (2019) emphasized that although artificial intelligence has the potential to personalize learning and improve instructional support, educators must ensure that learners continue to develop critical thinking and independent problem-solving skills. Likewise, Treve (2026) argued that the increasing datafication of education requires institutions to establish ethical frameworks for the responsible use of AI technologies.

According to Eagly & Chaiken (1993), attitudes consist of cognitive, affective, and behavioral components that influence individuals' intentions and actual behavior. Similarly, Bohner & Dickel (2011) explained that positive attitudes often predict behavioral intentions toward adopting new technologies. Although previous studies have highlighted the potential of generative AI in enhancing teaching and learning, limited research has specifically examined the relationship between pre-service mathematics teachers' attitudes toward generative AI and their utilization of the technology as a learning tool in mathematics education (Alreiahi & Alrwaished, 2025). Furthermore, there remains limited evidence on how cognitive, affective, and behavioral attitudes influence the responsible and meaningful use of generative AI among future mathematics teachers. Addressing this gap is essential for informing teacher education programs and promoting effective AI integration in mathematics instruction. Given this context, this study aims to examine the relationship between pre-service mathematics teachers' attitudes toward generative AI (cognitive, affective, and behavioral) and their utilization of the technology as a learning tool in mathematics. As a correlational study, it seeks to provide evidence that can support the responsible integration of generative AI into mathematics teacher education and instructional practice.

The findings of this study are expected to contribute to mathematics teacher education by providing evidence on how pre-service mathematics teachers' attitudes influence their utilization of generative AI as a learning tool. The results may assist teacher educators and

curriculum developers in designing instructional strategies that foster responsible, ethical, and meaningful AI integration while strengthening students' technological and pedagogical competencies. Ultimately, the study may help prepare pre-service mathematics teachers to utilize generative AI effectively in supporting student learning and enhancing instructional readiness in future classroom practice.

Objectives

This study examined the attitudes toward and utilization of generative AI as a learning tool among pre-service mathematics teachers enrolled during the Academic Year 2024–2025. Specifically, the study sought to:

1. Determine the respondents' attitude towards generative AI as a learning tool in Mathematics along the following dimensions:
 - 1.1. Cognitive,
 - 1.2. Behavioral, and
 - 1.3. Affective.
2. Assess the respondents' extent of utilization of generative AI in learning mathematical concepts.
3. Examine the relationship between the respondents' attitudes toward generative AI and their utilization of the technology using correlational analysis; and
4. Develop an evidence-based action plan grounded on the empirical findings of the study to support the effective integration of generative AI into mathematics instruction

Methodology

Research Design

This study employed a quantitative correlational research design to examine the relationship between the attitudes and utilization of generative AI as a learning tool among pre-service mathematics teachers. The quantitative approach was particularly suitable because it aligned with the study's objectives of systematically assessing both attitudes and usage patterns, while the correlational design enabled the examination of the relationship between these variables through Pearson's product-moment correlation coefficient (Pearson r) (Creswell, 2014). By employing statistical methods, the study provided measurable evidence regarding the prevalence of AI tool usage and the factors that influenced students' attitudes. This approach enabled the identification of trends and relationships, offering valuable insights that could inform the integration of AI into mathematics education. The structured nature of quantitative research ensured that the findings were reliable and generalizable, allowing for a comprehensive analysis of how teacher education students engaged with AI as a learning tool.

Respondents

The study employed stratified random sampling, with the respondents stratified according to year level to ensure proportional representation of first-, second-, third-, and fourth-year Bachelor of Secondary Education major in Mathematics students. A total of 71 students currently enrolled in the Bachelor of Secondary Education major in Mathematics during the Academic Year 2024–2025, who had access to generative AI tools, participated in the study. This approach ensured that the participants were suitable for the study's focus.

The finalized questionnaire was distributed online via Google Forms, providing easy access to participants. Along with the survey link, instructions and informed consent forms were shared, emphasizing voluntary participation. The students were given one week to complete the survey, with follow-up reminders sent after three days to those who had not yet responded.

Instrumentation

The survey questionnaire consisted of two sections: attitudes toward generative AI and utilization of generative AI tools. The first section measured attitudes using 15 statements (five items each for the cognitive, behavioral, and affective dimensions) rated on a four-point Likert scale, while the second section examined the respondents' frequency of utilizing generative AI in learning mathematical concepts using 10 items on the same scale. This closed-ended format allowed for the systematic analysis of students' attitudes toward and utilization of generative AI as a learning tool in mathematics.

Prior to its administration, the questionnaire underwent content validation by experts in mathematics education and educational technology to ensure the relevance, clarity, and appropriateness of the items. A pilot test was likewise conducted to establish the reliability of the instrument. The computed Cronbach's alpha coefficient of 0.91 indicated acceptable internal consistency.

To interpret the computed mean scores, we utilized the following mean ranges along with corresponding verbal interpretations:

Scale Point	Mean Ranges	Interpretation
4	3.51 – 4.00	Positive/Highly Utilized
3	2.51 – 3.50	Moderately Positive /Moderately Utilized
2	1.51 – 2.50	Moderately Negative/Slightly Utilized
1	1.00 – 1.50	Negative/Least Utilized

Data Collection Procedure

A formal letter was addressed to the Dean and University President requesting permission to conduct the study among Bachelor of Secondary Education major in Mathematics students. Upon approval, the researcher coordinated with the appropriate university offices and the department secretary regarding the administration of the survey.

The questionnaire was administered online through Google Forms. The survey link, informed consent form, and instructions were disseminated to the respondents through their official communication channels. Participation was voluntary, and respondents were assured that their responses would remain confidential and would be used solely for research purposes. The students were given one week to complete the questionnaire, and reminder messages were sent after three days to those who had not yet responded to improve the response rate.

Results

1. Attitude towards Generative AI as a Learning Tool in Mathematics

This part of the study determined the respondents' attitude towards generative AI as a learning tool in Mathematics in terms of cognitive, behavioral and affective dimensions. These are found on the succeeding tables.

1.1 Cognitive

Table 1 presents the respondents' attitudes toward generative AI as a learning tool in mathematics in terms of the cognitive dimension. It shows the computed mean and standard deviation for each statement, together with their corresponding descriptive interpretations. The mean scores ranged from 3.38 to 3.49, with all items receiving a descriptive interpretation of Moderately Positive. The highest mean score (Mean = 3.49, S.D. = 0.58) was obtained for the statement, "Improve my ability to understand complex mathematical concepts." This finding indicates that the respondents generally hold a moderately positive cognitive attitude toward the use of generative AI in enhancing their understanding of complex mathematical

concepts. Although the score did not reach the Positive category, it suggests that the respondents recognize the potential of generative AI to support conceptual understanding and facilitate mathematics learning.

Table 1 Attitude towards Generative AI as a Learning Tool in Mathematics in Terms of Cognitive Dimension

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1.Improve my ability to understand complex mathematical concepts.	3.49	0.58	Moderately Positive
2.Enhance my ability to analyze and apply mathematical principles effectively.	3.39	0.72	Moderately Positive
3.Help me identify patterns and relationships in mathematical problems, improving my problem-solving skills.	3.45	0.62	Moderately Positive
4.Provide innovative and efficient ways to study Mathematics.	3.41	0.68	Moderately Positive
5.Bridge learning gaps in Mathematics by offering personalized learning support.	3.38	0.64	Moderately Positive
Overall	3.43	0.53	Moderately Positive

The respondents' moderately positive cognitive attitudes suggest that they recognize the educational value of generative AI in supporting conceptual understanding and mathematical reasoning. Holmes et al. (2019) noted that AI can personalize instruction and provide adaptive learning experiences, while Zawacki-Richter et al. (2019) concluded that AI applications have considerable potential to improve learning outcomes in higher education. These findings support the present study, which indicates that pre-service mathematics teachers perceive AI as beneficial for understanding mathematical concepts.

Conversely, the lowest mean score (Mean = 3.38, S.D. = 0.64), although still interpreted as Moderately Positive, was obtained for the statement, "Bridge learning gaps in Mathematics by offering personalized learning support." This result suggests that while the respondents acknowledge the personalized learning capabilities of generative AI, they may not yet fully recognize or experience its potential to address individual learning needs. This relatively lower rating may also indicate the need for greater exposure to AI tools that provide adaptive and personalized instructional support. Previous studies similarly caution that the educational benefits of AI depend on its appropriate and guided use. Holmes et al. (2019) noted that excessive reliance on AI may reduce students' active participation and independent problem-solving. This finding underscores the importance of teacher guidance in ensuring that generative AI serves as a tool for meaningful learning rather than merely providing convenient answers.

In general, the respondents demonstrated a Moderately Positive cognitive attitude toward generative AI as a learning tool in mathematics (Mean = 3.43, S.D. = 0.53). This indicates that they generally perceive generative AI as beneficial for enhancing conceptual understanding, supporting mathematical reasoning, and facilitating problem-solving. Taken together, the present findings and previous studies suggest that although students recognize the cognitive advantages of generative AI, maximizing these benefits requires its thoughtful and responsible integration into mathematics instruction.

1.2 Behavioral

Table 2 presents the respondents' attitudes toward generative AI as a learning tool in mathematics in terms of the behavioral dimension. It presents the computed mean and standard deviation for each statement together with their corresponding descriptive interpretations.

The mean scores ranged from 2.89 to 3.34, with all items receiving a descriptive interpretation of Moderately Positive. The highest mean score (Mean = 3.34, S.D. = 0.73) was obtained for the statement, "Check AI-generated solutions to verify my own understanding." This finding indicates that the respondents generally demonstrate a positive behavioral tendency to use generative AI as a means of validating and reinforcing their understanding of mathematical concepts rather than relying solely on AI-generated answers.

Table 2 Attitude towards Generative AI as a Learning Tool in Mathematics in Terms of Behavioral Dimension

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1. Seek AI-generated explanations when facing problem-solving challenges.	3.28	0.63	Moderately Positive
2. Use AI tools as a regular part of study routines.	2.96	0.70	Moderately Positive
3. Encourage classmates to integrate AI-powered learning tools into their studies.	2.89	0.72	Moderately Positive
4. Check AI-generated solutions to verify my own understanding.	3.34	0.73	Moderately Positive
5. Apply AI assistance selectively to reinforce problem-solving skills.	3.23	0.72	Moderately Positive
Overall	3.14	0.54	Moderately Positive

These findings suggest that generative AI can support active learning by encouraging students to evaluate their own work and refine their problem-solving approaches. The findings also demonstrate that respondents use generative AI to verify their understanding of mathematical concepts rather than relying exclusively on AI-generated answers.

This aligns with Holmes et al. (2019), who emphasized that AI should function as instructional support rather than a replacement for human reasoning. Likewise, Watson & Watson (2007) highlighted that, educational technologies are most effective when integrated purposefully into learning activities. Conversely, the lowest mean score (Mean = 2.89, S.D. = 0.72), although still interpreted as Moderately Positive, was recorded for the statement, "Encourage classmates to integrate AI-powered learning tools into their studies." This result suggests that while the respondents are personally receptive to using generative AI, they are comparatively less inclined to promote its use among their peers. Such hesitation may reflect varying levels of confidence in AI tools or uncertainty regarding their appropriate application in collaborative learning environments.

Previous studies likewise suggest that students' behavioral adoption of AI is influenced by the extent to which they understand its appropriate educational use. Holmes et al. (2019) emphasized that AI is most effective when integrated with teacher guidance that promotes active learning and responsible use. This finding implies that strengthening students' confidence in the responsible use of generative AI may also encourage greater collaboration and peer advocacy in mathematics learning.

Overall, the respondents demonstrated a Moderately Positive behavioral attitude toward generative AI as a learning tool in mathematics (Mean = 3.14, S.D. = 0.54). This indicates that they generally exhibit favorable behavioral intentions and practices in using AI to support their

mathematics learning, particularly for verifying solutions and reinforcing their understanding. However, the relatively lower rating for encouraging peers to use AI suggests that opportunities remain to strengthen collaborative and responsible AI practices. All these findings indicate that although students are willing to integrate generative AI into their own learning, continued guidance and structured classroom experiences are needed to foster more consistent and meaningful behavioral engagement with AI technologies.

1.3 Affective

Table 3 presents the respondents' attitudes toward generative AI as a learning tool in mathematics in terms of the affective dimension. It presents the computed mean and standard deviation for each statement together with their corresponding descriptive interpretations.

The mean scores ranged from 3.00 to 3.28, with all items receiving a descriptive interpretation of Moderately Positive. The highest mean score (Mean = 3.28, S.D. = 0.72) was obtained for the statement, "Increase my enthusiasm for exploring new problem-solving techniques." This finding indicates that the respondents generally perceive generative AI as an engaging learning tool that stimulates their interest and enthusiasm for exploring different approaches to mathematical problem-solving.

Table 3 Attitude towards Generative AI as a Learning Tool in Mathematics in Terms of Affective Dimension

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1. Feel more confident solving mathematical problems with AI assistance.	3.00	0.63	Moderately Positive
2. Make me more curious about discovering new mathematical strategies.	3.24	0.72	Moderately Positive
3. Appreciate AI's interactive feedback, which enhances my motivation to study Mathematics.	3.15	0.64	Moderately Positive
4. Make me less anxious when verifying and checking mathematical solutions.	3.15	0.64	Moderately Positive
5. Increase my enthusiasm for exploring new problem-solving techniques.	3.28	0.72	Moderately Positive
Overall	3.17	0.54	Moderately Positive

The respondents' moderately positive affective attitudes indicate that generative AI promotes curiosity and engagement in mathematics learning. Hattie (2009) emphasized that students' motivation and engagement substantially influence academic achievement. Likewise, Kolb (1984) explained that meaningful learning occurs when learners actively engage with experiences and reflect on them. These perspectives support the observed motivational benefits associated with AI-assisted learning.

Conversely, the lowest mean score (Mean = 3.00, S.D. = 0.63), although still interpreted as Moderately Positive, was obtained for the statement, "Feel more confident solving mathematical problems with AI assistance." This finding suggests that while the respondents generally exhibit positive feelings toward generative AI, they remain somewhat cautious about relying on it to build their confidence in solving mathematical problems. This may indicate that students are still developing trust in AI as a learning support tool and may require additional experience and guidance to use it effectively.

Generally, the respondents demonstrated a Moderately Positive affective attitude toward generative AI as a learning tool in mathematics (Mean = 3.17, S.D. = 0.54). This

indicates that they generally view generative AI as a motivating and engaging resource that stimulates curiosity, reduces anxiety, and encourages the exploration of different mathematical problem-solving strategies. However, the relatively lower level of confidence in using AI suggests that pre-service mathematics teachers would benefit from additional opportunities to develop confidence and competence in utilizing AI effectively. Overall, the findings underscore the importance of providing guided learning experiences that foster positive attitudes while promoting the responsible and meaningful use of generative AI in mathematics education.

2. Extent of Utilization of Generative AI in Learning Mathematical Concepts

Table 4 presents the respondents' extent of utilization of generative AI in learning mathematical concepts. It shows the computed mean and standard deviation for each statement together with their corresponding descriptive interpretations.

The mean scores indicate that the respondents moderately utilized generative AI across all learning activities. The two highest-rated items were "Review step-by-step explanations to understand different problem-solving approaches" (Mean = 3.55, S.D. = 0.65) and "Seek explanations when struggling with mathematical concepts" (Mean = 3.49, S.D. = 0.63), with descriptive interpretations of Highly Utilized and Moderately Utilized, respectively. The present findings suggest that effective integration of AI requires institutional support and intentional instructional planning. The high utilization of step-by-step explanations indicates that students value AI's ability to simplify complex mathematical procedures, thereby facilitating conceptual understanding and problem-solving. These findings suggest that respondents primarily use generative AI to obtain explanations, verify understanding, and support independent learning in mathematics.

Table 4 Extent of Utilization of Generative AI in Learning Mathematical Concepts

Item Statements	Mean	Standard Deviation	Descriptive Interpretation
1. Seek explanations when struggling with mathematical concepts.	3.49	0.63	Moderately Utilized
2. Solve complex equations and word problems using advanced techniques.	3.20	0.68	Moderately Utilized
3. Explore simulations and visualizations to improve my understanding of abstract concepts.	3.32	0.60	Moderately Utilized
4. Receive feedback to refine my problem-solving skills.	3.23	0.84	Moderately Utilized
5. Compare generated solutions with my own to check for accuracy.	3.39	0.68	Moderately Utilized
6. Integrate learning tools into my regular Mathematics study routine.	3.07	0.79	Moderately Utilized
7. Use tutoring systems for additional learning support.	3.15	0.82	Moderately Utilized
8. Practice solving problem sets for mastery.	3.38	0.79	Moderately Utilized
9. Review step-by-step explanations to understand different problem-solving approaches.	3.55	0.65	Moderately Utilized
10. Share recommended strategies with classmates to enhance collaborative learning.	3.31	0.72	Moderately Utilized
Overall	3.31	0.54	Moderately Utilized

Conversely, the two lowest-rated items were "Integrate learning tools into my regular Mathematics study routine" (Mean = 3.07, S.D. = 0.79) and "Use tutoring systems for additional learning support" (Mean = 3.15, S.D. = 0.82), both interpreted as Moderately Utilized. Although these findings indicate that the respondents use generative AI in their mathematics learning, they also suggest that AI has not yet been fully integrated into their regular study habits. The relatively lower utilization of AI for routine learning activities may reflect limited opportunities for structured classroom integration or insufficient guidance on incorporating AI into daily academic practices.

These findings emphasize that the effective integration of AI requires both institutional support and intentional instructional planning. Successful AI implementation depends on curriculum alignment and well-designed learning activities that encourage sustained use of AI technologies. Collectively, while students recognize the usefulness of generative AI, they may require greater instructional support to incorporate AI more consistently into their regular learning routines (Holmes et al. (2019).

In general, the respondents demonstrated a Moderately Utilized level of generative AI use in learning mathematical concepts (Mean = 3.31, SD = 0.54). The findings indicate that students primarily utilize generative AI to obtain explanations, review step-by-step solutions, and support mathematical problem-solving. However, its comparatively lower utilization for routine study and extended tutoring suggests that AI remains a supplementary learning resource rather than an integral component of students' daily learning practices. These findings underscore the need for structured instructional strategies that promote the responsible, consistent, and meaningful integration of generative AI into mathematics learning.

3. Relationship between the Respondents' Attitude and Utilization of Generative AI as a Learning Tool in Mathematics

Table 5 presents the relationship between the respondents' attitude and utilization of generative AI as a learning tool in Mathematics. The correlation of the variables was tested using the Pearson r formula.

Table 5 Relationship between the respondents' attitude and utilization of generative AI as a learning tool in mathematics

Variables	Computed r	p value	Decision on H_0	Interpretation
Attitude and Utilization of Generative AI as a Learning Tool in Mathematics	.69	$p < .001$	Reject H_0	Significant Positive Correlation

Table 5 presents the relationship between the respondents' attitudes toward and utilization of generative AI as a learning tool in mathematics. The results revealed a significant positive correlation between the two variables ($r = .69$, $p < .001$), leading to the rejection of the null hypothesis. This finding indicates that respondents with more positive attitudes toward generative AI also tended to demonstrate higher levels of utilization in learning mathematics.

This finding suggests that students who perceive generative AI as useful, accessible, and relevant to their academic needs are more likely to incorporate it into their mathematics learning activities. Positive attitudes appear to encourage more frequent and meaningful utilization of AI, particularly for problem-solving, obtaining explanations, and supporting independent learning.

The significant positive relationship between attitude and utilization suggests that favorable perceptions encourage greater use of generative AI in mathematics learning. This

finding is consistent with Bohner & Dickel (2011), who explained that attitudes influence behavioral intentions, and with Eagly & Chaiken (1993), who proposed that cognitive, affective, and behavioral components collectively shape individuals' actions.

Likewise, Zawacki-Richter et al. (2019) emphasized that successful AI integration depends not only on technological availability but also on users' acceptance and readiness. Zawacki-Richter et al. (2019) similarly emphasized that students' engagement with AI is shaped not only by their attitudes but also by the instructional support provided during its implementation. Collectively, these studies reinforce the present finding that positive attitudes, coupled with appropriate educational support, promote more meaningful and sustained utilization of generative AI.

The findings further imply that structured learning experiences may strengthen both students' attitudes toward and utilization of generative AI. Opportunities for guided practice, teacher facilitation, and curriculum-integrated AI activities can foster greater confidence and encourage students to use AI responsibly as part of their mathematics learning. This relationship highlights the importance of developing instructional strategies that not only increase students' access to AI technologies but also cultivate positive attitudes that support their effective and ethical use.

The significant strong positive relationship between attitude and utilization demonstrates that students' perceptions of generative AI play an important role in determining how they engage with the technology in mathematics learning. This finding directly supports the development of the proposed action plan, which focuses on strengthening positive attitudes, promoting responsible AI utilization, and providing structured learning experiences that encourage meaningful integration of generative AI into mathematics instruction.

4. Evidence-Based Action Plan to Support the Effective Integration of Generative AI into Mathematics Instruction

Based on the findings of the study, an evidence-based action plan was developed to support the effective integration of generative AI into mathematics instruction. The proposed plan addresses the key findings that pre-service mathematics teachers demonstrated moderately positive attitudes toward generative AI, moderate levels of utilization, and a significant positive relationship between attitude and utilization. Specifically, the activities are designed to promote the regular and responsible use of generative AI, strengthen students' confidence and competence in using AI as a learning tool, and encourage its meaningful integration into mathematics learning.

Table 6 Evidence-Based Action Plan to Support the Effective Integration of Generative AI into Mathematics Instruction

Objectives	Activities	Description	Strategies
1. To develop an action plan that will encourage regular and meaningful use of AI in learning, foster collaborate through AI use and equip students with responsible AI usage skills.	AI ThinkLab: Smart Solutions in Action	A weekly classroom segment where students use AI tools like ChatGPT, Grammarly, or Canva Magic Write to solve real-world academic or subject-based problems.	• Integrate AI tools into lesson plans for research, writing, and design tasks. • Provide guided practice sessions using school-approved AI tools. • Encourage reflection logs on how AI improved their learning process.
	Team ThinkBot	Group-based tasks where students collaborate using AI tools (e.g., Google Bard, ChatGPT, or Gemini) to brainstorm solutions or create outputs.	• Assign mixed-ability teams to promote peer learning. • Use shared AI documents or collaborative spaces like Notion AI or Google Docs with AI assist. • Evaluate both collaboration and product AI-enhanced output.
	Trust the Tech, Check the Fact	An awareness campaign and activity where students verify AI-generated outputs using credible sources.	• Assign fact-checking challenges on AI-produced content. • Use infographic creation to highlight responsible use tips. • Display student-created posters or digital campaigns across campus.

The proposed action plan provides a structured and evidence-based framework for supporting the effective integration of generative AI into mathematics instruction. It was developed directly from the empirical findings of the study, particularly the respondents' moderately positive attitudes toward generative AI, their moderate level of utilization, and the significant positive relationship between attitude and utilization. These findings indicate that although pre-service mathematics teachers recognize the educational value of generative AI, its use has not yet become a regular component of their learning practices.

Accordingly, the proposed activities focus on three complementary areas: promoting the regular use of generative AI through guided classroom learning experiences (AI ThinkLab), strengthening collaborative learning through AI-assisted group activities (Team ThinkBot), and developing responsible AI practices through critical evaluation and verification of AI-generated outputs (Trust the Tech, Check the Fact). Collectively, these activities are intended to strengthen students' confidence, AI literacy, and responsible utilization of generative AI while supporting its meaningful integration into mathematics instruction.

Discussions

The findings revealed that BSEd Mathematics students demonstrated a moderately positive attitude toward the use of generative AI as a learning tool. They acknowledged its usefulness in enhancing understanding of mathematical concepts, supporting problem-solving, and increasing learning motivation. Despite this favorable disposition, their actual utilization of generative AI remained at a moderate level, indicating that these tools are not yet fully embedded in their regular study practices. This aligns with recent evidence showing that while mathematics students maintain highly positive attitudes toward AI-assisted problem solving, their depth of actual utilization remains insufficient (Sixian et al., 2026). The computed Pearson r value of 0.69 further indicated a significant moderate positive relationship between attitude and utilization, suggesting that more positive perceptions are associated with higher levels of AI use in academic tasks. In relation to existing literature, these results are generally consistent with studies reporting that positive attitudes toward educational technologies tend to facilitate greater adoption and use among learners (Lin & Jiang, 2025). However, while prior research often highlights more seamless integration of AI tools in learning environments, the present findings suggest a more cautious and gradual adoption among pre-service mathematics teachers, possibly due to limited training or uncertainty in appropriate academic use. This hesitation is frequently observed among mathematics educators and pre-service populations due to disciplinary demands for precision, lack of formal AI literacy training, and ethical anxieties (Hossein-Mohand et al., 2026). To strengthen this relationship, the researchers proposed a plan of activities, including seminars, workshops, and guided learning sessions, aimed at enhancing AI literacy and promoting responsible and effective use of generative AI in mathematics learning.

Conclusion and suggestions

This study concludes that pre-service mathematics teachers demonstrate a moderately positive attitude toward generative artificial intelligence (AI) as a learning tool and a moderate level of utilization in learning mathematics. Furthermore, a significant positive relationship was found between students' attitudes and their utilization of generative AI, indicating that more favorable attitudes are associated with greater use of AI in mathematics learning. These findings contribute to mathematics teacher education by providing empirical evidence that supports the role of positive attitudes in promoting the meaningful utilization of generative AI to enhance conceptual understanding, problem-solving, and independent learning. At the same time, the moderate level of utilization suggests that although students recognize the educational value of generative AI, its integration into their regular learning practices remains limited and requires further instructional support.

Based on these findings, it is recommended that the College of Teacher Education implement structured faculty and student development programs that strengthen AI literacy, promote the responsible and ethical use of generative AI, and encourage its meaningful integration into mathematics instruction. Faculty members should collaborate in developing instructional strategies and learning activities that provide students with guided opportunities to utilize generative AI effectively and responsibly. Likewise, the proposed evidence-based action plan should be implemented and periodically evaluated to determine its effectiveness in improving students' attitudes toward and consistent utilization of generative AI. Future studies may extend the present research by examining additional variables, such as academic performance, digital readiness, self-regulated learning, and technology acceptance, to further explain the role of generative AI in mathematics education and teacher preparation.

New knowledge and the effects on society and communities

This study contributes to the growing body of knowledge on the relationship between pre-service mathematics teachers' attitudes toward generative AI and their utilization of the technology as a learning tool. The findings underscore the importance of equipping future teachers with the knowledge, skills, and ethical awareness needed to utilize generative AI effectively and responsibly. By strengthening AI literacy and promoting its meaningful integration into teacher education, educational institutions can prepare technologically competent educators who are capable of fostering innovative, student-centered, and ethically grounded learning environments. Ultimately, empowering pre-service mathematics teachers to integrate generative AI responsibly into classroom practice can cultivate learners who use technology critically, creatively, and ethically, thereby contributing to the advancement of mathematics education and the broader goals of a digitally empowered society.

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Social Health Innovation and Emergency Preparedness in Universities: An Evaluation of Perceived Public Health Crisis Management Capacity in Guangxi, China

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Abstract

This cross-sectional survey study developed and applied a multidimensional framework for evaluating the public health emergency management capacity of higher education institutions (HEIs) in the Guangxi Zhuang Autonomous Region, China. Social health innovation defined here as the coordinated reform of institutional governance, community health partnership and technology adoption provided the conceptual lens for indicator development. A five-dimension, 30-item indicator system was constructed through two rounds of Delphi consultation with seventeen experts (effective response rates 100.00% and 91.67%; expert authority coefficient 0.94). Kendall's coefficient of concordance was in round one and 0.306 in round two (both $p < 0.01$), indicating statistically significant but modest expert agreement. Between February and June 2025, structured questionnaires were distributed by convenience sampling to students and faculty at twenty HEIs, yielding 1,701 valid responses (institutional sample sizes 30–368). Capacity was measured as respondents' perceptions rather than through objective institutional audit. The entropy weight method (EWM) derived data-driven indicator weights reflecting between-institution variability, and the rank sum ratio (RSR) method with Probit-based grading ranked and classified institutions. Management and command system construction (28.19%) and prevention and emergency preparedness (26.63%) carried the largest entropy weights; perceived shortfalls were most pronounced in contingency plan updating, inter-departmental coordination and post-incident evaluation. Descriptively, vocational colleges scored higher overall than undergraduate universities, and science-engineering and public security institutions scored higher than medical and arts institutions; these comparisons were not tested inferentially. Probit grading classified 4 of the 20 institutions (20.00%) as high capacity, 13 (65.00%) as medium and 3 (15.00%) as low. On the basis of these findings the study proposes as an interpretive contribution rather than a validated intervention a social health innovation framework centred on flatter emergency governance, university–community health partnerships and technology-enhanced early warning. For policy, the results indicate that regional education and health authorities should weight institutionalised command mechanisms and preventive preparedness most heavily in HEI assessment standards, and direct targeted support to institutions in the low-capacity tier.

Keywords: Social health innovation, University emergency management, Public health emergencies, Institutional capacity assessment, Guangxi higher education institutions

Introduction

Higher education institutions (HEIs) occupy a distinctive position within the social infrastructure of public health governance, serving simultaneously as sites of concentrated population density, hubs of knowledge production, and microcosms of the communities they serve. When public health emergencies infectious disease outbreaks, food safety incidents, or unexplained mass illnesses arise within campus settings, the consequences extend well beyond institutional boundaries to affect the well-being of surrounding communities and the stability of regional social systems (Chen et al., 2024).

This study adopts social health innovation as its guiding conceptual lens, and defines the construct operationally so that its relationship to the measured indicators is explicit. Drawing on the literature on community-based health governance and institutional resilience, social health innovation is understood here as the coordinated reform of three institutional capabilities: (i) governance restructuring the redesign of decision-making authority, cross-departmental coordination and accountability so that health risks can be managed rapidly and across organisational boundaries; (ii) community engagement the deliberate extension of institutional health capability outward through partnerships with hospitals, disease control agencies and neighbouring communities; and (iii) technology adoption the use of information systems for surveillance, early warning and risk communication (Cao et al., 2020; Heinsohn et al., 2022).

These three components directly informed the five-dimension indicator system used in this study, as summarised in Figure 1. Governance restructuring is represented by the management and command system construction dimension; community engagement and preparedness planning by the prevention and emergency preparedness and the emergency response and rescue dimensions; technology adoption by the monitoring and early warning dimension; and the aftermath recovery dimension captures the learning loop through which all three components are revised after an event. Social health innovation therefore functions in this study as an analytical framework for interpreting institutional capacity profiles. It should be stated at the outset that the construct was not measured as a separate latent variable, and the study does not claim to have empirically validated it.

The Guangxi Zhuang Autonomous Region, located in southern China with a population exceeding fifty million, presents a compelling context for such an investigation. Its subtropical to tropical monsoon climate sustains year-round vector activity and favourable conditions for arboviral and enteric infections, while its extensive land border with Viet Nam and its position on major regional transport corridors generate sustained cross-border population movement a documented pathway for the importation of communicable disease into the region. According to Ministry of Education data for 2024, Guangxi hosts eighty-seven higher education institutions comprising thirty-eight universities and forty-nine colleges, with a combined enrolment of approximately 1.55 million students. Between 2014 and 2016, Guangxi ranked third nationally in reported school-related public health incidents (Weng et al., 2019); this remains the most recent published national comparison of school-based incident rates by province, and more recent provincial surveillance data would strengthen the case further.

The COVID-19 pandemic sharpened the importance of robust emergency response capability in university settings, particularly in economically developing regions with constrained resources and distinctive epidemiological profiles (Cao et al., 2020). Earlier provincial analyses of public health emergencies in Guangxi (Zhizhi et al., 2011) are retained here only as evidence of the pre-pandemic incident baseline, and are no longer used to support claims about the pandemic period itself.

Recent evaluation research has advanced on three fronts, none of which resolves the problem addressed here. First, at the individual level, Wei et al. (2023) constructed a Delphi-based index for assessing personal emergency preparedness during major emerging infectious disease outbreaks, and Chen et al. (2024) evaluated public health emergency management competence and its associated factors among medical college students in southwest China; both measure people rather than institutions. Second, at the national and system level, Wang et al. (2022) evaluated emergency response capability across China and analysed the obstacles to it, while Murphy et al. (2019) quantitatively assessed disaster preparedness and resilience among United States HEIs; these operate above or outside the Chinese institutional context. Third, campus-level risk analysis work such as Dehdashti et al. (2020) documents hazard profiles but does not produce a comparative capacity ranking across institutions.

The research gap addressed by this study is therefore specific: no published work has constructed a multidimensional indicator system and used it to evaluate and comparatively rank public health emergency management capacity across multiple HEIs within a single Chinese province or autonomous region, in a way that accounts for institutional type and disciplinary orientation. Closing this gap matters practically, because without comparative institution-level evidence, education and health authorities cannot target scarce preparedness resources to the institutions that most need them.

Objectives

The study pursued three objectives:

1. To develop a multidimensional framework for evaluating the public health emergency management capacity of higher education institutions in Guangxi.
2. To assess and comparatively rank perceived emergency management capacity across twenty higher education institutions in Guangxi using that framework.
3. To propose, on the basis of the empirical findings, a social health innovation framework for strengthening institutional resilience.

Objectives 1 and 2 are empirical. Objective 3 is an interpretive or output objective: it yields a conceptual proposal derived from the observed capacity profiles, not an intervention that has been tested. Each objective is revisited explicitly in the Conclusion.

Literature Review

The scholarly literature on campus emergency management reveals a marked contrast between developed and developing country contexts. In nations such as the United States, the United Kingdom and Japan, comprehensive full-cycle management systems spanning pre-event warning, active response and post-event recovery have been established through coordinated government and institutional efforts (Huang & Wang, 2020; Zhang, 2022). At the university level, these systems emphasise proactive risk prevention through strengthened emergency regulations, systematic campus risk assessment, regular stockpiling of essential supplies and technical resources, effective risk communication strategies, and institutionalised psychological intervention programmes. Murphy et al. (2019) found, however, that even within this comparatively mature environment, preparedness and resilience vary substantially between institutions, which supports the value of institution-level rather than system-level measurement.

In the Chinese higher education context, emergency management systems continue to face several structural challenges. A central limitation involves the insufficient incorporation of students as active participants in emergency governance, manifested in inadequate cultivation of student awareness and response capabilities, limited institutional mechanisms supporting their engagement, and a tendency toward superficial rather than substantive public health education. A persistent gap between theoretical instruction and practical preparedness — often described as a separation of knowledge from action — further weakens institutional

readiness. At the operational level, existing systems commonly exhibit deficiencies in contingency plan design, implementation effectiveness, post-event recovery processes, and the adequacy of resource and institutional support mechanisms (Xu, 2021; Jiang et al., 2025). Cao et al. (2020) reached a convergent conclusion at national scale, identifying coordination and early-warning weaknesses as the principal constraints on China's public health emergency management during COVID-19.

Methodologically, indicator-system construction in this field has relied heavily on Delphi consultation, typically combined with the Analytic Hierarchy Process for weighting (Wei et al., 2023). Delphi establishes content validity but leaves weights dependent on further expert judgement. The present study departs from this convention by pairing Delphi-derived content with entropy weighting, which derives weights from the dispersion actually observed in the data, and with rank sum ratio analysis, which converts a multi-indicator matrix into a defensible institutional grading. The methodological contribution is therefore the pairing of these techniques with a social health innovation lens at the institutional level, rather than the novelty of the techniques in isolation.

Viewed through the lens of social health innovation, the documented weaknesses represent opportunities for institutional transformation. By reconceptualising emergency management not merely as an administrative function but as a form of social capital development one that strengthens the bonds between universities and their surrounding communities while building collective capacity for health governance institutions can move beyond reactive approaches toward proactive, community-embedded resilience. This theoretical perspective guided the development of the evaluation framework employed in the present study.

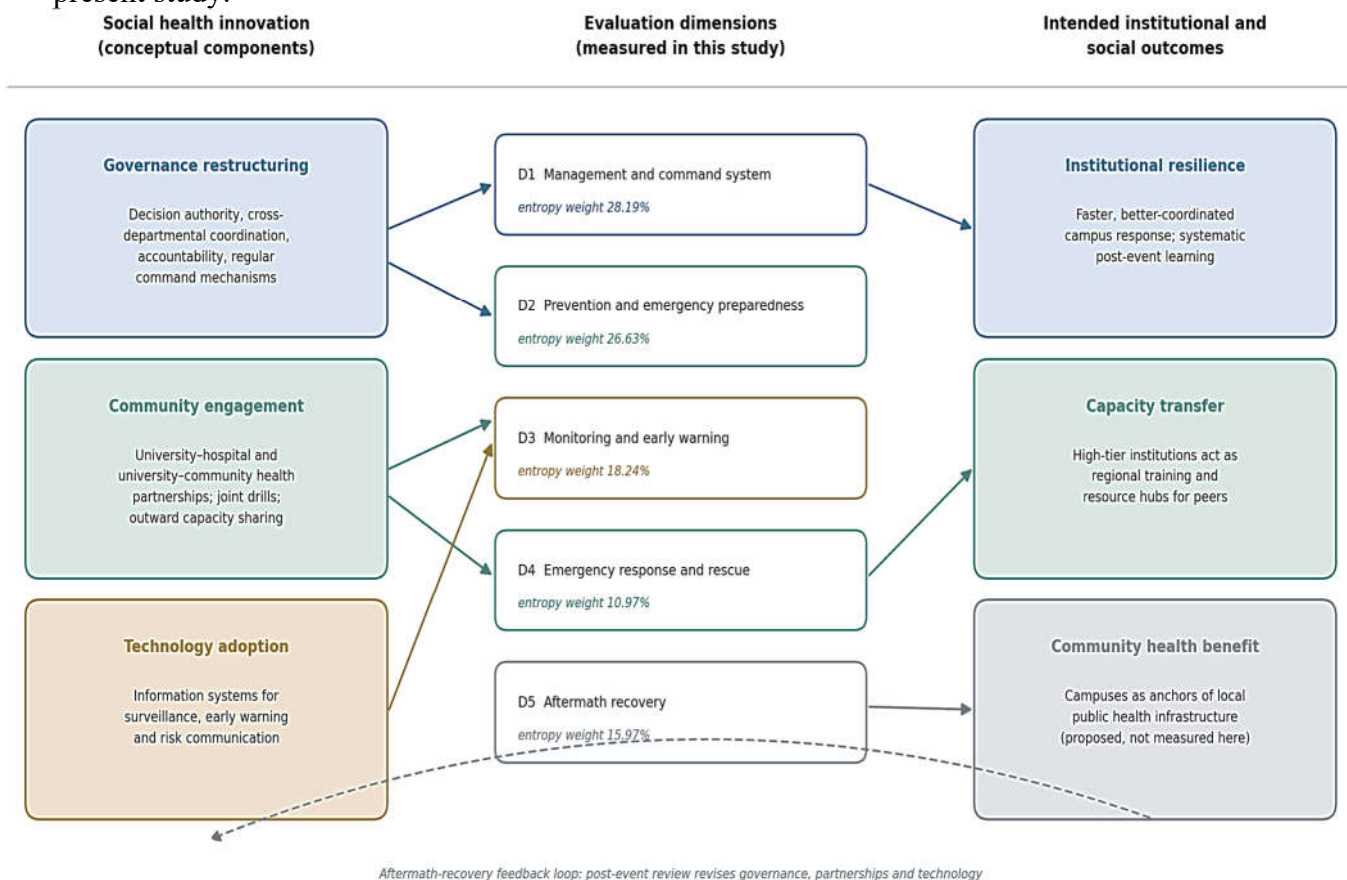


Figure 1 Operationalisation of social health innovation and its mapping onto the five evaluation dimensions. Entropy weights shown are those obtained in this study (Table 3). The community health benefit outcome is proposed rather than measured.

Methodology

Study design and setting

This was a cross-sectional, questionnaire-based study conducted across twenty higher education institutions in the Guangxi Zhuang Autonomous Region between February and June 2025. The sampled institutions comprised ten undergraduate universities (coded A1–A10) and ten vocational colleges (coded B1–B10), representing diverse disciplinary orientations: three comprehensive institutions, eight science and engineering institutions, one teacher training college, one finance and economics institution, five medical and pharmaceutical colleges, one arts institution, and one public security and law institution.

Sampling, participants and justification

A convenience sampling strategy was used. Electronic questionnaires were distributed through the institutional management channels of each participating institution; the survey link was forwarded to students and faculty by a designated coordinator, and participation was voluntary and anonymous. A total of individuals were invited, of whom 1,701 returned valid responses.

Inclusion criteria were: (i) currently enrolled student or actively employed faculty or staff member at one of the twenty institutions at the time of data collection; and (ii) provision of informed consent. Exclusion criteria were: (i) incomplete questionnaires; (ii) responses with uniform answers across all items or with a completion time below the pre-set minimum, which were treated as inattentive; and (iii) respondents who had been enrolled or employed at the institution for less than one semester and were therefore unable to comment on institutional practice.

Convenience sampling was adopted because the twenty institutions differ substantially in size, administrative structure and willingness to distribute external surveys, and no central sampling frame of students and staff across Guangxi HEIs was available to the research team. This strategy permits broad coverage at acceptable cost, but it does not produce a probability sample: respondents who chose to participate may differ systematically from those who did not, particularly in their interest in or exposure to emergency management. The resulting limits on generalisability, and the consequences of the unequal institutional sample sizes, are addressed in the Limitations section.

Ethical considerations

The study protocol was reviewed and approved by 5 . All participants were presented with an information statement describing the purpose of the study, the voluntary and anonymous nature of participation, and their right to withdraw at any point without consequence; electronic informed consent was obtained before the questionnaire could be accessed. No personally identifying information was collected, and institutional identities are reported only in coded form (A1–A10, B1–B10).

Indicator system development (Delphi)

The indicator system was refined through two rounds of Delphi consultation with seventeen domain experts. Effective response rates were 100.00% in round one and 91.67% in round two. The expert authority coefficient was calculated as $Cr = (Ca + Cs) / 2$, where Ca is the judgement basis coefficient and Cs the familiarity coefficient, yielding $Cr = 0.94$, which exceeds the conventional 0.70 threshold for authoritative consultation. Kendall's coefficient of concordance was in round one and $W = 0.306$ ($p < 0.01$) in round two.

The round-two value indicates that agreement among experts, while statistically significant, was modest in magnitude: a W of approximately 0.3 denotes weak-to-moderate concordance rather than strong consensus. This is not unusual in multi-indicator Delphi studies of emergency preparedness – comparable published frameworks in this field have reported Kendall's coefficients in the range of roughly 0.16 to 0.32 – but it does mean that the relative ordering of individual indicators should be treated as provisional, and this is reflected in the interpretation offered throughout.

Instrument and psychometric properties

The survey instrument was designed by the research team and comprised two sections. The first collected demographic information: gender, age, educational qualification, institutional role (faculty or student), years of professional experience, and academic title. The second assessed public health emergency management capability using the Delphi-refined indicator system: thirty items across five dimensions – management and command system construction, prevention and emergency preparedness, monitoring and early warning, emergency response and rescue, and aftermath recovery – with six items per dimension.

Response scales used either a three-point (0, 1, 2) or a four-point (0, 1, 2, 3) format, with higher scores indicating stronger perceived capability. Because the two formats have unequal ranges, every indicator column was min–max normalised to the interval [0, 1] before entropy weighting and rank assignment, so that four-point items did not exert disproportionate influence on the composite score simply by virtue of their wider raw range.

Content validity was established through the two Delphi rounds. Internal consistency was acceptable, with Cronbach's alpha coefficients for the five dimensions ranging from 0.841 to 0.915. No exploratory or confirmatory factor analysis was conducted, so the five-dimension structure rests on content validity rather than on empirically demonstrated dimensionality; this is acknowledged as a limitation and identified as a priority for future work.

Measurement construct

An important feature of the design should be made explicit. Capacity was not measured by objective institutional audit – for example by inspecting contingency plan documents, verifying stockpile levels, or observing drills. It was measured as the aggregated perception of students and staff regarding the practices of their own institution. The construct is therefore perceived institutional capacity. Perceptions are informative because students and staff are the population on whom emergency arrangements actually operate, and because low perceived capacity is itself a governance problem regardless of what documentation exists. They are nonetheless subject to self-report bias, to differences in respondents' proximity to emergency management functions, and to variation in institutional communication about arrangements that do exist. All findings should be read accordingly.

Analytical workflow

Analyses were conducted in SPSS version 26.0. The workflow proceeded in six steps, presented here in full because the aggregation of individual responses to institution-level scores is central to interpreting the results.

Step 1 Screening. Returned questionnaires were screened against the exclusion criteria above, leaving 1,701 valid responses.

Step 2 Aggregation to institution level. For each institution j and each of the thirty secondary indicators i , the arithmetic mean of all valid respondent scores at that institution was computed. This produced a 20×30 institution-by-indicator matrix, which was the unit of analysis for all subsequent steps. Institutional means were unweighted: every respondent at an

institution contributed equally to that institution's score, and institutions contributed equally to the analysis regardless of how many respondents they supplied.

Step 3 Normalisation. Each of the thirty indicator columns was min–max normalised to $[0, 1]$ to remove the effect of the differing three- and four-point response ranges.

Step 4 Entropy weighting. For each normalised indicator, information entropy e_i was computed and the weight derived as $w_i = (1 - e_i) / \sum(1 - e_i)$. Entropy weights quantify how much an indicator discriminates between institutions: an indicator on which all twenty institutions score similarly carries little information and receives a low weight, while an indicator that spreads institutions widely receives a high weight. They are a property of the observed data distribution and are not a measure of the substantive or theoretical importance of an indicator.

Step 5 Rank sum ratio. Institutions were ranked on each indicator, and the weighted rank sum ratio computed as $WRSR_j = \sum(w_i \times R_{ij}) / m$, where R_{ij} is the rank of institution j on indicator i and m is the number of institutions.

Step 6 Probit grading. $WRSR$ values were converted to cumulative frequencies and Probit values, and the regression $RSR = a + b \times \text{Probit}$ was fitted. Optimal grading on the fitted line partitioned the twenty institutions into high, medium and low capability tiers.

Justification of the analytical methods

The entropy weight method was selected in preference to subjective weighting procedures such as the Analytic Hierarchy Process because expert judgement had already been used once, in the Delphi rounds, to establish which indicators belong in the system. Applying a second layer of expert judgement to set the weights would compound any bias present in the first; entropy weighting instead derives weights from the observed data, and is reproducible from the dataset alone. Its trade-off, addressed above, is that the resulting weights carry no theoretical claim.

The rank sum ratio method was selected in preference to a simple weighted composite index or to TOPSIS for three reasons: it is non-parametric and therefore robust to the ordinal, non-normally distributed scores produced by short response scales; it performs adequately with a small number of evaluation objects, which matters when only twenty institutions are compared; and its Probit-based grading step produces an explicit, reproducible rule for classifying institutions into tiers rather than requiring an arbitrary cut-off (Tian, 1993; SPSSPRO, 2021).

Descriptive performance thresholds are also reported. The 1.5-point threshold applied to items scored on the three-point (0–2) scale corresponds to 75% of the maximum attainable score for that item. Thresholds are used for description only, and no inferential test was applied to threshold crossings.

Results

Respondent characteristics

A total of 1,701 valid questionnaires were obtained from the twenty sampled institutions. Respondent characteristics are summarised in Table 1. Individual institutional samples ranged from 30 to 368 respondents.

Table 1 Characteristics of respondents (n = 1,701)

Characteristic	Category	n	%
Institution type	Undergraduate university	1,079	63.40
	Vocational college	622	36.60
Role	Student	1,254	73.70
	Faculty and staff	447	26.30
Age (years)	≤ 25	-	72.70
	26–45	-	21.40
Highest qualification	Bachelor's degree	-	54.40
Academic title (faculty)	Intermediate	-	44.50
Work experience (faculty)	6–12 years	-	38.90
	≥ 13 years	-	40.00

Note: Male-to-female ratio 1.09:1

Dimension-level scores

In the management and command system dimension, most institutions achieved mean scores above the 1.5-point descriptive threshold on the three-point scale. Three institutions scored below it: A10 (undergraduate, medicine), A3 (undergraduate, medicine) and B10 (vocational, medicine). Institution A10 recorded 0.75 points on the regularity of emergency command meetings, and scored below threshold on inter-departmental coordination and on accountability structures.

In the prevention and emergency preparedness dimension, institutions A10, B8 (vocational, arts) and A3 scored below threshold, specifically on contingency plan updating, staff training provision, and comprehensive preventive measure development.

The monitoring and early warning dimension and the emergency response and rescue dimension produced mean scores above threshold at all twenty institutions. Within the monitoring dimension, however, four institutions A3, A7, A10 and B10, all medical or pharmaceutical recorded the lowest scores in the sample on indicators relating to information technology integration in monitoring systems.

In the aftermath recovery dimension, institutions A10 and B8 scored below threshold on post-event comprehensive assessment, follow-up care, plan optimisation and preventive awareness training.

Entropy weights

Entropy weights for the five primary dimensions are reported in Table 2. Weights reflect the degree to which each dimension discriminated between the twenty institutions in this dataset.

Table 2 Entropy weights of the five primary dimensions

Dimension	Weight (%)	Rank
D1 Management and command system construction	28.19	1
D2 Prevention and emergency preparedness	26.63	2
D3 Monitoring and early warning	18.24	3
D5 Aftermath recovery	15.97	4
D4 Emergency response and rescue	10.97	5
Total	100.00	

Note: Weights are data-derived and express each dimension's discriminating power across the twenty institutions; they are not a ranking of substantive importance.

Across the thirty secondary indicators, weights ranged from 0.76% to 15.01%. The indicator on regular emergency command team meetings carried the highest weight (15.01%), meaning that institutions varied more on this indicator than on any other. The indicator on hospital–university cooperation mechanisms carried the lowest (0.76%), meaning that institutions scored similarly on it.

Institutional ranking and tier classification

Weighted rank sum ratio values and the resulting Probit-based tier classification are reported in Table 4. The five highest-ranked institutions were B7 (vocational, science-engineering), A6 (undergraduate, comprehensive), B6 (vocational, science-engineering), A8 (undergraduate, public security-law) and B9 (vocational, science-engineering). The five lowest-ranked were A10, B8, A3, A5 and A7. Probit grading placed four institutions (20.00% of the twenty institutions evaluated) in the high-capability tier, thirteen (65.00%) in the medium tier and three (15.00%) in the low tier. All percentages refer to institutions, not to respondents.

Table 4 Weighted rank sum ratio, rank and capability tier by institution

Code	Type	Disciplinary orientation	Rank	Tier
B7	Vocational	Science-engineering	1	High
A6	Undergraduate	Comprehensive	2	High
B6	Vocational	Science-engineering	3	High
A8	Undergraduate	Public security-law	4	High
B9	Vocational	Science-engineering	5	Medium
...	...	...	6–15	Medium
A7	Undergraduate	Medicine	16	Medium
A5	Undergraduate	Medicine	17	Medium
A3	Undergraduate	Medicine	18	Low
B8	Vocational	Arts	19	Low
A10	Undergraduate	Medicine	20	Low

Descriptively, three of the five highest-ranked institutions were vocational colleges, and four of the five lowest-ranked were medical or pharmaceutical institutions. No inferential test of the difference between institutional types or between disciplinary orientations was conducted, and these patterns are therefore reported as descriptive observations only.

Discussions

The findings speak to institutional emergency management and to the broader discussion of social health innovation in higher education. Strong scores in the monitoring—early warning and emergency response—rescue dimensions suggest that Guangxi's HEIs have reached a reasonable baseline of perceived reactive capacity. Whether that perceived capacity would translate into effective performance during an actual emergency is a question this design cannot answer, and the distinction matters: respondents were reporting what they believe their institution can do.

Institutions with well-regarded monitoring systems may be well placed to extend expertise outward — sharing resources, providing technical guidance and offering training to neighbouring institutions and community organisations. This is offered as an implication for practice rather than as a finding: no community-level outcome was measured in this study, and the effect of such sharing on regional resilience remains untested (Wei et al., 2023).

The medical institution paradox

The most striking pattern is that medical and pharmaceutical institutions — A3, A7, A10 and B10 — scored lowest on command system governance, preventive preparedness, post-event recovery, and on information technology integration in monitoring. Professional medical expertise, on this evidence, does not automatically translate into perceived campus-level emergency governance. Two explanations are consistent with the data, and the study does not distinguish between them.

The first is substantive: an institutional culture oriented toward clinical treatment may under-invest in systematic administrative management, producing genuine governance gaps. The second is a reporting artefact: respondents at medical institutions have professional training in what good public health practice looks like and may therefore apply a more exacting standard when rating their own institution, depressing scores relative to institutions whose respondents lack that benchmark. This second possibility is a specific vulnerability of perception-based measurement and cannot be excluded here. Distinguishing the two would require either an objective audit component or a calibration of respondent expectations, and is proposed below as a priority for future research.

If the substantive explanation holds, integrated emergency governance models that explicitly bridge clinical competence with administrative management systems drawing on the standardised process approaches observed in high-scoring science and engineering institutions would be the appropriate response (Jia et al., 2024).

Interpreting the entropy weights

Management and command system construction and prevention and emergency preparedness together accounted for 54.82% of the total weight. It is important not to over-read this. Because entropy weights measure dispersion, the correct interpretation is that these two dimensions discriminated most sharply between institutions they are where Guangxi HEIs differ most, and therefore where evaluation and targeted investment can be most efficiently directed. The result does not establish that these dimensions are causally the most consequential for emergency outcomes, although that proposition is consistent with the wider literature on proactive governance (Cao et al., 2020; Wang et al., 2022).

The same caution applies in reverse to the lowest-weighted indicator. Hospital–university cooperation received 0.76% not because such cooperation is unimportant, but because institutions scored uniformly on it in this sample, uniformly undeveloped. A dimension on which all institutions are equally weak is invisible to entropy weighting precisely when it

may most warrant attention. Strengthening university–hospital ties therefore remains a plausible avenue for social health innovation despite its low weight, and this reading is supported by prior work rather than by the weight itself (Zhang, 2022).

Institutional type and organisational structure

Vocational colleges scored higher overall than undergraduate universities. A structural explanation is available and intuitively appealing: shorter management chains, smaller organisational scale and more agile decision-making may facilitate more responsive emergency governance, consistent with organisational theory on flat structures and crisis communication (Hou et al., 2022). This study did not measure management chain length, organisational scale or decision latency, and did not test the association statistically. The structural account is therefore advanced as a hypothesis generated by the data, not as a finding established by it, and testing it directly is proposed below.

Undergraduate universities, particularly those spanning multiple campuses with complex disciplinary portfolios, may nonetheless find value in examining the management practices of high-scoring vocational institutions and adapting relevant elements to their own contexts.

Limitations

Seven limitations qualify these findings.

1. Design. The study is cross-sectional and describes perceived capacity at a single point between February and June 2025. It cannot establish causal relationships, nor track how capacity changes after an incident or a policy intervention.

2. Sampling. Convenience sampling was used and no probability sampling frame was available. Respondents who elected to participate may differ systematically from those who did not, particularly in their engagement with emergency management, which may bias institutional scores in an unknown direction.

3. Measurement. Capacity was measured through respondent perception rather than objective audit. Self-report bias, variation in respondents' proximity to emergency management functions, and differences between institutions in how well existing arrangements are communicated all affect the scores. The medical institution finding is particularly exposed to this limitation, as discussed above.

4. Unequal and small institutional samples. Institutional sample sizes ranged from 30 to 368. Because institutional scores are unweighted means, estimates for institutions with around 30 respondents are considerably less stable than those for institutions with several hundred, yet both contribute equally to the ranking. Conclusions about individual institutions — including A10, A3 and B8 — should be read with the corresponding sample size in view.

5. Weighting method. Entropy weights derive from the dispersion observed in this particular dataset. They would change with a different sample of institutions, and they carry no theoretical claim about which dimensions matter most for emergency outcomes.

6. Absence of inferential testing. Comparisons between vocational and undergraduate institutions, and between disciplinary orientations, are descriptive. No significance tests, confidence intervals or effect sizes are reported, so the possibility that these differences reflect sampling variation cannot be excluded.

7. Generalisability and structure. Findings derive from twenty institutions in one autonomous region and may not transfer to other provinces or to other higher education systems. The five-dimension structure rests on Delphi content validity and has not been confirmed by factor analysis.

Future Research

Five directions follow from these limitations. First, pairing perception-based measurement with an objective audit component document review, stockpile verification, drill observation at a subset of institutions would establish how far perceived capacity tracks demonstrable capacity, and would directly test the reporting-artefact explanation of the medical institution result. Second, applying exploratory and confirmatory factor analysis to the thirty items would test whether the five-dimension structure is empirically supported. Third, collecting organisational variables management chain length, campus count, staffing ratios, decision latency would allow the structural explanation for the vocational college advantage to be tested rather than inferred. Fourth, subgroup analysis by respondent role and by gender, and inferential comparison between institutional types with appropriate adjustment for clustering, would strengthen the comparative claims. Fifth, longitudinal follow-up, or replication in another province, would establish whether the capacity profile identified here is stable and whether it is specific to Guangxi.

Conclusion and suggestions

Each objective is addressed in turn. On the first objective, a multidimensional evaluation framework comprising five dimensions and thirty indicators was developed through two rounds of Delphi consultation, with acceptable internal consistency ($\alpha = 0.841\text{--}0.915$) and an expert authority coefficient of 0.94, though with only modest expert concordance ($W = 0.306$). On the second, the framework was applied to twenty Guangxi HEIs: perceived capacity varied across institutional types, disciplinary orientations and management dimensions; the aftermath recovery dimension was consistently the weakest across the sample; and Probit grading classified four institutions as high capacity, thirteen as medium and three as low. On the third, a social health innovation framework is proposed below on the basis of these findings, as a conceptual and policy proposal rather than a validated intervention.

Recommendations derived directly from the study findings

1. Assessment standards should weight command system governance and preventive preparedness most heavily, because these two dimensions discriminated most sharply between institutions (28.19% and 26.63% of total entropy weight) and are therefore where evaluation is most informative and targeted investment most efficient.

2. The three institutions in the low-capability tier, and specifically A10, A3 and B8, require targeted intervention on the indicators on which they fell below threshold: regularity of emergency command meetings, inter-departmental coordination, accountability structures, contingency plan updating and staff training provision.

3. A mandatory post-event review protocol should be institutionalised across all HEIs. Aftermath recovery was the dimension on which institutions were weakest overall, and A10 and B8 fell below threshold on post-event comprehensive assessment, follow-up care and plan optimisation.

4. Medical and pharmaceutical institutions warrant specific attention to information technology integration in campus monitoring systems, on which A3, A7, A10 and B10 recorded the lowest scores in the sample with the caveat, noted above, that this pattern may partly reflect more exacting self-assessment at these institutions.

Broader policy implications supported by previous literature

The following are consistent with the present findings but rest primarily on prior evidence rather than on what this study measured, and are offered as implications rather than conclusions.

1. High-capability institutions could serve as regional training hubs disseminating practice to lower-performing peers. This study did not evaluate any such transfer mechanism.
2. Formal university–hospital cooperation agreements and regular joint exercises would address an area in which all sampled institutions scored uniformly low, though the benefit of doing so is inferred from prior work (Zhang, 2022) rather than demonstrated here.
3. Technology-enhanced monitoring incorporating artificial intelligence and Internet of Things applications, prioritised for higher-risk campus environments such as dormitories and dining facilities, is supported by the wider disaster informatics literature (Lu et al., 2022; Jia et al., 2024).
4. Where the structural explanation for the vocational college advantage is borne out by future testing, flatter emergency governance structures in large multi-campus universities would follow as a design recommendation.

New knowledge and the effects on society and communities

The study contributes in three respects. First, it provides the first comparative, institution-level evaluation of perceived public health emergency management capacity across multiple HEIs in Guangxi, producing a reproducible ranking and tier classification rather than a single-institution case description. Second, it demonstrates a methodological pairing not previously applied in this domain: entropy weighting and rank sum ratio have each been used in health services evaluation, but their combination for cross-institutional HEI emergency capacity assessment with weights derived from data rather than from a second round of expert judgement is novel to this field, and offers a template that other regions can apply without access to a large expert panel. Third, the finding that vocational colleges scored above undergraduate universities is counter-intuitive relative to the resource-based assumption that better-funded institutions are better prepared, and generates a testable structural hypothesis about organisational form and emergency governance.

The findings have identifiable users. Provincial and municipal education authorities can use the tier classification to target preparedness funding and to set differentiated assessment standards. HEI administrators — particularly directors of student affairs, campus health services and security offices — can use the dimension profiles to locate their own institution's weakest indicators. Regional centres for disease control can use the hospital–university cooperation finding to identify where partnership infrastructure is absent. Accreditation bodies can incorporate the indicator system into institutional review.

Claims about community and regional health benefit should be framed carefully. This study measured campus-level perceptions; it did not measure community health outcomes, and no inference about community resilience can be drawn from its data. The proposition that strengthened HEI preparedness contributes to regional public health infrastructure is an aspiration consistent with the social health innovation framework and with prior literature, and is offered as a direction for future evaluation rather than as a demonstrated effect.

The framework is in principle transferable. Its requirements are modest — an expert panel for content validation, a survey of students and staff, and standard statistical software — and it does not depend on features unique to China. Higher education systems with a comparable mix of institutional types and a similar administrative relationship between institutions and regional health authorities, including those in Southeast Asia, could apply the same procedure, adapting indicator content to local regulatory requirements while retaining the five-dimension structure and the entropy–RSR analytical pipeline.

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Factors Influencing the Comprehensive Ability of Undergraduate Photography Students in Shanxi Province, China

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Abstract

Photography education in China is shifting from a technique-centred model towards the cultivation of comprehensive professional competence, yet the factors that shape this competence in regional institutions remain under-examined. This study examined the factors influencing the comprehensive ability of undergraduate photography students in Shanxi Province. From a population of 4,254 students enrolled across six universities, 460 questionnaires were distributed and 418 valid responses were retained (90.90%), supplemented by semi-structured interviews with 15 students. Content validity was established through expert review (IOC = 0.60–1.00), the data were confirmed as suitable for factor extraction (KMO = 0.792–0.926; Bartlett's test $p < .001$), and internal consistency was acceptable ($\alpha = 0.862–0.913$). All variables scored at a moderate level or above. Learning Attitude was highest ($M = 4.04$, $SD = 0.74$) and Photographic Creation Ability lowest ($M = 3.30$, $SD = 0.90$), with narrative expression weakest ($M = 3.19$), indicating an imbalance between technical skill and reflective capacity. Comprehensive ability was significantly correlated with Learning Attitude, Personal Interests and Employment Prospects ($r = 0.640, 0.607, 0.603$, respectively; $p < .01$). A path model with observed composite variables accounted for 27.90% of the variance in comprehensive ability. Learning Attitude showed the largest total effect ($\beta = 0.293$), operating partly through Photographic Creation Ability, while Employment Prospects mediated the influence of Learning Resources and Family Support. The dual-mediator structure one internal and creative, the other external and market-oriented suggests that intrinsic motivation and industry alignment jointly shape competence, and that raising comprehensive ability requires both individual effort and systemic institutional support.

Keywords: Comprehensive ability, Photography education, Learning attitude, Photographic creation ability, Employment prospects, Path analysis

Introduction

Higher photography education in China is being reshaped by integrated media and rapid changes in visual production. Contemporary programmes must prepare students not only to operate equipment but also to combine aesthetic judgement, conceptual development, digital production and professional communication. Recent work on Chinese higher photography education therefore calls for curricula that connect technical learning with short-video production, digital platforms, industry practice and interactive assessment (Chen, 2024). This broader orientation makes comprehensive ability a central educational outcome rather than a narrow measure of equipment proficiency.

Research relevant to photography competence supports a multidimensional definition. At the technical and compositional level, photographic quality is partly associated with recognisable design principles, even though successful images may deliberately depart from conventional rules (Wang et al., 2022). At the perceptual level, aesthetic sensitivity concerns the capacity to discriminate visual quality, and evidence from Chinese students indicates that formal artistic training can strengthen this capacity (Zhang et al., 2023). At the cognitive and creative level, aesthetic sensitivity is related to intelligence, openness to aesthetics and figural divergent thinking (Myszkowski et al., 2014). Taken together, these strands describe comprehensive ability as an integration of technical execution, aesthetic judgement and creative cognition rather than as any one component in isolation.

Learning theory suggests a mechanism by which this integration develops. Cognitive load theory describes domain-specific schemas as central to expert problem solving and explains why disconnected procedures must be organised into retrievable knowledge structures (Sweller, 1988). Project-based learning places such knowledge within student-directed inquiry and the production of authentic outputs (Bell, 2010), while control-value theory explains how learners' emotions, perceived control and task value influence engagement and achievement (Pekrun, 2006). These perspectives point to a coherent pathway: motivation sustains effort, authentic creative practice converts knowledge into performance, and perceived future relevance helps maintain engagement. Interest is consistently associated with attention, persistence and learning (Harackiewicz et al., 2016), and connected arts research further shows how interest-driven making, supportive relationships and links to academic or career opportunities operate together (Peppler et al., 2022).

In Shanxi Province, this general problem takes a specific regional form. Photography provision is distributed across institution types with markedly different resource bases—comprehensive universities, a media college, normal universities and vocational institutions—and equipment and staffing are unevenly matched to the demands of contemporary practice. Curricula continue to centre on classical photographic theory and foundational technique, with limited coverage of short-video production, aerial photography and computational image processing, so graduates absorb the cost of closing those gaps early in their careers. Student development mirrors the imbalance: some students operate professional equipment competently but produce work that is thin in conception and emotional expression, while others show strong aesthetic perception that they cannot realise technically. This local pattern parallels broader calls for Chinese higher photography education to move beyond conventional technique-centred delivery by integrating emerging media, industry-linked tasks and interactive forms of assessment (Chen, 2024).

Despite this, three gaps remain. First, most existing accounts are descriptive or conceptual and do not test the proposed relationships empirically. Second, those that are empirical typically examine one factor at a time and therefore cannot show how internal and external influences combine. Third, almost no study models the pathways through which distal

factors reach comprehensive ability, so it remains unknown whether resources and family circumstances matter directly or only insofar as they shape what students perceive about their professional futures. The present study addresses these gaps by testing an integrated model in a regional Chinese setting.

The variables in that model were selected on this basis. Five predictors are drawn from the two domains the literature identifies as consequential: the internal domain of Learning Attitude, Personal Interests and Photography Skills, which together represent motivation, disposition and executable technique; and the external domain of Learning Resources and Family Support, which represent the institutional and familial conditions under which learning occurs. Research on creative learning environments highlights the importance of appropriate resources, flexible learning settings and collaborative relationships (Davies et al., 2013), while connected arts learning emphasises the joint roles of interests, supportive relationships and career-linked opportunities (Pepler et al., 2022). Two mediators are specified because the reviewed work implies two distinct routes rather than one. Photographic Creation Ability represents the internal route, in which motivation and technique are enacted in creative production before contributing to broader competence. Employment Prospects represents the external route, in which resources and support influence competence only to the extent that students translate them into an informed reading of the labour market. Modelling both routes simultaneously allows the study to test whether internal and external influences reach comprehensive ability through different mechanisms, which single-mediator designs cannot establish.

Research Objectives

1. To examine the levels of the studied variables among undergraduate photography students in Shanxi Province.
2. To examine the direct and indirect effects of the hypothesised factors on students' comprehensive ability.
3. To propose policy recommendations for enhancing photography students' comprehensive ability.

Research Hypotheses

- H1: Learning Attitude has a direct effect on photography students' comprehensive ability.
- H2: Learning Attitude has an indirect effect on photography students' comprehensive ability through Photographic Creation Ability.
- H3: Personal Interests have an indirect effect on photography students' comprehensive ability through Photographic Creation Ability.
- H4: Photography Skills have an indirect effect on photography students' comprehensive ability through Photographic Creation Ability.
- H5: Photographic Creation Ability has a direct effect on photography students' comprehensive ability.
- H6: Learning Resources have an indirect effect on photography students' comprehensive ability through Employment Prospects.
- H7: Family Support has an indirect effect on photography students' comprehensive ability through Employment Prospects.
- H8: Employment Prospects have a direct effect on photography students' comprehensive ability.
- H9: Family Support has a direct effect on photography students' comprehensive ability.

Conceptual Framework

The model comprises five predictor variables (Learning Attitude, Personal Interests, Photography Skills, Learning Resources and Family Support), two mediator variables (Photographic Creation Ability and Employment Prospects) and one criterion variable (photography students' comprehensive ability), as shown in Figure 1.

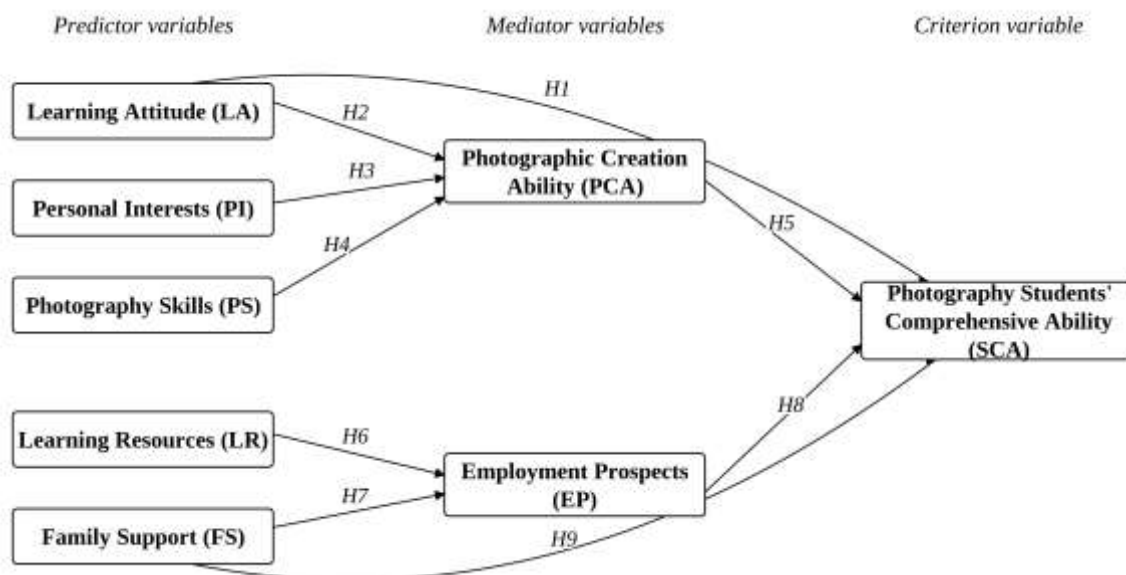


Figure 1 Conceptual framework of the research

Methodology

Research Design

The study used a cross-sectional, quantitative-dominant mixed-methods design. Questionnaire data were used to estimate the hypothesised model, and semi-structured interviews were used to interpret and contextualise the quantitative findings. Because all data were collected at a single point in time, the analysis identifies associations consistent with the hypothesised structure rather than establishing causal precedence.

Population and Sample

The population comprised undergraduate students majoring in photography at the six institutions in Shanxi Province offering photography programmes: comprehensive universities (Shanxi University, Jinzhong University), a media college (Communication University of Shanxi), normal universities (Shanxi Normal University, Taiyuan Normal University) and a vocational institution (Shanxi Vocational University of Engineering Science and Technology). Enrolment data supplied by the institutions gave a total population of 4,254 students.

Sample size was determined using Cochran's formula with a 95% confidence level ($Z = 1.96$), maximum variability ($p = q = 0.50$) and a margin of error of 5% ($e = 0.05$), yielding $n_0 = 384$. Applying the finite population correction for $N = 4,254$ gave a required sample of 353. To allow for non-response, the target was inflated using an expected effective response rate of 85%, giving 415, and 460 questionnaires were distributed.

Stratified sampling was applied with institution type as the stratum (comprehensive, media, normal and vocational), and the number of questionnaires allocated to each institution was proportional to its share of the photography enrolment. Within each stratum, the sampling frame was the institution's list of enrolled photography students ordered by student identification number; a sampling interval was computed by dividing the stratum population

by the stratum allocation, a random start was selected within the first interval, and cases were drawn at fixed intervals thereafter. Questionnaires were distributed online by academic affairs offices to the students selected in this way. Because distribution was mediated by institutional staff, an element of clustering at the institution level cannot be excluded, and this is acknowledged as a limitation. Non-response was handled by retaining the achieved sample rather than by replacement sampling; the achieved n of 418 exceeds the 353 required by the power calculation.

Research Instruments

Two instruments were used: a questionnaire on the factors affecting the comprehensive ability of photography majors, and a semi-structured interview guide.

Part 1: Respondent characteristics (checklist) — gender, institution, year of study, internship experience and duration of photography study.

Part 2: Predictor and mediator variables (five-point Likert scale) — seven constructs comprising 42 items in total.

Part 3: Criterion variable, comprehensive ability (five-point Likert scale) — 7 items.

Part 4: Two open-ended questions inviting additional views and suggestions.

The semi-structured interview guide comprised six open-ended questions covering the perceived importance of comprehensive ability, obstacles to its improvement, the use of cultural, technical and theoretical resources, suggestions for enhancement, and the perceived effectiveness of curriculum innovation and the creative climate within the institution.

The instruments were developed in English, translated into Chinese by a bilingual researcher, independently back-translated into English by a second bilingual translator who had not seen the original, and reconciled by the research team. Discrepancies concerned wording rather than meaning and were resolved by consensus before the pilot rounds.

Instrument Quality

Instrument quality was established in three distinct respects, which are reported separately because they provide different kinds of evidence.

Content validity

A draft questionnaire was reviewed by the thesis supervisor for language, accuracy and coverage of the construct definitions, and was then submitted to five experts who rated item-objective congruence. Items with an IOC index between 0.60 and 1.00 were retained.

Factorability

Kaiser–Meyer–Olkin values ranged from 0.792 to 0.926 across constructs and all exceeded the 0.60 criterion, and Bartlett’s test of sphericity was significant in every case ($p < .001$), indicating that the data were suitable for factor extraction. These statistics establish that the correlation structure is factorable; they are not evidence of construct validity.

Internal consistency

The instrument was piloted with three groups of respondents similar to the sample ($n = 60, 63$ and 60). Cronbach’s alpha ranged from 0.862 to 0.913 for the factor scales, was 0.862 for the comprehensive ability scale, and exceeded 0.85 for the instrument as a whole.

Limitation of the validity evidence

Confirmatory factor analysis was not conducted, and average variance extracted and composite reliability are therefore not reported. Content validity, factorability and internal consistency do not substitute for construct validity evidence. This limitation constrains the interpretation of the structural results and is revisited in the Limitations section.

Ethical Considerations

Permission to collect data was obtained from the Graduate School, Southeast Asia University, and the permission letter, together with the research purpose and the questionnaire, was presented to the academic affairs offices and photography department heads of the six participating institutions. Participation was voluntary and anonymous. Students were informed of the purpose of the study and of the confidentiality of their responses before completing the questionnaire, and interview participants gave permission for their interviews to be recorded and transcribed.

Data Collection

Questionnaire data were collected through the online survey platform Wenjuanxing. Of the 460 questionnaires distributed, 432 were returned. Fourteen responses were excluded because key information was missing or the response pattern showed evident non-differentiation, leaving 418 valid cases and an effective response rate of 90.9%. No imputation was required, as the retained cases were complete on all modelled variables. For the qualitative component, 15 students of differing academic standing and practical experience were selected for in-depth interviews conducted offline or online; all interviews were recorded with permission and transcribed for analysis.

Data Analysis

Descriptive statistics, correlation analysis and reliability analysis were conducted in SPSS 26.0. The hypothesised model was estimated by maximum likelihood. Because each construct was represented by a single observed composite formed from the mean of its items, rather than by multiple indicators of a latent variable, the analysis is a path analysis with observed variables rather than a latent-variable structural equation model, and it is described as such throughout. Composite scoring was adopted to preserve statistical power given the number of constructs relative to the sample size; the trade-off is that measurement error is not modelled, which tends to attenuate the estimated coefficients. Indirect effects were tested using bootstrapped estimates with bias-corrected confidence intervals.

The results are presented in five parts: (1) examination of data distribution characteristics; (2) levels of the studied variables; (3) relationships among the variables and comprehensive ability; (4) fit of the hypothesised model to the empirical data; and (5) direct and indirect effects of the causal factors on comprehensive ability.

Results

Part 1 Data Distribution Characteristics

Table 1 Means, standard deviations, coefficients of variation, skewness and kurtosis of the observed variables (n = 418)

Variable	k	M	SD	C.V. (%)	Level	Skewness	Kurtosis	p (χ^2)
SCA	7	3.86	0.73	18.78	High	−0.546	0.444	.999
LA	7	4.04	0.74	18.43	High	−0.920	1.138	.999
PI	6	4.01	0.59	14.73	High	−0.350	0.941	.994
PS	6	3.69	0.79	21.27	Moderate	−0.548	−0.041	.985
LR	6	3.78	0.68	18.18	High	−0.560	0.828	.998
FS	6	3.59	0.73	20.30	Moderate	−0.061	−0.506	.996
PCA	6	3.30	0.90	27.38	Moderate	−0.003	−1.107	.962
EP	5	4.02	0.57	14.10	High	−0.462	1.871	.998

Note: SCA = Comprehensive Ability; LA = Learning Attitude; PI = Personal Interests; PS = Photography Skills; LR = Learning Resources; FS = Family Support; PCA = Photographic Creation Ability; EP = Employment Prospects. k = number of items

Table 1 reports the descriptive statistics for the eight observed variables. All variables scored at a moderate level or above. Learning Attitude recorded the highest mean ($M = 4.04$) and Photographic Creation Ability the lowest ($M = 3.30$). Coefficients of variation ranged from 14.10% for Employment Prospects to 27.38% for Photographic Creation Ability, indicating that responses were relatively concentrated, with the widest dispersion on the lowest-scoring variable. Skewness values were negative throughout, and skewness and kurtosis remained within conventional limits for approximate normality, supporting the use of maximum likelihood estimation.

Part 2 Levels of the Studied Variables

Table 2 Means, standard deviations and levels of the studied variables (n = 418)

No.	Variable	M	SD	Level
1	Comprehensive Ability	3.86	0.73	High
2	Learning Attitude	4.04	0.74	High
3	Personal Interests	4.01	0.59	High
4	Photography Skills	3.69	0.79	Moderate
5	Learning Resources	3.78	0.68	High
6	Family Support	3.59	0.73	Moderate
7	Photographic Creation Ability	3.30	0.90	Moderate
8	Employment Prospects	4.02	0.57	High

Note: Interpretation criteria: 1.00–1.80 = very low; 1.81–2.60 = low; 2.61–3.40 = moderate; 3.41–4.20 = high; 4.21–5.00 = very high

Table 2 shows that six of the eight variables fell in the high band and two in the moderate band. Learning Attitude was highest ($M = 4.04$), followed by Employment Prospects ($M = 4.02$) and Personal Interests ($M = 4.01$). Photographic Creation Ability was the only variable in the lower part of the moderate band ($M = 3.30$) and also showed the greatest dispersion ($SD = 0.90$), indicating both a lower average level of creative production capacity and greater variation among students on this dimension than on any other. Within the comprehensive ability scale, artistic creation items scored above the scale mean while critical analysis items scored below it, and within Photographic Creation Ability the narrative expression item was lowest ($M = 3.19$). Together these patterns describe an imbalance between execution and reflection.

Part 3 Relationships Among the Variables

Table 3 Correlation matrix for the studied variables and comprehensive ability ($n = 418$)

Variable	LA	PI	PS	LR	FS	PCA	EP	SCA
LA	1.000	.590**	.506**	.437**	.440**	.346**	.516**	.640**
PI		1.000	.475**	.536**	.487**	.398**	.606**	.607**
PS			1.000	.386**	.406**	.308**	.454**	.561**
LR				1.000	.569**	.445**	.475**	.443**
FS					1.000	.492**	.446**	.511**
PCA						1.000	.425**	.445**
EP							1.000	.603**
SCA								1.000

Note: KMO = 0.931. Bartlett's test of sphericity: $df = 28$, $p < .001$. ** $p < .01$.

Table 3 presents the correlations among the studied variables. All variables were significantly and positively correlated with comprehensive ability. Learning Attitude showed the strongest association ($r = .640$), followed by Personal Interests ($r = .607$) and Employment Prospects ($r = .603$), while Photographic Creation Ability showed the weakest ($r = .445$). Inter-correlations among the predictors were moderate, ranging from .308 to .590, which is consistent with distinct but related constructs; no coefficient approached the level at which multicollinearity would threaten estimation. The KMO value of 0.931 and the significant Bartlett's test indicate that the correlation structure was suitable for factor extraction.

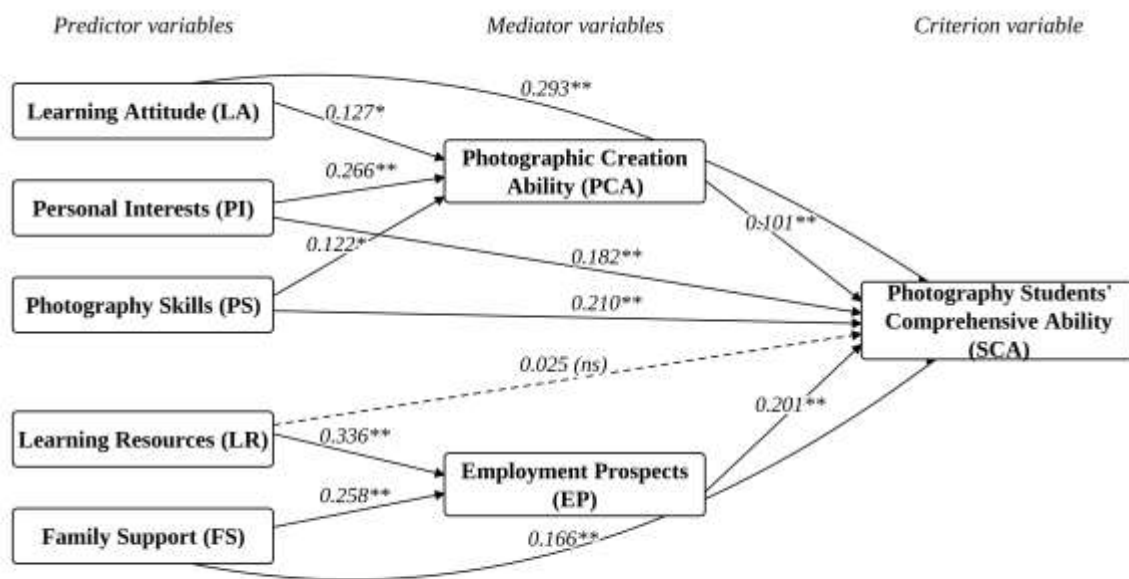
Part 4 Model Fit

Table 4 Model fit statistics

Index	Recommended criterion	Obtained value	Assessment
χ^2/df	< 3 preferred; < 5 acceptable	4.114	Acceptable
CFI	$\geq .90$	0.832	Below threshold
TLI	$\geq .90$	Not reported	Not assessed
RMSEA	$\leq .08$	Not reported	Not assessed
SRMR	$\leq .08$	Not reported	Not assessed



Model fit was mixed. The χ^2/df ratio of 4.114 falls within the range often treated as acceptable for large samples, but the comparative fit index of 0.832 falls below the conventional threshold of .90, indicating that the hypothesised structure does not reproduce the observed covariances as closely as would be required for the model to be described as well fitting. The model is therefore interpreted as providing a partial account of the relationships among the variables, and the substantive findings reported below should be read with that qualification. The direct path from Learning Resources to comprehensive ability was not statistically significant ($\beta = 0.025$) and was removed; the reported estimates are those of the respecified model. Because this respecification was data-driven rather than theory-driven, it requires confirmation in an independent sample.



Note. Dashed line = statistically non-significant path. Coefficients are standardised total effects; see Table 5 for the decomposition. * $p < .05$. ** $p < .01$.

Figure 2 Estimated path model

Part 5 Direct and Indirect Effects

Table 5 Direct, indirect and total effects on the endogenous variables

Outcome	R ²	Effect	LA	PI	PS	LR	FS	PCA	EP
PCA	.189	DE	.127*	.266**	.122*	—	—	—	—
		IE	—	—	—	—	—	—	—
		TE	.127*	.266**	.122*	—	—	—	—
EP	.594	DE	—	—	—	.336**	.258**	—	—
		IE	—	—	—	—	—	—	—
		TE	—	—	—	.336**	.258**	—	—
SCA	.279	DE	.280**	.155**	.198**	—	.114**	.101**	.201**
		IE	.013*	.027*	.012*	.067**	.052**	—	—
		TE	.293**	.182**	.210**	.067**	.166**	.101**	.201**

Note: DE = direct effect; IE = indirect effect; TE = total effect. All coefficients are standardised. * $p < .05$.

** $p < .01$.

Table 5 reports the decomposition of effects. The model accounted for 27.9% of the variance in comprehensive ability, 18.9% in Photographic Creation Ability and 59.4% in Employment Prospects. Learning Attitude had the largest total effect on comprehensive ability ($\beta = .293$), followed by Photography Skills ($\beta = .210$), Employment Prospects ($\beta = .201$), Personal Interests ($\beta = .182$) and Family Support ($\beta = .166$). Photographic Creation Ability had the smallest significant total effect ($\beta = .101$). Learning Resources reached comprehensive ability only indirectly, through Employment Prospects ($\beta = .067$), its direct path having been non-significant.

The two mediators operated on different sets of predictors. Photographic Creation Ability carried small but significant indirect effects from Learning Attitude, Personal Interests and Photography Skills, while Employment Prospects carried the effects of Learning Resources and Family Support. Employment Prospects was also the more strongly determined of the two mediators, with 59.4% of its variance explained compared with 18.9% for Photographic Creation Ability.

With respect to the hypotheses, H1, H5 and H8 were supported for the direct paths, and H2, H3, H4, H6 and H7 were supported for the indirect paths. H9, specifying a direct effect of Family Support, was supported, although the indirect route through Employment Prospects accounted for a substantial share of its total effect.

Discussions

Associations Between the Studied Variables and Comprehensive Ability

All seven factors were positively and significantly associated with comprehensive ability, with coefficients between .308 and .640. The ordering of these associations is informative. Learning Attitude was most strongly associated with comprehensive ability ($r = .640$), followed by Personal Interests ($r = .607$) and Employment Prospects ($r = .603$)—that is, two dispositional variables and one perceptual variable outranked the direct measure of technical skill ($r = .561$). This ordering is consistent with social cognitive accounts of learning, in which self-directed effort and outcome expectancies regulate the acquisition of complex competence (Bandura, 1986), and with Gardner's (1983) broader account of spatial intelligence, which is relevant to visual disciplines. It also accords with evidence that interest supports attention, persistence and learning (Harackiewicz et al., 2016), and with connected arts research linking interest-driven making to supportive relationships and academic or career opportunities (Peppler et al., 2022).

The comparatively weaker association of Photography Skills, alongside interview accounts of curricula that emphasise equipment operation over interpretive analysis, should not be read as showing that technical skill is unimportant. Photography research shows that design principles provide an important basis for image quality but that successful work also depends on judgement about when and how conventions can be departed from (Wang et al., 2022). Research on Chinese students likewise indicates that artistic training strengthens visual aesthetic sensitivity (Zhang et al., 2023), and aesthetic sensitivity itself is associated with figural divergent thinking (Myszkowski et al., 2014). Together, these findings support the interpretation that technical and aesthetic development must proceed in combination. Because the design is cross-sectional, however, these associations do not establish direction: students who are already developing broad competence may equally acquire more favourable attitudes and clearer career expectations as a result.

Model Fit and the Non-Significant Resource Path

The hypothesised structure was only partially supported by the fit statistics, and the most substantively interesting result is a negative one: the direct path from Learning Resources to comprehensive ability was not significant, while its indirect path through Employment Prospects was ($\beta = .067$). Read through Bronfenbrenner's (1979) ecological framework, this suggests that institutional provision does not act on competence as a simple input. This interpretation is compatible with research on creative learning environments, which treats resources as part of a wider configuration of pedagogy, collaboration, learner agency and external connections rather than as stand-alone inputs (Davies et al., 2013). Resources appear to matter insofar as they alter what students perceive to be possible and required in the labour market—that is, insofar as the mesosystem linking institution and industry is active. Interview accounts of a gap between teaching equipment and professional standards are consistent with this interpretation, although an equally plausible explanation is that the measure of Learning Resources captured availability rather than use, and availability may be only weakly related to the practice through which competence develops.

A similar pattern held for Family Support, whose effect was partly transmitted through Employment Prospects ($\beta = .052$). Material support appears to be associated with comprehensive ability chiefly where it is converted into industry exposure. This interpretation is consistent with connected arts learning, which emphasises supportive relationships and networks as bridges from interest-driven practice to future opportunities (Peppler et al., 2022). Interviews indicated that some students without such support achieved comparable exposure through self-directed learning and peer networks, which suggests that the mechanism is access to professional experience rather than family resources as such; however, this observation rests on a small number of interviews and should be treated as a hypothesis for further testing rather than an established finding.

The Dual-Mediator Structure

The clearest theoretical contribution of the model lies in the contrast between its two mediators. Photographic Creation Ability transmitted the effects of the internal predictors—attitude, interest and skill—whereas Employment Prospects transmitted the effects of the external predictors—resources and family support. The two routes are not interchangeable. The internal route corresponds to a project-based account of competence as something formed through authentic production (Bell, 2010), in which motivation must be enacted in creative work before it registers as broader capacity; the small size of the indirect effects through this route ($\beta = .012$ to $.027$) suggests that this conversion is currently inefficient, which is consistent with Photographic Creation Ability being the lowest-scoring variable in the study. The external route corresponds to the ecological account, in which context shapes development through the meanings students attach to it (Bronfenbrenner, 1979).

That Employment Prospects was far better explained than Photographic Creation Ability ($R^2 = .594$ versus $.189$) reinforces the point. Students' reading of the labour market is strongly conditioned by their institutional and family circumstances, whereas their creative production capacity is largely determined by factors this model does not contain. Since the full model explained 27.9% of the variance in comprehensive ability, substantial influences remain unmeasured. Interview data pointed to cross-media capability — short-video editing, visual storytelling — and to mentoring relationships as likely candidates. Alternative explanations for the unexplained variance, including omitted institutional characteristics and prior ability, cannot be ruled out with the present design.

Conclusion and suggestions

This study found that the comprehensive ability of undergraduate photography students in Shanxi Province is most strongly associated with Learning Attitude, and that external conditions such as institutional resources and family support are related to it primarily through students' perceptions of employment prospects rather than directly. The following recommendations follow from these findings.

1. For students. Given that Learning Attitude carried the largest total effect ($\beta = .293$), students would benefit from setting staged and specific goals, from deliberately strengthening the technical foundations on which creative work depends, and from developing aesthetic literacy through sustained study of established work. Because Employment Prospects also carried a substantial effect ($\beta = .201$), building a portfolio oriented towards emerging areas of practice and seeking feedback on professional platforms are likely to be productive.

2. For teachers. The weakness of Photographic Creation Ability, and the small indirect effects running through it, indicate that the conversion of motivation into creative output is the point at which current provision is least effective. Project-based assignments grounded in local subject matter, structured peer review producing a creation–feedback–iteration cycle, and workshops addressing narrative and visual storytelling target this specific weakness, which the item-level results locate in narrative expression ($M = 3.19$).

3. For institutions. Because Learning Resources influenced comprehensive ability only through Employment Prospects, investment in equipment alone is unlikely to be sufficient. Resource provision should be paired with structured industry contact partnerships with local media and cultural enterprises, involvement of practising professionals in curriculum design, and coverage of emerging fields so that provision translates into an informed reading of professional requirements. Assessment should combine process evaluation, portfolio review and industry mentor input.

4. For families and the wider community. Since the effect of Family Support ran substantially through Employment Prospects, support that provides industry exposure is likely to be more consequential than material provision alone. Encouraging participation in events such as the Pingyao International Photography Festival, together with industry–academia collaboration and mentoring schemes, can supply such exposure to students whose families cannot.

Limitations

The design is cross-sectional, so the estimated paths describe associations consistent with the hypothesised ordering rather than causal effects. Reverse causation and reciprocal influence are plausible for several relationships, particularly between attitude and ability. Constructs were modelled as observed composites rather than as latent variables with multiple indicators, so measurement error is unmodelled and coefficients are likely to be attenuated. Confirmatory factor analysis was not conducted, and construct validity evidence is therefore limited to content validity and internal consistency. The comparative fit index (0.832) falls below conventional standards, indicating that the specified structure reproduces the observed relationships only partially. Removal of the non-significant Learning Resources path was data-driven and requires cross-validation in an independent sample. Data were self-reported and collected through institutional intermediaries, introducing possible common-method variance and a degree of clustering at the institution level. The findings concern one province and one discipline, and generalisation beyond comparable settings should be cautious.

Recommendations for Future Research

1. Extend the sample across regions at different levels of economic development, and across career stages from undergraduate study to professional practice, to test whether the dual-mediator structure holds under different conditions.

2. Introduce moderators such as gender, year of study and internship experience, and collect longitudinal data capable of establishing temporal ordering in the motivation–practice–ability sequence. Disaggregating Photographic Creation Ability into technical implementation, conceptual development and narrative expression would allow the weakest link to be identified precisely.

3. Combine the survey approach with ethnographic observation and, where feasible, eye-tracking studies of aesthetic judgement, together with monitoring of industry demand, to explain the substantial variance the present model leaves unaccounted for.

New knowledge and the effects on society and communities

1. Theoretical contribution: a dual-mediator model. Existing accounts of competence formation in art education generally posit a single pathway from antecedent to outcome. This study specifies and tests two parallel mediators representing distinct mechanisms — Photographic Creation Ability as an internal, production-based route and Employment Prospects as an external, market-oriented route and finds that they carry different sets of predictors. This provides art education research with a framework capable of distinguishing influences that operate through what students make from those that operate through what students understand about their professional futures.

2. Empirical contribution: attitude outweighs technique. Learning Attitude showed a larger total effect on comprehensive ability ($\beta = .293$) than Photography Skills ($\beta = .210$). This qualifies the technique-centred assumption underlying much photography curriculum design and indicates that dispositional factors warrant explicit attention as objects of instruction rather than being treated as prerequisites students bring with them.

3. Methodological and contextual contribution. The study provides quantitative evidence on photography education in an inland Chinese province, a setting largely absent from a literature dominated by conceptual argument and by evidence from coastal metropolitan institutions, and it does so across four institution types rather than a single case.

4. Practical and social impact. For the six institutions studied, the findings function as a diagnostic instrument. They locate the weakest point in provision at narrative and interpretive capacity rather than at technical training, and they indicate that resource investment yields returns chiefly when accompanied by industry linkage. Acting on both points would address the skill–reflection imbalance documented here and strengthen the professional preparation of the regional creative workforce, with consequences for the cultural and economic development of Shanxi Province.

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Whistleblower Protection as Social Capital Infrastructure: Institutional Design and Weaponization Risks in Thailand's 2025 Anti-SLAPP Law

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Abstract

Thailand's 2025 Anti-SLAPP law represents a significant legal innovation in whistleblower protection, yet this article identifies a systemic paradox: the very mechanisms designed to shield whistleblowers from retaliation may enable their weaponization against legitimate targets. Through qualitative document analysis comparing Thailand's Organic Act on Counter-Corruption (No. 2) B.E. 2568 (2025) with international frameworks including UNCAC Article 33, the U.S. False Claims Act, Singapore's Prevention of Corruption Act, and Vietnam's anti-corruption legislation, this study analyzes, in the continued absence of documented implementation data, the institutional conditions under which legal protection could convert dormant social capital into active citizenship, and what safeguards would prevent abuse. The analysis reveals that Thailand's framework shifts from passive immunity toward active legal defense, providing comprehensive protection through seven mechanisms. However, the undefined "good faith" standard and absence of penalties for false reporting create pathways for "lawfare"—the strategic use of legal mechanisms for competitive or political advantage. Two hypothetical scenarios illustrate potential weaponization risks: business warfare through false allegations and coordinated political suppression. The study proposes four safeguards: explicit good faith definition adopting UNCAC 2023 standards, two-tier review process, NACC-enforced penalties, and confidentiality protocols. These findings contribute to understanding how legal infrastructure interacts with social capital in hierarchical societies, offering a diagnostic framework for anticipating weaponization risk in comparable legal reforms.

Keywords: Whistleblower protection, Anti-SLAPP, Social capital, Thailand, Corruption, Legal mobilization, UNCAC



Introduction

On July 17, 2013, a 41-word paragraph published by the Phuketwan news website exposed the Royal Thai Navy's alleged involvement in human trafficking. Journalists Alan Morison and Chutima Sidasathian faced criminal prosecution under Thailand's defamation laws—up to seven years imprisonment (Human Rights Watch, 2015). Their acquittal in 2015 did little to reverse the chilling effect: potential whistleblowers calculating that personal costs of exposing wrongdoing exceed any benefit (Canan & Pring, 1988). The case became emblematic of how legal systems intended to protect reputation can silence legitimate public interest reporting.

This problem is acute in hierarchical societies structured by patron-client networks (Scott, 1972; Sidel, 1999)—relationships in which access to resources and protection flows through personal loyalty to powerful patrons rather than through impersonal institutions. Citizens possess localized knowledge to detect corruption, but absent safe channels, this information remains dormant (known but unreported due to the absence of safe disclosure channels). Social capital—networks and norms enabling collective action (Putnam et al., 1994)—stays inactive despite widespread awareness of wrongdoing. Persson et al., (2013) demonstrate that in contexts of systemic corruption, anti-corruption efforts fail when they assume the existence of trustworthy enforcement institutions. Without credible protection, rational citizens remain silent even when collective action could produce significant benefits.

Yet social capital carries risk. Bourdieu (1986) showed networks can reproduce inequality, while Portes (1998) identified how elites capture collective resources for exclusionary purposes. This duality means legal mechanisms designed to activate social capital for accountability might simultaneously be captured for domination. Whistleblower protection functions as infrastructure reducing individual risk (Ostrom, 1990), but rights require active claiming—citizens must know protections exist, trust enforcement, and access resources (Epp, 1998; McCann, 1994). Legal text alone cannot manufacture such conditions (Vandekerckhove, 2007).

On June 5, 2025, Thailand enacted the Organic Act on Counter-Corruption (No. 2) B.E. 2568 (2025), shifting from passive immunity toward active legal defense. The reform provides whistleblowers with legal counsel, litigation expenses, and financial support through Anti-SLAPP mechanisms. However, the undefined "good faith" standard and absence of penalties for false reporting create pathways for lawfare (Carr & Lewis, 2010)—the strategic use of legal mechanisms to pursue competitive or political objectives beyond the law's protective intent. The same infrastructure designed to empower citizens can be exploited by sophisticated actors.

Existing scholarship examines whistleblower protection through legal mobilization and social capital lenses separately but has not analyzed how Anti-SLAPP mechanisms interact with patron-client structures to enable weaponization, a gap sharpened by limited engagement with Thai and ASEAN whistleblower literature.

Two questions guide this study: Under what conditions can whistleblower protection convert dormant social capital into active citizenship? What safeguards prevent weaponization while preserving protection for genuine reporters?

This study pursues three objectives: descriptively mapping Thailand's seven protection mechanisms; comparatively benchmarking these against UNCAC, U.S., Singaporean, and Vietnamese frameworks; and normatively proposing safeguards that preserve protection while curbing weaponization.

Methodology

This study employs qualitative document analysis combined with comparative legal study, applying purposive legal interpretation to identify statutory provisions and gaps. The research analyzes Thailand's Organic Act on Counter-Corruption (No. 2) B.E. 2568 (2025) as the primary source, comparing it with international frameworks including UNCAC Article 33, the 2023 UNCAC Resolution on whistleblower protection (CAC/COSP/2023/L.12/Rev.1), the U.S. False Claims Act, Singapore's Prevention of Corruption Act, and Vietnam's anti-corruption legislation as a civil-law ASEAN comparator. Secondary sources include academic literature on social capital theory (Bourdieu, 1986; Portes, 1998; Putnam et al., 1994), legal mobilization theory (Epp, 1998; McCann, 1994), and whistleblower protection research (Loyens & Vandekerckhove, 2018; Vandekerckhove, 2007), alongside reports from UNODC (United Nations, 2003; UNODC, 2018) and the Government Accountability Project (2023), prioritizing peer-reviewed sources given potential publication bias in institutional reports.

The analytical framework proceeds in four stages: first, textual analysis identifying protection mechanisms and statutory gaps in Thailand's legal provisions; second, comparative assessment positioning Thailand against international standards and peer jurisdictions selected for Anti-SLAPP legislation and ASEAN relevance; third, risk scenario modeling based on identified vulnerabilities, drawing on patterns observed in Malaysia and other ASEAN countries (UNODC, 2018), serving as a proxy for empirical risk assessment given the continued absence of documented implementation data; and fourth, synthesis generating policy recommendations aligned with UNCAC standards. The comparative analysis examines five dimensions: Anti-SLAPP mechanisms, coverage scope, good faith standards, penalties for false reporting, and institutional enforcement capacity.

The study's limitation is the continued absence of documented NACC implementation data, notwithstanding the law's enactment in June 2025. Analyzing legal architecture ahead of the emergence of such data allows identification of vulnerabilities that policymakers can address proactively, following the approach used in comparative whistleblower protection research (Loyens & Vandekerckhove, 2018). The analysis begins with Thailand's 2025 framework and its position relative to international standards.

Results

Thailand's Organic Act on Counter-Corruption (No. 2) B.E. 2568 (2025), enacted June 5, 2025, establishes whistleblower protection through seven interconnected mechanisms. The framework shifts from passive immunity—merely exempting reporters from liability—toward active legal defense during litigation.

Table 1 Thailand's 2025 Whistleblower Protection Framework

Article	Provision	Mechanism	Operational Detail
33	Reporting Channels	Accessible, anonymous allowed	NACC must create channels "simple, convenient, causing no harm"
131	Physical Protection	Witness protection extended	Financial compensation during protection period
132	Triple Immunity	Civil, criminal, disciplinary	Conditional on "good faith" (undefined)
132/2-132/3	Anti-SLAPP Defense	Legal counsel, costs, bail	NACC pays expenses; suspends disciplinary proceedings
133	Workplace Protection	Transfer rights	Maintained rank and salary
137	Financial Rewards	Forfeited assets	Incentivizes reporting through economic benefit
162-163	Funding	Independent budget	National Anti-Corruption Fund

Note: Protections under Articles 132-133 require "good faith"—a term undefined in the statute, creating interpretive uncertainty.

Articles 132/2-132/3 represent the framework's core innovation, distinguishing Thailand from jurisdictions providing only passive immunity. When whistleblowers face defamation suits, the NACC provides legal counsel and covers all litigation expenses. For criminal charges, the NACC arranges defense and pays bail. This shifts financial and psychological burden from individual reporters to the state institution responsible for anti-corruption enforcement. The approach recognizes that even successful legal defense can bankrupt individual whistleblowers, creating deterrence through process costs rather than outcomes (Canan & Pring, 1988).

Article 137 creates financial incentives through rewards from forfeited assets, transforming whistleblowing from pure civic duty into economically rational behavior. This parallels *qui tam* provisions in the U.S. False Claims Act, where whistleblowers receive 15-30% of recovered funds, generating billions in fraud recoveries (Engstrom, 2012). However, financial incentives carry risk of encouraging speculative or frivolous reporting, making robust screening mechanisms essential.

Table 2 Comparative Whistleblower Protection Frameworks

Dimension	Thailand 2025	UNCAC Art. 33	USA (False Claims)	Singapore	Vietnam
Anti-SLAPP	Explicit	Implicit	State-level (40 states + DC)	None	None
Coverage	Citizens + Officials	Any person	Public + Private	Public + Private	Citizens (broad)
Good Faith Standard	Undefined	Good faith + reasonable grounds	Reasonable belief	Implicit	Undefined ("deliberate" prohibition only)
False Report Penalties	Absent	Not specified	Dismissal + penalties	General criminal law	Explicit (administrative fines + Criminal Code)
Financial Incentives	Yes (Art. 137)	Not specified	Yes (15-30% recovery)	No	Yes (Art. 68)

Thailand advances beyond UNCAC minimum standards through explicit Anti-SLAPP provisions and broad coverage. Singapore extends informer confidentiality to both public and private reporters but has no Anti-SLAPP defense mechanism, favoring institutional stability over active litigation support (Quah, 2011). Anti-SLAPP protection in the United States

remains state-based, now covering 40 states and the District of Columbia (Reporters Committee for Freedom of the Press, 2026)—a fragmented landscape Thailand's unified framework avoids. These state statutes, however, protect public-interest speech broadly rather than corruption reporting specifically; their applicability to a whistleblower retaliation suit depends on judicial characterization of the disclosure as a matter of public concern, whereas Thailand's Anti-SLAPP defense applies automatically once a report falls within the statute's corruption-reporting scope. Vietnam's Law on Denunciations (2018) and Law on Anti-Corruption (2018) offer a further civil-law ASEAN comparator. Coverage is broad, and Article 68 provides financial rewards for informers, paralleling Thailand's Article 137. Vietnam lacks an explicit Anti-SLAPP mechanism, however, relying instead on confidentiality and anti-retaliation safeguards. Article 8 prohibits "deliberately making untruthful denunciations," backed by administrative fines and Criminal Code penalties—an explicit false-reporting deterrent Thailand's framework lacks, though "deliberate" remains as operationally undefined as Thailand's good faith standard.

The 2023 UNCAC Resolution—which Thailand co-sponsored alongside the European Union, Norway, and other nations—defines good faith as "the reporting person's reasonable belief that the information reported is true, and without consideration of personal reasons" (United Nations, 2023). Thailand has not incorporated this definition domestically despite co-sponsoring the resolution, creating tension between international commitment and domestic implementation.

Identified Gaps

Two structural gaps emerge from the analysis. The more consequential concerns the good faith standard, which lacks statutory definition. The term appears in Article 132 as a condition for protection but receives no operational criteria. The statute provides no interpretive criteria for NACC officials making this determination. Thai legal tradition relies on judicial interpretation to fill such gaps, but this creates years of uncertainty while case law develops.

Second, no penalties exist for malicious false reporting within NACC jurisdiction. Whistleblowers receive comprehensive protection during the 15-day determination period, but those filing false reports face only general criminal defamation laws under Criminal Code Article 172—separate jurisdiction, different evidentiary standards, and lengthy prosecution that most victims decline to pursue given time and cost barriers. The U.S. False Claims Act addresses this asymmetry through explicit dismissal procedures and penalties for knowingly false claims (Engstrom, 2012). Without similar mechanisms, no equivalent deterrent exists within NACC jurisdiction.

These structural gaps create pathways for manipulation that warrant closer examination.

Discussions

The gaps identified—undefined good faith and absent penalties—create concrete pathways for abuse. This section examines two scenarios illustrating how protection mechanisms can be weaponized, using illustrative parameters rather than documented cases, models the common pathway enabling manipulation, and compares Thailand's vulnerabilities with experiences in other jurisdictions.

Scenario A: Business Warfare

A construction firm files an NACC report alleging a competitor's CEO accepted bribes, timed days before a major government contract bid. Fabricated bank documents showing suspicious transfers accompany the report, referencing recent infrastructure failures to suggest safety corner-cutting. During the 15-day review period, immediate damage unfolds: the target

company's stock experiences a significant decline, commercial banks freeze credit lines pending investigation, and the contracting agency delays procurement. Media coverage amplifies reputational harm regardless of eventual determination.

By the time NACC conducts thorough investigation and determines the report lacks good faith—potentially months later—the accusing firm has secured substantial alternative contracts. The target must pursue separate criminal prosecution under Criminal Code Article 172 in different jurisdiction, a process requiring years of litigation with different evidentiary standards. Cost-benefit calculation reveals false reporting as profitable strategy: significant competitive gains against manageable legal risk (Portes, 1998). Without NACC-enforced penalties, the framework inadvertently incentivizes strategic abuse by sophisticated commercial actors.

Scenario B: Political Suppression

A provincial governor implements land reform benefiting small farmers but threatening established landowner interests. Within weeks, dozens of NACC reports arrive from different individuals across the province, each alleging different forms of corruption in the reform program. Investigation reveals coordinated characteristics: identical document formatting, similar legal language, and synchronized submission timing suggesting professional preparation.

The governor spends the majority of working time responding to inquiries rather than implementing policy. Media coverage focuses on the volume of allegations rather than their merit, damaging public trust. Reform momentum stalls as officials hesitate to proceed under investigation. The governor loses the subsequent election. Post-election investigation confirms the reports originated from networks funded by affected landowners, with a professional intermediary coordinating submissions. Accusers claim reasonable suspicion protection based on publicly available information. Without clear good faith criteria distinguishing genuine concern from coordinated harassment, NACC cannot impose penalties. Other reform-minded officials observe the outcome and avoid controversial policies (Gingerich, 2013).

The Weaponization Pathway

Although both scenarios share the same enabling pathway, they represent distinct weaponization typologies: competitive commercial abuse (Scenario A) and coordinated political suppression (Scenario B), each with differentiated intervention implications. The pathway itself unfolds in four stages:

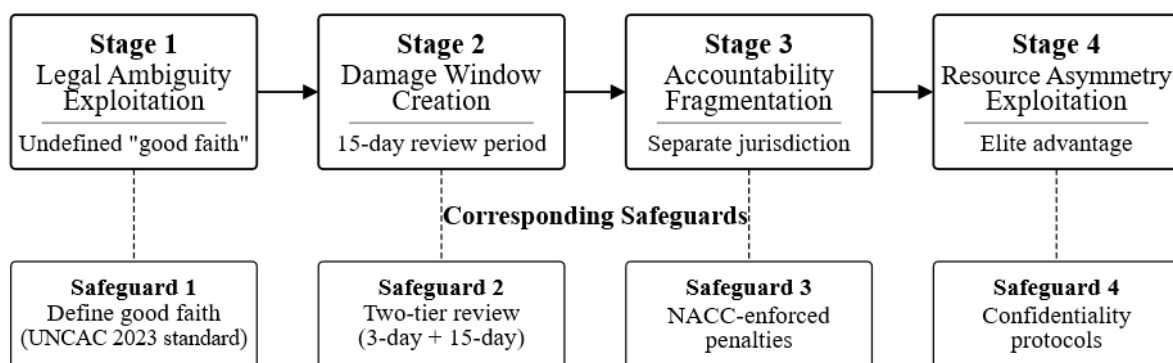


Figure 1 The Weaponization Pathway

(Source: Author's analysis based on Thailand's Organic Act on Counter-Corruption (No. 2) B.E. 2568, 2025)

Stage 1: Legal Ambiguity Exploitation. Undefined good faith allows claims of subjective belief without objective verification. NACC cannot prove internal intent, and judicial precedent defaults toward protecting reporters in ambiguous cases. Sophisticated actors craft allegations satisfying surface plausibility while serving strategic objectives.

Stage 2: Damage Window Creation. The 15-day initial review period permits irreversible harm before determination. Media disclosure precedes official assessment. Markets, institutions, and public opinion react to allegations rather than verified findings. Even eventual exoneration cannot fully restore reputation or recover lost opportunities.

Stage 3: Accountability Fragmentation. Victims must pursue remedies through Criminal Code Article 172 in separate jurisdiction with different evidentiary standards requiring proof of intentional defamation. Most decline lengthy prosecution given time, cost, and uncertain outcomes. Fragmented accountability means false reporters rarely face consequences proportionate to harm inflicted.

Stage 4: Resource Asymmetry Exploitation. Sophisticated actors with legal expertise and media connections navigate the system more effectively than ordinary citizens. NACC staff, facing existing caseload pressures, may lack capacity for deep investigation of coordinated attacks within tight deadlines. Surface-level review cannot distinguish genuine reports with limited evidence from sophisticated false reports with fabricated documentation .

Comparison with Other Jurisdictions

Malaysia's 2010 Whistleblower Protection Act provides instructive comparison. UNODC (2018) documents a structural vulnerability directly analogous to Thailand's: Section 11 grants the enforcement agency itself discretion to revoke protection where a disclosure is deemed to merely question government policy, a standard UNODC warns could lead to inconsistent implementation. Section 8 separately criminalizes a whistleblower's disclosure of their own report to third parties, including legal counsel. The Malaysian experience suggests that broad official discretion over good-faith determinations, absent clear operational criteria, creates the same ambiguity-exploitation risk identified in Stage 1 of the pathway above, regardless of institutional context. Both countries share patron-client structures and anti-corruption commissions balancing broad protective mandates against limited capacity for consistent enforcement.

The U.S. False Claims Act addressed similar vulnerabilities through explicit penalties creating deterrent effects. Whistleblowers filing knowingly false claims face dismissal, fee-shifting, and potential criminal prosecution. This accountability mechanism has not deterred legitimate reporting—qui tam filings have increased substantially—while discouraging frivolous or malicious claims (Engstrom, 2012). Yet this breadth-versus-specificity trade-off cuts both ways: the U.S. model offers wider speech protection overall, while Thailand's corruption-embedded design offers narrower but more predictable coverage for whistleblowers specifically.

Singapore represents an alternative approach: coverage extends to both public and private reporters, but protection relies on confidentiality rather than active litigation defense, minimizing weaponization risk at the cost of institutional support (Quah, 2011). Thailand's broader framework offers greater detection potential but requires stronger safeguards than Singapore's approach.

Thailand's framework concentrates on protection without equivalent accountability mechanisms. High social capital actors—those with legal expertise, media connections, and procedural knowledge—can exploit this imbalance more readily than marginalized communities can access protection benefits. These risks point to four safeguards addressing each stage of the weaponization pathway.

Conclusion and suggestions

This study examined whether Thailand's 2025 Anti-SLAPP framework can convert dormant social capital into active citizenship, and what safeguards prevent weaponization. The analysis reveals that legal protection alone cannot achieve transformation—and without accountability mechanisms, protection risks capture by the networks it aims to challenge.

Key Findings

Two principal findings emerge from the analysis. First, Thailand's framework provides robust protection infrastructure but lacks accountability balance. The undefined good faith standard and absent penalties create asymmetric risk: genuine whistleblowers face informal retaliation—social ostracism, career damage, economic boycott—while false reporters face minimal formal consequences. This asymmetry favors sophisticated actors capable of exploiting legal ambiguity over ordinary citizens seeking to report genuine wrongdoing.

Second, social capital activation requires more than legal text. Awareness of available protections, trust in enforcement institutions, capacity to navigate procedures, and cultural legitimacy determine whether citizens use available mechanisms (Epp, 1998; Vandekerckhove, 2007). Thailand's hierarchical social structure and historical stigmatization of "informers" create additional barriers that legal reform alone cannot address. Persson, Rothstein, and Teorell (2013) demonstrate that anti-corruption reforms fail when they assume institutional trustworthiness that does not exist in practice.

Proposed Safeguards

Four safeguards address the weaponization pathway stages identified in Section 4:

Table 3 Integrated Safeguard Framework

Safeguard	Target Stage	Mechanism	Implementation	Primary Typology
1. Define good faith	Stage 1: Ambiguity	UNCAC 2023 standard	Amend NACC regulations with operational criteria	Scenario B (political suppression)
2. Two-tier review	Stage 2: Damage window	Rapid screening + substantive review	Tier 1 (3 days) + Tier 2 (15 days)	Both
3. NACC-enforced penalties	Stage 3: Fragmentation	Administrative fines, registry, civil damages	Establish within NACC jurisdiction; requires additional investigative staffing/resources	Scenario A (commercial abuse)
4. Confidentiality protocols	Stage 4: Resource asymmetry	Sealed reports until determination	Prohibit disclosure; penalize leaks	Both

Safeguard 1: Define good faith explicitly. Adopt the UNCAC 2023 standard Thailand co-sponsored: "reasonable belief that information is true, without consideration of personal reasons" (United Nations, 2023). Operational criteria should require identification of specific wrongdoing with sufficient detail, provision of documentary or testimonial basis for belief, and absence of knowledge that information is false. These criteria reduce interpretive discretion while preserving protection for reporters acting on reasonable suspicion.

Safeguard 2: Implement two-tier review. Replace the single 15-day determination with differentiated process. Tier 1 (3 days): screen for obvious malice indicators—fabricated documents, coordinated submissions targeting competitors, vindictive patterns following

disputes. Reports demonstrating clear bad faith receive immediate rejection without protection. Tier 2 (15 days): substantive assessment of evidence quality, allegation specificity, and coordination indicators for reports passing initial screening (Loyens & Vandekerckhove, 2018). This structure prevents the damage window while maintaining thorough review.

Safeguard 3: Establish NACC-enforced penalties. Create accountability mechanisms within NACC jurisdiction rather than relying on separate criminal prosecution. Components include: administrative fines scaled to harm severity, public vexatious reporter registry for repeat offenders, expedited civil damages adjudication, and criminal referral for clear fabrication. These create deterrent effects where potential penalties outweigh strategic gains from false reporting (Engstrom, 2012). Effective deterrence depends on NACC's investigative capacity, however; without additional staffing and resources, expedited penalty procedures risk becoming procedurally sound but practically underenforced.

Safeguard 4: Require confidentiality during investigation. Prohibit media disclosure until Tier 2 determination completes. Reports remain sealed during review. Reporters may disclose after NACC confirms good faith determination. Penalties for unauthorized disclosure include loss of protection plus civil defamation liability. This prevents trial by accusation where reputational damage occurs before legitimacy determination, equalizing vulnerability between reporters and targets (Brown et al., 2014).

Ecosystem Requirements

Safeguards prevent manipulation but cannot alone activate positive social capital. Effective implementation requires sustained ecosystem development: multimedia awareness campaigns in regional languages ensuring citizens understand available protections, quarterly transparency reports demonstrating NACC determination patterns and building institutional credibility, legal aid centers in provinces providing practical support to those without resources for complex procedures, and civil society organizations serving as intermediaries bridging citizens and formal institutions. This ecosystem-building imperative aligns with Ostrom's (1990) analysis of collective action, which demonstrates that sustainable governance of shared resources depends on multiple, mutually reinforcing institutional layers rather than a single top-down mechanism—a principle equally applicable to sustaining whistleblower reporting as a collective good.

Cultural transformation—reframing whistleblowing from betrayal of group loyalty to contribution toward collective welfare—spans decades rather than years, requiring integration into educational curricula and public recognition programs (McCann, 1994). Effective implementation would require emphasizing protection credibility through demonstrated enforcement before expecting widespread citizen utilization.

Future Research

This study's primary limitation is the continued absence of documented NACC implementation data, notwithstanding the law's enactment in June 2025. Future research should pursue three directions: longitudinal monitoring of NACC determination patterns examining potential selective enforcement; stakeholder interviews revealing practical barriers faced by whistleblowers and implementing officials; and cross-country comparison with other UNCAC signatories facing similar implementation challenges. Such studies would validate whether theoretical predictions hold in practice and identify context-specific adaptations.

Thailand's crisis of silence will not end through legal text alone. Transformation requires sustained commitment beyond formal mechanisms—building awareness, institutional trust, and cultural legitimacy that convert legal rights into lived practice. Beyond immediate policy implications, this analysis yields broader insights for understanding law and social change.

New knowledge and the effects on society and communities

This analysis contributes to understanding the relationship between legal reform and social transformation in two dimensions: conceptual framework and practical application.

Conceptual Contribution

The study develops a "Law as Social Capital Infrastructure" framework demonstrating that whistleblower protection functions not merely as individual rights but as institutional architecture enabling or constraining collective action. This framework synthesizes Putnam's (1994) emphasis on social capital's civic benefits with Bourdieu's (1986) insight that networks simultaneously reproduce inequality. The synthesis predicts that legal infrastructure activates social capital bidirectionally—empowering both accountability and domination depending on safeguard design. This bidirectional emphasis distinguishes the framework from legal consciousness theory (individual interpretation of law) and procedural justice theory (perceived fairness of process); neither explains how the same architecture can simultaneously enable and undermine accountability.

Thailand's broad framework maximizes both detection potential and weaponization risk, requiring strong accountability mechanisms to channel activation toward transparency rather than elite capture. Frameworks relying on confidentiality alone, like Singapore's, minimize manipulation but sacrifice active litigation support. The framework suggests optimal design depends on institutional context: societies with strong rule of law can sustain protection-heavy approaches, while those with weaker enforcement capacity require balanced accountability from inception. This suggests a testable proposition: combining protection with accountability mechanisms should reduce weaponization incidence relative to protection-only frameworks.

The four-stage weaponization pathway—legal ambiguity exploitation, damage window creation, accountability fragmentation, and resource asymmetry—provides analytical tools applicable beyond Thailand. UNODC (2018) documents comparable ambiguity-exploitation risk in Malaysia's enforcement-discretion provisions, suggesting the pathway model helps policymakers diagnose vulnerabilities before implementation failures occur rather than responding reactively after damage materializes.

Practical Application

The integrated safeguard framework offers guidance for countries implementing UNCAC Article 33 whistleblower protection requirements. The explicit linkage between manipulation stages and targeted safeguards enables jurisdictions to prioritize interventions based on specific vulnerability profiles. Contexts with high business competition should emphasize rapid review and financial penalties. Contexts with politicized enforcement should prioritize clear good faith criteria and confidentiality protocols preventing selective targeting.

Effects on Society and Communities

Thailand's framework holds potential to reshape civic participation if implementation addresses identified vulnerabilities. Citizen empowerment may emerge as reduced reporting costs and available legal defense activate communities possessing corruption knowledge but historically lacking safe channels. Institutional trust may develop as consistent NACC enforcement demonstrates credible protection, building confidence in formal mechanisms over informal patron-client arrangements. Cultural evolution may gradually occur as transparency becomes legitimized over hierarchical loyalty norms.



However, realizing this potential requires recognizing that marginalized communities face greater barriers than sophisticated actors in accessing protection benefits. Provincial farmers, informal sector workers, and those without legal literacy possess valuable knowledge but lack resources to navigate complex reporting procedures or sustain prolonged engagement with formal institutions. Without the ecosystem investment outlined above, protection risks remaining accessible primarily to urban educated elites already possessing social capital.

The journey from Thailand's crisis of silence to integrity culture depends not on legal text alone, but on whether implementation activates positive social capital while preventing capture by networks the law aims to challenge. Success will be measured by whether citizens without connections or resources gain genuine capacity to report wrongdoing safely transforming dormant knowledge into collective action against corruption.

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Enhancing Sustainable Economic Development through the BCG Model: Development and Commercialization of Stingless Bee Honey from Southern Thailand

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Abstract

Stingless bee honey, derived from small eusocial bees within the Apinae subfamily, has emerged as a promising natural product in the global health supplement market. These bees are predominantly found in tropical and subtropical regions and exhibit limited tolerance to environmental extremes due to their reduced capacity for thermoregulation. Unlike conventional honey bees, stingless bees produce honey with higher moisture content, which undergoes natural fermentation within the hive, resulting in a distinctive sweet–sour taste profile. The compositional characteristics of stingless bee honey include proteins, essential amino acids, phenolic compounds, vitamins, and minerals. These constituents are associated with antioxidant activity and potential functional benefits, making the honey a candidate for nutraceutical and functional food development. Research has increasingly focused on its production systems, extraction processes, and value-added applications.

In Thailand, stingless bee honey production is supported by community-based enterprises, including Ban Ko La Nang Farm in Songkhla Province, operating under the Community Enterprise Promotion framework. Such initiatives contribute to sustainable rural development and are aligned with the Bio-Circular-Green (BCG) economic model, which integrates bioeconomy, circular economy, and green economy principles. Due to relatively low production yields compared to honey bees, stingless bee honey remains a scarce and high-value commodity in international markets.

Keywords: Stingless bees honey, Chemical composition, Biological activity, Volatile organic compounds, Monosaccharides

Introduction

Stingless bees are eusocial insects in the tribe *Meliponini*, family *Apidae*. Although they share some similarities with honey bees, they are generally smaller and lack a functional stinger. Instead, they defend their colonies by biting. Stingless bees are distributed mainly in tropical regions, including Central and South America, Africa, and South Asia, and are found throughout Thailand (Moreira et al., 2023; Mokaya et al., 2022; Yong et al., 2022).

In Thailand, stingless bees comprise 10 genera and 32 species. They nest in diverse habitats, including tree hollows, underground cavities, and crevices in buildings and other structures.

A typical nest consists of brood combs, storage pots for honey and pollen, and an entrance tube made of cerumen, sometimes mixed with mud or wood particles. Nest structure and entrance form are useful characteristics for species identification. Stingless bee nests are constructed from resin and cerumen, a mixture of wax and plant resins such as propolis (Manickavasagam et al., 2024; Marcolin et al., 2021).

Stingless bees are economically significant because they contribute to pollination, particularly in tropical fruit production, and provide products such as honey, pollen, and propolis. These products generate additional income for farmers and support rural livelihoods, especially in southern and eastern Thailand, where stingless beekeeping is increasingly practiced. The development of stingless bee products therefore offers an opportunity to strengthen community based enterprises and promote sustainable agricultural systems.

This project supports 10 families in southern Thailand through stingless bee honey production and marketing. Thai-Canada Innovation Research and Service Co., Ltd. is responsible for purchasing stingless bee honey, pollen, and propolis. The core activity is the Ban Koh Lae Nang Stingless Bee Farm Community Enterprise in Songkhla Province, registered under the Community Enterprise Promotion Act B.E. 2548. The project also involves 10 stingless bee farming families across southern Thailand, with the aim of promoting sustainable livelihoods, equitable income generation, and long-term community development.

This aligns with Molino et al. (2026) and Quicazán et al. (2026), who highlight the importance of the project is guided by the BCG (Bio-Circular-Green) model, which integrates the bioeconomy, circular economy, and green economy. This framework is consistent with the Sustainable Development Goals and Thailand's Sufficiency Economy philosophy. The proposed activities focus on selecting suitable stingless bee strains, analyzing the chemical composition of stingless bee honey, evaluating its pharmacological properties, and developing honey products that meet Canadian market standards. These efforts are intended to enhance product value, strengthen consumer confidence, and support the international competitiveness of Thai stingless bee products (Moreira et al., 2023).

Furthermore, Ikhsan et al. (2022) and Mduda et al. (2025) resulted that Stingless bee honey from *Meliponini* is increasingly recognized for its distinctive flavor, high acidity, and bioactive composition, making it attractive as a premium functional food ingredient. However, unlike conventional honey from *Apis* species, stingless bee honey often shows higher moisture and acidity and lower reducing sugars, which can affect shelf life, fermentation risk, and market acceptance. The attached project from southern Thailand focuses on selected species including *Tetragonula laeviceps*, *Tetragonula pagdeni*, *Tetragonula terminata*, and *Tetragonula fuscobalteata* and reports that *Tetragonula pagdeni* and *Tetragonula laeviceps* are the most suitable for cultivation because of their robustness and honey yield. For export to Canada, honey products must comply with Canadian food safety and import requirements under the Safe Food for Canadians Regulations and Food and Drug Regulations, while organic claims must be consistent with EU Regulation 2018/848 and its apiculture related control principles

because stingless bee honey does not fully fit the physicochemical profile of conventional honey standards, exporters need a dedicated testing strategy, validated specifications, and strong traceability. This paper therefore integrates the project findings with a standardized quality-control framework for export-ready stingless bee honey (Mello dos Santos et al., 2025; Negera et al., 2026).

Research Objectives

This project deals with the Ban Koh Lae Nang Stingless Bee Farm Community Enterprise in Songkhla Province and the project also involves 10 stingless bee farming families across southern Thailand are as follows:

1. To investigate the diversity of stingless bee species in Thailand and select commercially promising species in the southern provinces for cultivation.
2. To survey, collect, and document the biological characteristics of selected stingless bee species, including *Tetragonula laeviceps*, *Tetragonula pagdeni*, *Tetragonula terminata*, and *Tetragonula fuscobalteata*.
3. To compare the cultivation efficiency and honey yield of selected stingless bee species under different food resource conditions.
4. To evaluate the physicochemical and bioactive properties of stingless bee honey and assess its potential for quality standard development and dietary supplement applications.

Methodology

1. Finding the species of stingless bees in Thailand and provide 3 species to 10 families participating in the project in the southern provinces.
2. Survey, collected samples, and compiled basic biological data of stingless bee species that were commercially viable and had the potential for cultivation in the southern provinces of Thailand.
3. Collecting data and selected species for cultivation and production. Stingless bees obtained from farmers in the surveyed areas selected to identify the species desired for research, namely *Tetragonula laeviceps*, *Tetragonula pagdeni*, *Tetragonula terminata*, and *Tetragonula fuscobalteata*.
4. Conducting experimental cultivation compared the efficiency of production. Four study areas with sufficient food resources were selected as follows (using a food level measurement criterion of 1-3 (1 = low food quantity requiring supplemental feeding, 2 = moderate food quantity requiring supplemental feeding no more than 1-2 times in a 3-month period, 3 = sufficient food quantity). (No supplementation is necessary.)
5. Comparing the yield obtained, i.e., honey. Harvest every 3 months for 1 year. Recorded general characteristics such as color, weight, hardness/brittleness/stickiness, and smell, and the amount harvested per hive and analyzed the color, acidity, alkalinity, sweetness, and moisture content of the stingless bee honey samples, referencing the agricultural product standard for honey, TIS 8003-2556.
6. Moisture content analysis according to the AOAC standard method, 2000.
7. Sweetness analysis: Diluted the honey sample and measure the sweetness using a hand refractometer.
8. Acidity and alkalinity analysis: Diluted the stingless bee honey sample and measure it using a pH meter.
9. Total phenolic content analysis
10. Analyzed stingless bee honey to establish standards for the Canada market.
11. Studying the important chemical composition and properties of natural products obtained from stingless bees and to develop and apply it for the benefit of the dietary

supplement industry for sale in Canada market and biology of each stingless bee species and characteristics of research areas.

12. Surveys had revealed that there were at least 7 species of stingless bees in Thailand that can be cultivated.

These included *Tetragonula pagdeni*, *Tetragonula laeviceps*, *Tetragonula terminata*, *Tetragonula fuscobultiata*, *Tetragonula apicalis*, *Tetragonula collina*, and *Tetragonula minor*.

Four species are the most popular for cultivation in Thailand.



Figure 1 shows the general characteristics of *Tetragonula pagdeni*: (a) the entrance to the cocoon, (b) the larval and pupal clusters, pollen and nectar storage cells.



Figure 2 shows the general characteristics of *Tetragonula laeviceps*: (a) the entrance to the cocoon, (b) the larval and pupal clusters, pollen and nectar cells.



Figure 3 shows the general characteristics of *Tetragonula terminata*, depicting (a) the entrance to the cocoon, and (b) the larval and pupal clusters, pollen-storing cells, and nectar.



Figure 4 shows the general characteristics of *Tetragonula fuscobalteata*, depicting (a) the entrance to the cocoon, and (b) the larvae and pupae, pollen cells, and nectar.

Results

Currently, stingless bee honey is receiving more attention due to its high medicinal and nutritional properties. A comparison of stingless bee rearing for production from four popular species: *Tetragonula pagdeni*, *Tetragonula laeviceps*, *Tetragonula terminata*, and *Tetragonula fuscobalteata*, using a standard wooden box rearing method, showed that the honey yield, in descending order, was *Tetragonula pagdeni*, *Tetragonula laeviceps*, *Tetragonula terminata*, and *Tetragonula fuscobalteata*. The propolis yield, in descending order, was also *Tetragonula terminata*, *Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula fuscobalteata*. Analysis of the composition of honey from three stingless bee species, *Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula terminata*, was also conducted (Mduda et al., 2025; Quicazán et al., 2026).

Obtained from research areas in the Stingless Bee Center, Koh Lae Nang, 63/1 Moo 3, Pak Bang Subdistrict, Thepha District, Songkhla Province, the south Thailand which is a community enterprise group The properties of honey were analyzed according to industrial product standards, including: reducing sugars (calculated as invert sugars), moisture, sucrose, insoluble matter, ash, acidity, diastase value, activity, hydroxymethylfurfural content, and food

additives. It was found that stingless bee honey had higher acidity and moisture content than the standard, but lower reducing sugars than the standard. Other characteristics met the criteria. The research on the efficacy of honey from *Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula terminata* in inhibiting microorganisms, tested using the agar penetration method and the paper penetration method with the microorganisms *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, and *Micrococcus aeruginosa* (gram-positive bacteria), *Escherichia coli* (gram-negative bacteria), and *Candida albicans* (yeast), showed that all three types of stingless bee honey exhibited good antimicrobial activity. Honey from the stingless bee species *Tetragonula laeviceps* showed the highest efficacy in inhibiting all tested microorganisms. Honey from *Tetragonula padgeni*, *Tetragonula terminata*, and *Tetragonula fuscobalteata* were unable to inhibit the growth of *Candida albicans*. Propolis extracts also exhibited good antimicrobial activity, with the ethyl acetate extract showing the highest efficacy compared to hexane and methanol extracts. The inhibitory efficacy varied depending on the rearing environment and the type of microorganism tested. Further separation of the ethyl acetate extract using column chromatography and analysis of the active fractions using GC-MS, followed by comparison with a database spectrum, revealed the presence of diterpenoids, triterpenoids, long-chain hydrocarbons, and phenolic derivatives. Approximately 18 other compounds were found in significant quantities but could not yet be identified (Mello dos Santos et al., 2025).

Table 1 Results of the analysis of stingless bee honey according to food industry standards

Qualification	Standard criteria	Test results		
		<i>Tetragonula. pagdeni</i>	<i>Tetragonula laeviceps</i>	<i>Tetragonula terminata</i>
General characteristics		Thick brown liquid	Thick brown liquid	Thick brown liquid
Reducing sugar accounts for the percentage of inverted sugar	≥ 65	61.4 *	55.5 *	42.5 *
Humidity (percentage)	≤ 21	23.4 *	23.7 *	23.5 *
Sucrose (percentage)	≤ 5	Not found	Not found	Not found
Insoluble substances (percentage)	≤ 0.1	0.07	0.35	0.02
Ash (percentage)	≤ 0.6	0.25	0.23	0.25
Acidity (mill equivalent of acid/kg)	≤ 40	113.6 *	112.4 *	206.8 *
Diastase activity value (Goth scale)	≥ 3	Not found	Not found	Not found
Hydroxymethylfurfural content (milligrams/kilogram)	≤ 80	28.8	20.3	20.1
Food coloring (milligrams/kilogram)	Not found	Not found	Not found	Not found
Benzoic acid or its salt (milligrams/kilogram)	Not found	Not found	Not found	Not found
Sorbic acid or its salt (milligrams/kilogram)	Not found	Not found	Not found	Not found
Salicylic acid or its salt (milligrams/kilogram).	Not found	Not found	Not found	Not found
Saccharin (milligrams/kilogram)	Not found	Not found	Not found	Not found
Cyclame (milligrams/kilogram)	Not found	Not found	Not found	Not found

Note: * This characteristic does not meet the honey standard (according to industry standards).

Results of Bioactive Compounds in Honey and Propolis from Stingless Bees

1. Physical Characteristics of Honey and Propolis Extracts

Honey: Thick and viscous, golden brown in color similar to honey but clearer.

Propolis: The extract was very viscous and its color varies depending on the type of stingless bee.

Propolis extract from *Tetragonula pagdeni* was dark brown in color and very viscous.

Propolis extract from *Tetragonula laeviceps* was dark brown in color and very viscous.

Propolis extract from *Tetragonula terminata* was brownish-reddish-gold in color and less viscous than the two above.

2. Results of Antimicrobial Activity Testing using Agar Diffusion Assay

The preliminary results of testing the antimicrobial activity of five types of microorganisms using honey showed that:

Honey from all three types of stingless bee honey effectively inhibited the growth of *Candida albican*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Staphylococcus aureus* (Figure 5).

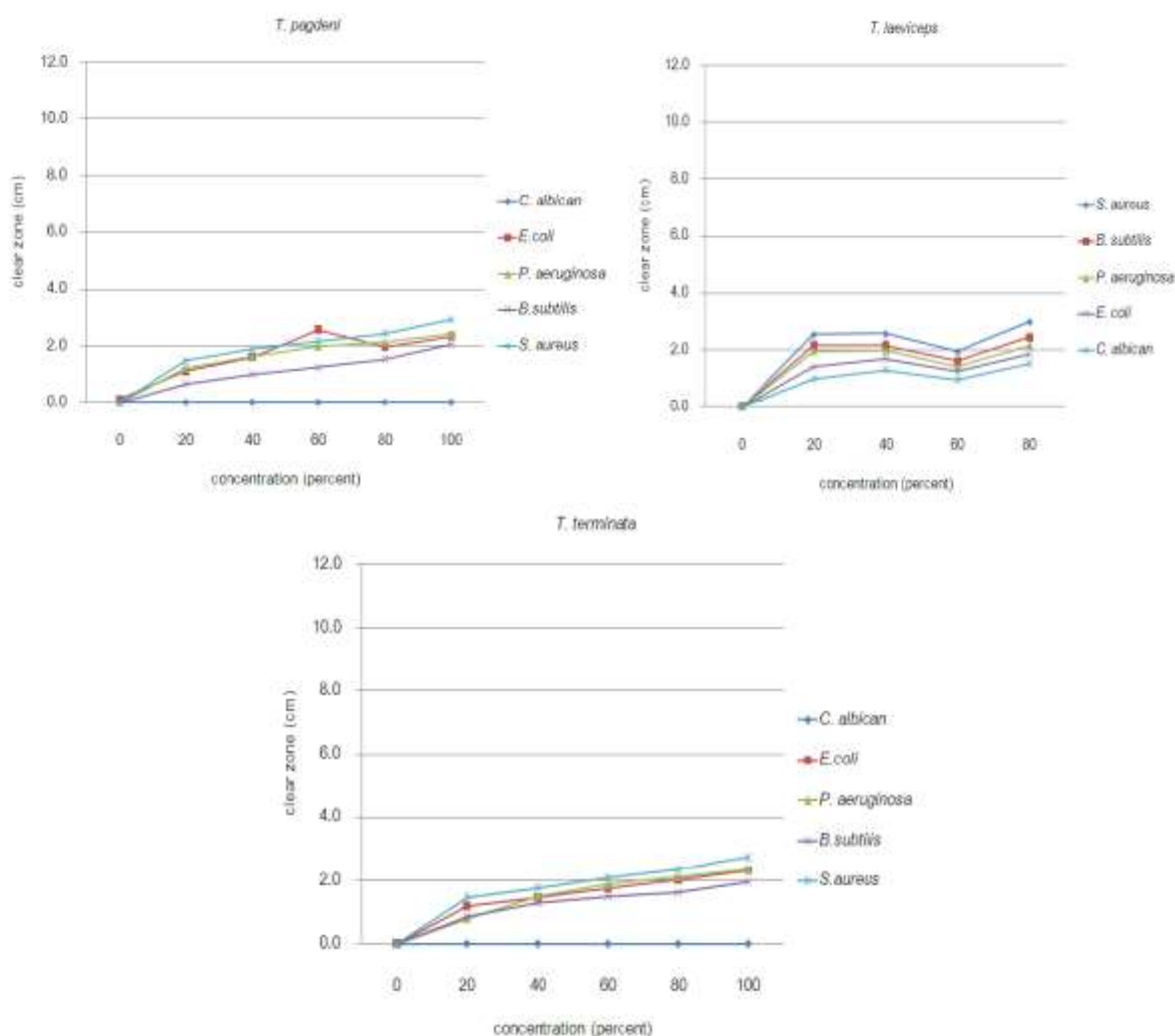


Figure 5 Inhibition zone (clear zone) from tests using three types of stingless bee honey (using the agar diffusion assay)

Preliminary tests of the antimicrobial activity against five types of microorganisms using crude propolis extract showed that propolis effectively inhibited the growth of *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Staphylococcus aureus*. However, only some types of propolis were able to inhibit *Candida albican* (Figure 6-8). The crude extract of propolis from *Tetragonula pagdeni*, specifically the ethyl acetate crude extract, showed the best inhibitory effect on microbial growth, followed by the methanol crude extract. The hexane crude extract showed the least inhibitory effect on microbial growth and was unable to inhibit *Escherichia coli* at all (Figure 6).

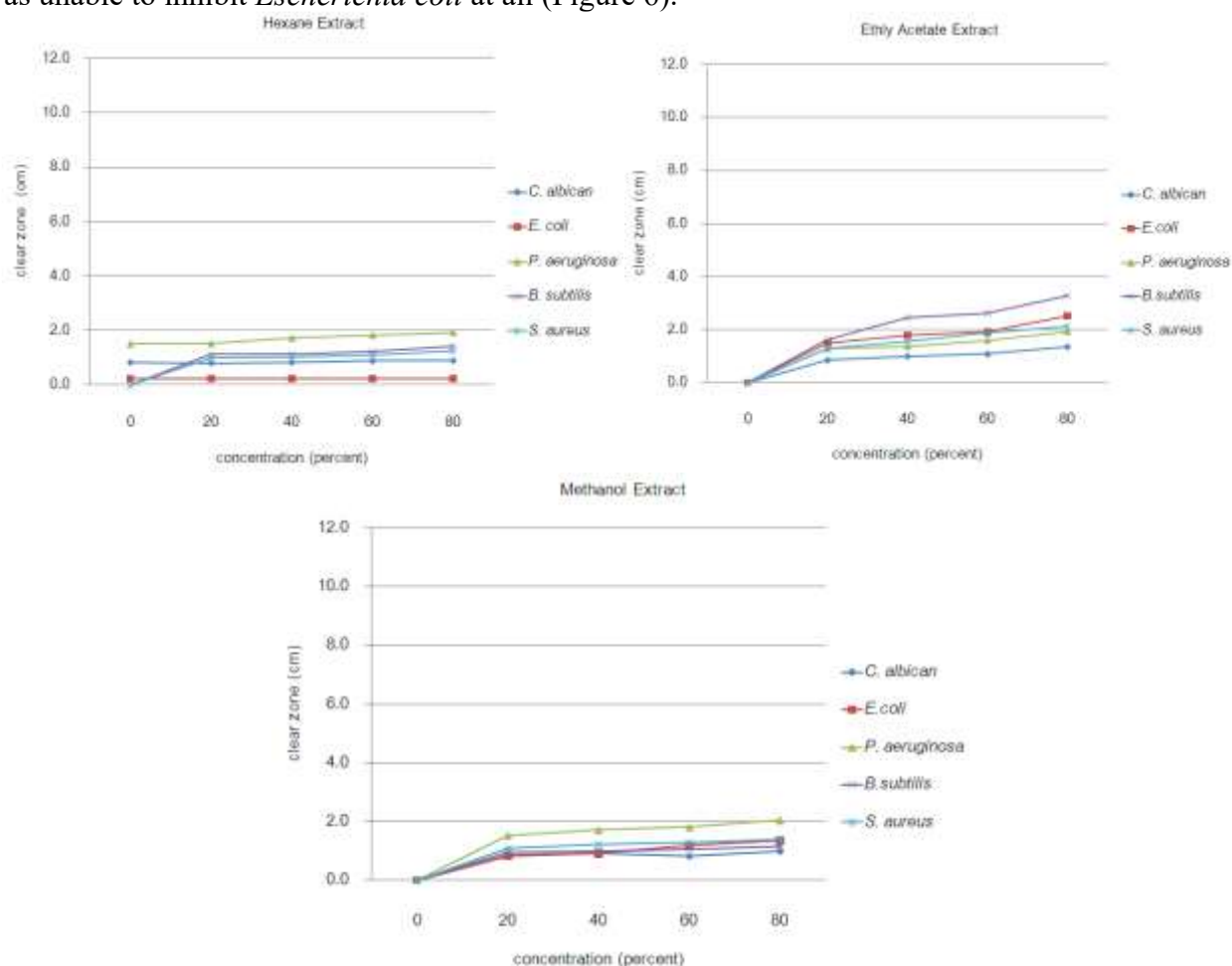


Figure 6 Inhibition zone (clear zone) from testing with crude propolis extract from the stingless bee species *Tetragonula pagdeni*

Crude extracts of propolis from *Tetragonula laeviceps*, ethyl acetate, and methanol showed the best inhibitory effects on microbial growth. The hexane extract, however, failed to inhibit the growth of *Escherichia coli* at all (Figure 7).

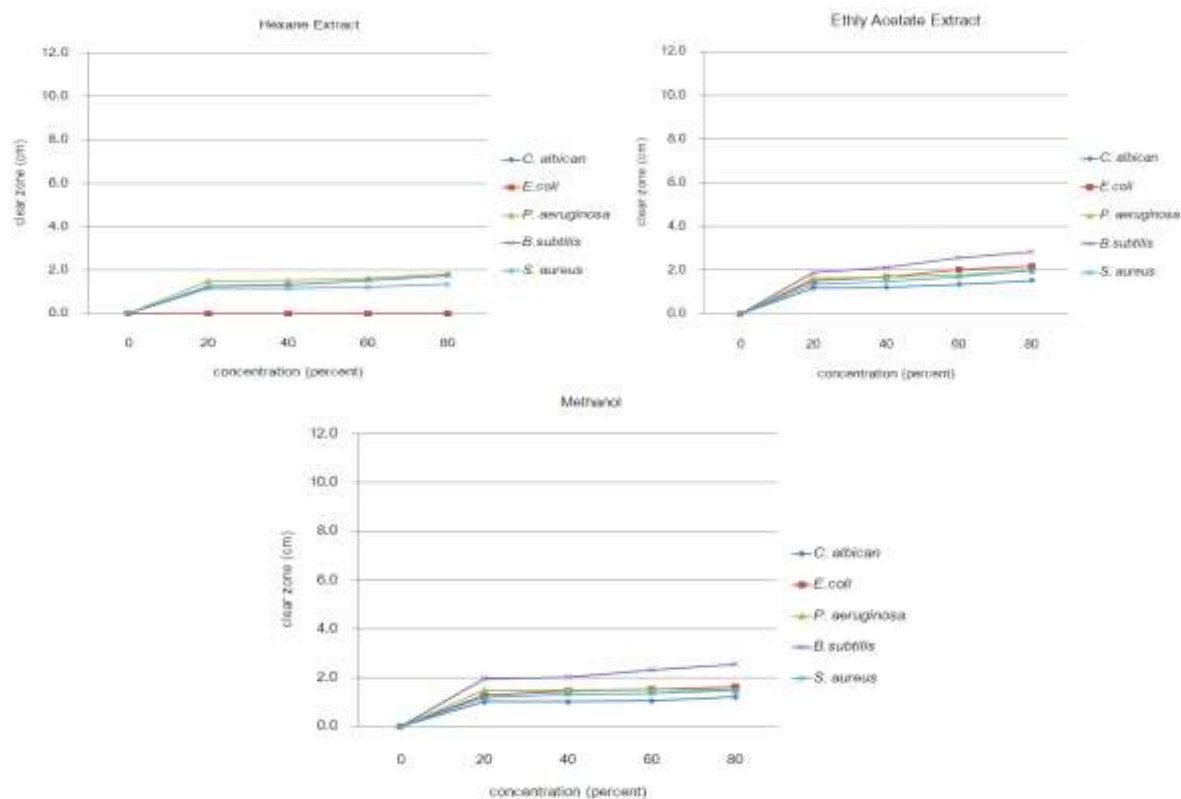


Figure 7 Inhibition zone (clear zone) from testing with crude propolis extract from the stingless bee species *Tetragonula. Laeviceps*

The crude propolis extract from *Tetragonula terminata*, specifically the ethyl acetate extract, showed the best inhibitory effect on the growth of all types of microorganisms. The methanol extract was unable to inhibit *S. aureus*, and the hexane extract was unable to inhibit the growth of *Escherichia coli* (Figure 8).

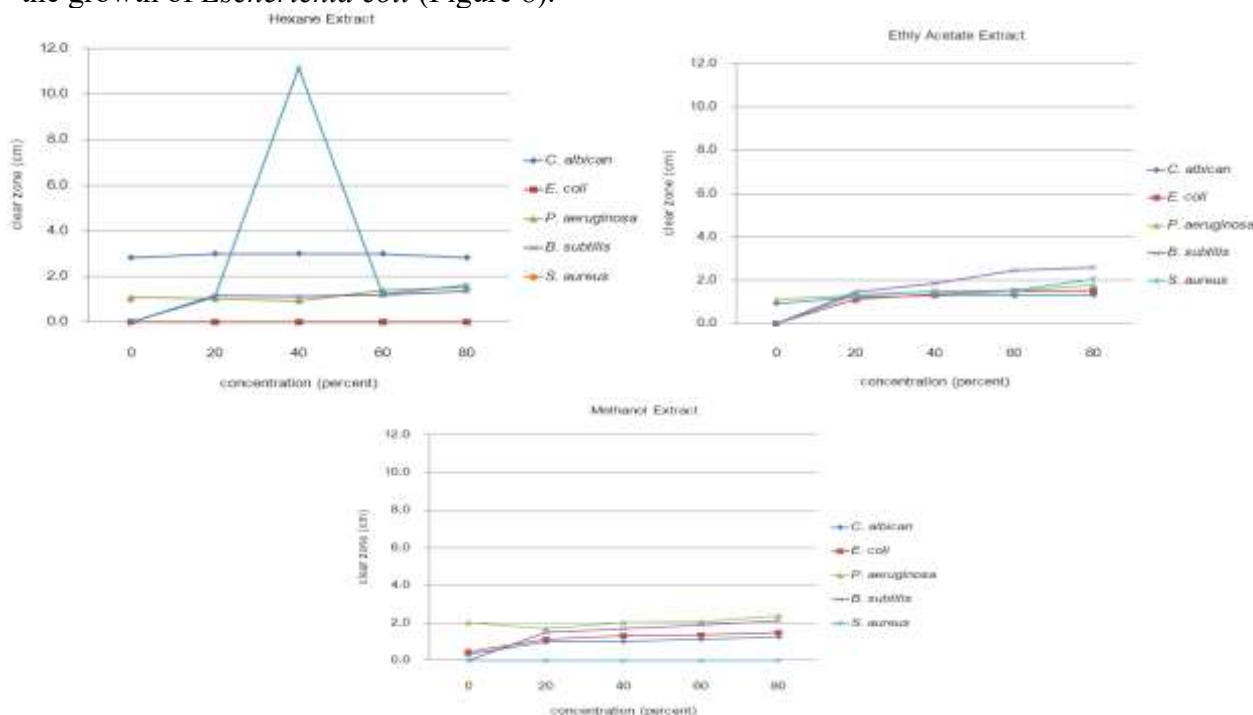


Figure 8 Inhibition zone (clear zone) from testing with crude propolis extract from the stingless bee species *Tetragonula terminata*

3. Results of the antimicrobial activity test using the Paper disc diffusion assay

Preliminary antimicrobial activity testing of the five microorganisms using crude extracts by the paper disc diffusion assay yielded the following MIC values: *Micrococcus luteus* (64.5), *Pseudomonas aeruginosa*, *Escherichia coli* (64.5), *Candida albicans* ATCC8684 (64.5), and *Candida albicans* ATCC5815 (no growth, therefore not tested) (Figure 9)

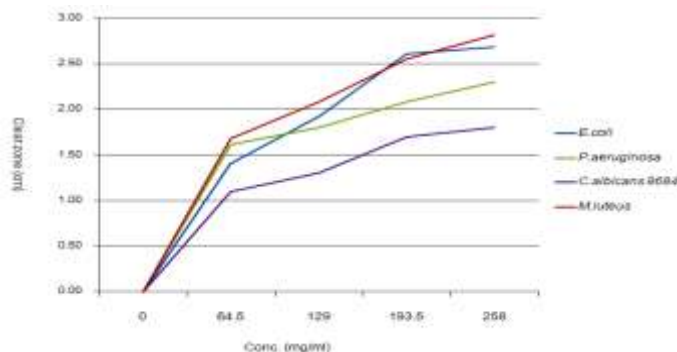


Figure 9 Inhibition zone (clear zone) from testing with honey from stingless bees *Tetragonula laeviceps* (using the paper disc diffusion assay)

Table 2 Chemical composition analyzed from propolis extracts exhibiting antimicrobial activity

No.	Compounds	RT	<i>T. pagdeni</i>			<i>T. laeviceps</i>			<i>T. terminata</i>		
			H	EtOAc	MeOH	H	EtOAc	MeOH	H	EtOAc	MeOH
1	(1-cyclohexen-1-yloxy)trimethyl-Silane	2.158	0.976								
2	2-[(trimethylsilyl)oxy]Propanoic acid trimethylsilyl ester	2.17		3.136	1.319		2.912	2.225		1.422	0.973
3	Tetradecane	4.696		0.639	0.575						
4	Trimethylsilyl ether of glycerol	4.761	5.646	5.679	5.92	5.03	7.227	5.418	5.182	4.387	4.747
5	Tridecane	5.01	0.09						0.091		
6	Docosane	8.585	0.889	0.792	0.678	0.733	1.051	0.934	0.953	0.893	0.366
7	Triacotane	8.716	0.258	0.818		0.756				0.811	0.128
8	(R*,R*)-2,3,4-tris[(trimethylsilyl)oxy]-Butanal	9.338									1.196
9	1,2,3,4-tetrakis[(trimethylsilyl)oxy]-Butane	9.496			0.299						
10	gamma-lactone, 1,2,3,5-tris-O-(trimethylsilyl)-Arabinic acid	11.984									0.108
11	Dodecanoic acid, trimethylsilyl ester	12.071		0.103							
12	16-oxide, 2-chloro-8-ethyl-10-hydroxy-10H-Phenoxaphosphine	12.854					0.119				
13	Hexacosane	13.109		0.111			1.034	0.128		0.896	
14	2-methyl-Eicosane	13.992	0.093								
15	1,2,3,4,5-pentakis-O-(trimethylsilyl)-Xylitol	14.087									1.262
16	1,2,3,4,5-pentakis-O-(trimethylsilyl)-Ribitol	14.176									0.177
17	2,3,4,5,6-pentakis-O-(trimethylsilyl)-L-Arabinose	14.378									0.347
18	1,4-Benzenedicarboxylic acid, bis(trimethylsilyl) ester	15.008	0.215	0.205	0.137	0.184	0.377	0.307	0.168	0.503	
19	Tetradecanoic acid, trimethylsilyl ester	16.109	0.314	0.239		0.286	0.477	0.399	0.401	0.289	
20	1,3,4,5,6-pentakis-O-(trimethylsilyl)-D-Fructose	16.648			3.756		0.465	0.783			1.134
21	(1,2,4,5-cyclohexenetetraoxol-4-ylidene)tetraakis(trimethylsilyl)-Silane	17.135									0.201
22	1,2,3,5-tetrakis-O-(trimethylsilyl)-Arabinofuranose	17.135		0.25							
23	methyl 2,3,4,6-tetrakis-O-(trimethylsilyl)-alpha-D-Mannopyranoside	17.338								0.372	1.013
24	Heneicosane	17.425	0.164	0.14	0.643	0.94	0.209	0.989	0.71	1.043	0.382
25	Glucopyranosan pentaTMS	17.538			12.938			0.478			
26	1,2,3,4-tetrakis-O-(trimethylsilyl)-beta-D-Glucopyranuronic acid, trimethylsilyl ester	17.544					0.772				

Table 2 Chemical composition analyzed from propolis extracts exhibiting antimicrobial activity (Cont.)

No.	Compounds	RT	<i>T. pagdeni</i>			<i>T. laeviceps</i>			<i>T. terminata</i>		
			H	EtOAc	MeOH	H	EtOAc	MeOH	H	EtOAc	MeOH
27	2,3,4,5,6-pentakis-O-(trimethylsilyl)-D-Galactose	17.55									22.693
28	1,2,3,4,6-pentakis-O-(trimethylsilyl)- α -D-Galactopyranose	17.787									0.97
29	Methyl 3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate	17.906	0.278			0.254	0.328	0.296	0.35	0.405	
30	Tetraacosane	18.238	0.796								
31	Pentacosane	18.249		1.168	0.719	0.136	1.124	1.151	0.958	0.865	
32	1,2,3,4,5,6-hexakis-O-(trimethylsilyl)-D-Mannitol	18.279			4.406						14.45
33	Hexadecanoic acid, ethyl ester	18.836		0.497	0.762	0.121	0.778	1.448	0.361	0.748	0.193
34	pentakis-O-(trimethylsilyl)-Glucose	19.406			8.127		0.372				
35	Geraniol	19.429									17.358
36	2,3,4,5,6-pentakis-O-(trimethylsilyl)-Galactonic acid, trimethylsilyl ester	19.643			1.158						
37	2,3,4,5,6-pentakis-O-(trimethylsilyl)-D-Gluconic acid, trimethylsilyl ester	19.648									1.814
38	Hexadecanoic acid, trimethylsilyl ester	19.898	23.988	27.329	19.384	23.19	31.17	33.568	27.137	28.024	11.784
39	1,2,3,4,6-pentakis-O-(trimethylsilyl)- β -D-Glucopyranose	20.437									0.667
40	(Z,Z)-8,12-Octadecadienoic acid, methyl ester	20.674			0.711						
41	8,12,15-Octadecatrienoic acid, methyl ester	20.799			1.26						
42	Trisolein	20.811						1.002			
43	1,2,3,4,5,6-hexakis-O-(trimethylsilyl)-Myo-Inositol	21.143									0.202
44	8-heptyl-Pentadecane	21.344		0.472							
45	Linoleic acid ethyl ester	21.896	0.693	1.382	1.589			1.157			0.686
46	8,12-Octadecadienoic acid, ethyl ester	21.896					0.629				
47	Ethyl Oleate	21.961					1.505	2.813		0.567	0.267
48	(Z,Z,Z)-8,12,15-Octadecatrienoic acid, ethyl ester	21.965		1.414	1.831						
49	Octadecanoic acid, ethyl ester	22.459			0.164			0.242			
50	(Z,Z)-8,12-Octadecadienoic acid, trimethylsilyl ester	22.785	1.549		0.909	0.429					
51	trans-9-Octadecenoic acid, trimethylsilyl ester	22.85				3.397		4.947			1.313
52	Oleic acid, trimethylsilyl ester	22.868		19.231					2.638		
53	Oleic acid TMS	22.892	3.344		3.003		3.943			2.325	
54	Retinoic acid, methyl ester	23.063				1.69					
55	Octadecanoic acid, trimethylsilyl ester	23.354	11.251	13.526	8.581	10.17	14.075	14.33	11.932	13.388	5.533
56	Tetraatriacontane	24.967			0.449		0.483				0.201
57	2-methyl-Hexadecane	24.985					0.569				
58	2-O-Glycerol- α -D-galactopyranoside, hexa-TMS	25.127									0.691
59	1-iodo-Octadecane	25.619								0.556	
60	Eicosanoic acid, trimethylsilyl ester	26.562		1.715							
61	11-cis-Octadecenoic acid, trimethylsilyl ester	26.597						1.321			
62	(Z)- θ -Tricosene	28.471								0.379	

Table 2 Chemical composition analyzed from propolis extracts exhibiting antimicrobial activity (Cont.)

No.	Compounds	RT	<i>T. pagdeni</i>			<i>T. laeviceps</i>			<i>T. terminata</i>		
			H	EtOAc	MeOH	H	EtOAc	MeOH	H	EtOAc	MeOH
63	Decanoic acid, 2-[[trimethylsilyloxy]-1-[[trimethylsilyloxy]methylethyl ester	28.554	0.441								
64	2-Monopalmitin trimethylsilyl ether	28.578			0.356			0.58		0.759	0.415
65	1,21-Docosadiene	28.844			0.092						
66	Heptacosane	30.374	0.975	0.601	0.302	0.595	2.68		0.412	2.249	0.36
67	3,8-dimethyl-Decane	30.38						0.784			
68	anhydrotetrakis-O-(trimethylsilyl)-D-Altro-2-Heptulose	30.86									0.165
69	3,4,5,6-tetrachloro-3,5-Cyclohexadiene-1,2-dione	31.384						1.094			
70	octakis(trimethylsilyl)-Maltose	31.649									
71	Octadecanoic acid, 2,3-bis[[trimethylsilyloxy]propyl ester	31.821					6.678				
72	Squalene	32.123							1.226		
73	4,8,13,17-Tetramethyl-4,8,12,16-octadecatetraenal	32.135								0.739	
74	17-Pentatriacontene	32.775							3.261		
75	9-Nonadecene	32.787							4.413	0.98	
76	Nonacosane	33.143	13.056	4.386	0.184	3.547	7.826		2.311	14.451	0.271
77	Octacosane	33.196	0.552	0.994		18.16		0.983	0.505	2.021	
78	4-O-[2,3,4,6-tetrakis-O-(trimethylsilyl)-.beta.-D-galactopyranosyl]-1,2,3,6-tetrakis-O-(trimethylsilyl)-D-Glucopyranose	33.706									0.879
79	4-O-[2,3,4,6-tetrakis-O-(trimethylsilyl)-.beta.-D-galactopyranosyl]-2,3,5,6-tetrakis-O-(trimethylsilyl)-D-Glucose	34.362									0.957
80	Eicosane	35.769	8.438	0.325		0.156	0.993	0.643	1.128	0.747	
81	Henriacontane	35.77					3.855		5.674		
82	Heptadecane	35.811				16.35			21.191		
83	4,4,6a,6b,8a,11,11,14b-Octamethyl-1,4,4a,5,6,6a,6b,7,8,8a,9,10,11,12,12a,14,14a,14b-octadecahydro-2H-picen-3-one	36.36		3.878	15.685	10.97		18.551	3.67	5.589	1.608
84	.beta.-Amyrin trimethylsilyl ether	36.835	2.288	0.726	1.786	2.914		3.43	6.827	4.056	2.379
85	.alpha.-Amyrin	38.935		10.242							
86	Urs-12-ene	38.971	21.385				8.37				
87	[[3.beta.]-lanosta-11(11),24-dien-3-yl]oxytrimethylsilane	39.404							2.914		
88	[[3.beta.]-lanosta-8,24-dien-3-yl]oxytrimethylsilane	39.422							1.93	0.389	
89	[8,11-cyclo-9.beta.-lanos-24-en-3.beta.-yloxy]trimethylsilane	39.445	2.32		2.297						
90	(+)-3-oxo-Urs-12-en-24-oic acid, methyl ester	39.866									0.761
91	Olean-12-ene	39.89							5.174		

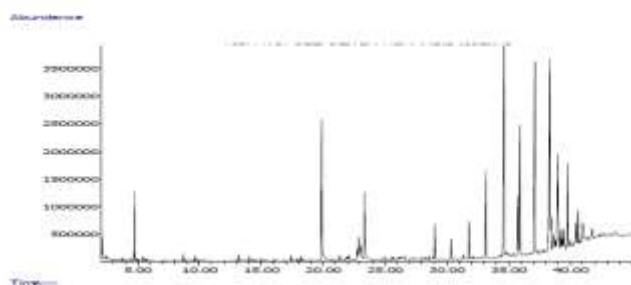


Figure 10 Chromatogram of hexane extract of propolis from *Tetragonula. pagdeni*

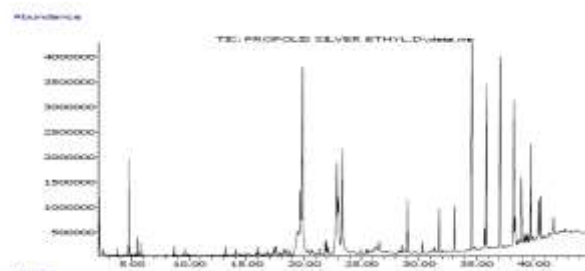


Figure 11 Chromatogram of the ethyl acetate extract of propolis from *Tetragonula pagdeni*

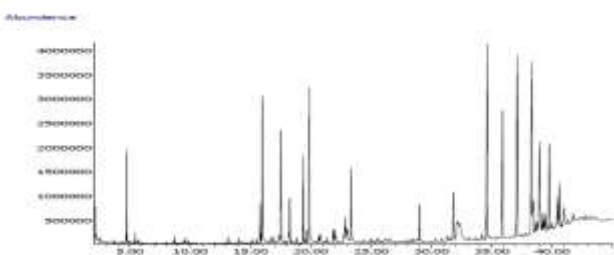


Figure 12 Chromatogram of the methanol extract of propolis from *Tetragonula pagdeni*

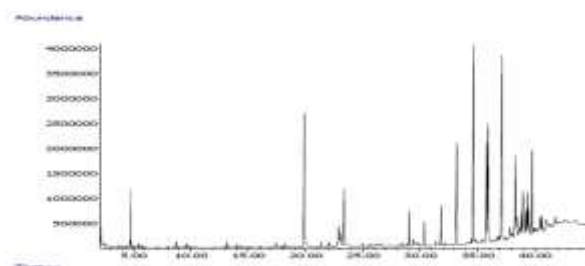


Figure 13 Chromatogram of hexane extract of propolis from *Tetragonula laeviceps*

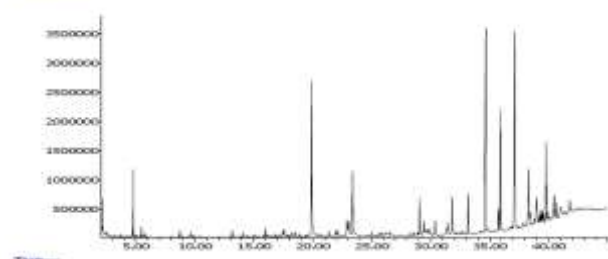


Figure 14 Chromatogram of the ethyl acetate extract of propolis from *Tetragonula . laeviceps*.

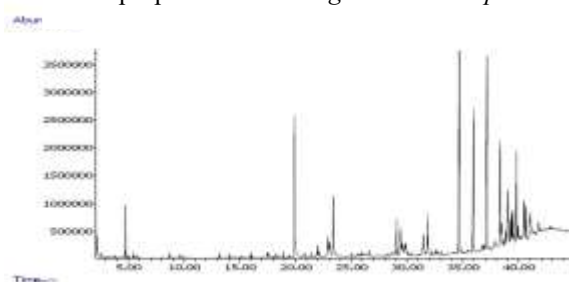


Figure 15. Chromatogram of the methanol extract of propolis from *Tetragonula laeviceps*

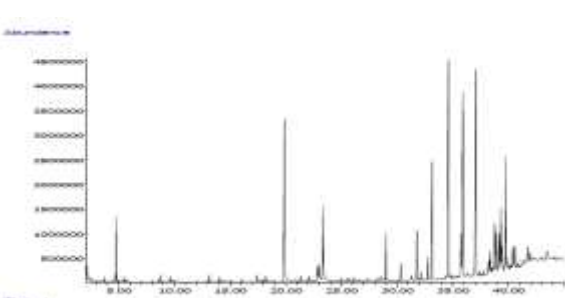


Figure 16 Chromatogram of hexane extract of propolis from *Tetragonula terminata*.

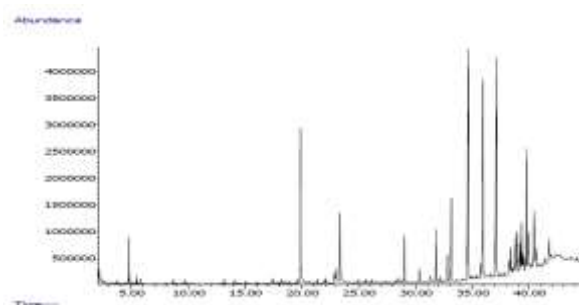


Figure 17 Chromatogram of the ethyl acetate extract of propolis from *Tetragonula terminata*.

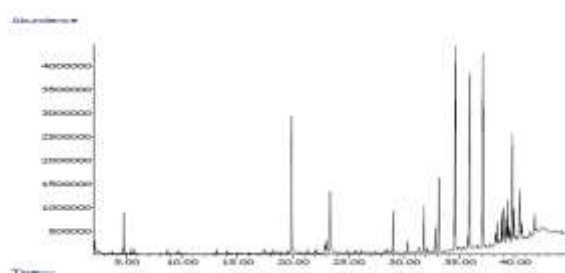


Figure 18 Chromatogram of the methanol extract of propolis from *Tetragonula terminata*.

Discussions

Suitable Stingless Bee Species for Cultivation

Surveys revealed that at least seven species of stingless bees were suitable for cultivation in Thailand had *Tetragonula pagdeni*, *Tetragonula laeviceps*, *Tetragonula terminata*, *Tetragonula fuscobalteata*, *Tetragonula apicalis*, *Tetragonula collina*, and *Tetragonula minor*. There had four species the most popular for cultivation, *Tetragonula pagdeni*, *Tetragonula laeviceps*, *Tetragonula terminata*, and *Tetragonula fuscobalteata*. Changes in the volume of egg cells, larvae, pupae, nectar, and pollen showed that *Tetragonula pagdeni* had the highest growth rate, followed by *Tetragonula terminata*, *Tetragonula laeviceps*, and *Tetragonula fuscobalteata*, in that order. Changes in hive weight and growth were significantly different among the four stingless bee species, specifically *Tetragonula pagdeni*, *Tetragonula laeviceps*, *Tetragonula terminata*, and *Tetragonula fuscobalteata*, respectively. However, *Tetragonula terminata* had the highest abandonment rate, with all hives (raised in boxes) abandoning completely after the rearing period.

Analysis of the three honey species, according to Thai Industrial Standards (TIS), revealed that *Tetragonula fuscobalteata* honey yielded very little, insufficient for testing. Honey from all three stingless bee species (*Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula terminata*) had lower than standard reducing sugar levels, and higher moisture and acidity levels (Molino et al., 2026).

The selection of suitable stingless bee species for this research considered:

1. Ability to survive under diverse environmental conditions;
2. Population growth potential and the number of individuals found in each species. Species with high population density and efficient population growth resulted in higher yield per hive;
3. Production efficiency. Stingless bees had different abilities to harvest raw materials; species with high efficiency produced higher yields.
4. Market demanded for certain types of stingless bee honey was popular, while others showed little movement.

Similarly, Mduda et al.(2025) demonstrated that the trade may depend on which types were in high demand, had good taste, and yield high production to meet consumer demand, or which types are currently popular for use in medicinal purposes. *Tetragonula collina* typically inhabits underground nests in termite mounds. Bringing species from the wild for breeding was difficult due to the highly complex structure of the underground nests; some nest entrances were up to 40 meters long. They lived up to 10 meters deep underground. Furthermore, rearing them in hives was not very successful because the conditions in the wooden hives differ considerably from the soil. *Tetragonula terminata* lived in living tree cavities. Rearing wild species in hives had a relatively low chance of success, even if the nests were large and yield high production, because the temperature must be controlled to closely resemble the conditions inside the living tree cavity. This was why this species of stingless bee had a very high rate of escape in experiments. Based on these characteristics, *Tetragonula pagdeni* is the most suitable species because of its hardiness, adaptability to all rearing areas, and high yield. In addition, *Tetragonula laeviceps* was also suitable for rearing due to its hardiness and good yield. If *Tetragonula pagdeni* was unavailable, other suitable species may be needed (Molino et al, 2026).

Properties of Stingless Bee Honey

Analysis of the three types of honey according to the Thai Industrial Standard (TIS) showed that all three stingless bee species, *Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula terminata*, had lower reducing sugar levels than the standard, and higher moisture and acidity levels than the standard. This is consistent with the study which compared the properties of stingless bee honey with honey from domesticated bees and found that stingless bee honey had higher moisture content but lower sugar content than domesticated bee honey. Stingless bee honey in other countries also had relatively high moisture levels. Therefore, this had become a topic of debate. Standards for stingless bee honey state that stingless bee honey could not be standardized using the same standards as honey from honey bees. Therefore, specific standards should be established for stingless bee honey, as it had a predominantly sour taste due to the fermentation of plant and herbal pollen in the bees. This results in a higher sucrose content compared to regular honey and makes it more expensive (Quicazán et al., 2026).

Results of studies on bioactive compounds in honey and propolis from stingless bees

Stingless bee honey was thick and viscous, with a golden brown color similar to regular honey but clearer. It had a more sour taste than sweet, which was a characteristic of stingless bee honey. Propolis extract was very viscous and varies in color depending on the species of stingless bee. Propolis extract from *Tetragonula pagdeni* was dark brown and very viscous. Propolis extract from *Tetragonula laeviceps* is dark brown and very viscous. Propolis extract from *Tetragonula terminata* was reddish-brown to golden brown and less viscous than the other two types.

The color and physical characteristics of honey and propolis can vary depending on the type of host plant, and the latex-producing plants. However, *Tetragonula fuscobalteata* produces a beautiful light golden-brown honey, but yields relatively little per hive. Therefore, raising it for honey production may not be cost-effective (Negera et al., 2026).

Antimicrobial Activity

Preliminary tests of the antimicrobial activity against five types of microorganisms using honey showed that honey from all three species of stingless bees effectively inhibited the growth of *Candida albican*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Staphylococcus aureus*. Preliminary tests of the antimicrobial activity against the five types of microorganisms using crude extract of propolis showed that propolis effectively inhibited the growth of *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Staphylococcus aureus*. However, only some types of propolis were able to inhibit *Candida albican*. The ethyl acetate crude extract of propolis from three stingless bee species, *Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula terminata*, showed the best inhibitory effect on microbial growth. Antimicrobial properties were also found in the methanol extract of propolis and partially in the hexane extract. However, the hexane crude extracts of *Tetragonula pagdeni* and *Tetragonula laeviceps* did not show any inhibitory effect on *Escherichia coli*. The propolis from *Tetragonula terminata*, the methanol crude extract could not inhibit *Staphylococcus aureus*, and the hexane extract could not inhibit the growth of *Escherichia coli*.

Experiments showed that the crude extract, ethyl acetate, exhibited the best inhibitory activity against microorganisms, indicating that it was a slightly to moderately polar compound. However, some bioactive compounds were soluble in Methanol and Hexane. Propolis extracts clearly showed inhibitory effects on pathogenic bacteria, despite some differences in specific details. They exhibited relatively high inhibitory efficacy, and were widely accepted and received considerable attention from researchers in Brazil, South America, and Australia and in Japan, the antimicrobial properties come from the tree resin that bees collected as an ingredient in their hives. Therefore, honey had this property, but in a lower

concentration than directly extracted propolis. Most research focused on propolis rather than honey, testing its antibacterial and antimicrobial activity (Marcolin et al., 2021).

However, the antimicrobial properties of honey were very similar to those of propolis extracts. Most studies indicated that propolis extracts were more effective at inhibiting gram-negative bacteria than gram-positive bacteria. Propolis from stingless bees (*Partamona* spp.) and *Tetragonisca angustula* was more effective than propolis from honey bees. In Thailand, several research studies investigated various pathogenic microorganisms and found inhibitory properties against the bacteria *Staphylococcus aureus* and the fungus *Candida albicans* from honey and propolis of *Tetragonula laeviceps* in Samut Songkhram province. Furthermore, and also found inhibition of cell division in colon cancer cells.

Bioactive Compounds with Antimicrobial Properties

GC-MS analysis revealed over 90 compounds, mostly terpinoids, diterpinoids, and phenolic compounds, along with some hydrocarbon compounds. This aligns with several studies that mention that bioactive compounds were generally moderately polar, and therefore the highest concentration of active compounds was found in the hexane extract. The propolis from *Melipona quadrifasciata*, diterpenic acids were found to be the active compounds inhibiting bacteria. However, the effectiveness of propolis varies depending on the species. For example, 12 species of propolis from stingless bees in Brazil showed inconclusive inhibitory effects against *Staphylococcus aureus* and were less effective than propolis from bees (Mello dos Santos et al., 2025).

The information was disseminated to the Stingless Bee Center, Koh Lae Nang, 63/1 Moo 3, Pak Bang Subdistrict, Thepha District, Songkhla Province, which is a community enterprise group to sell of stingless bee honey.



Figure 19 Support Stingless Bee Honey Framework

Conclusion and suggestions

The attached project data showed that stingless bee honey from *Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula terminata* was a thick brown liquid with moisture values around 23.4%, 23.7%, and 23.5%, respectively, all above the conventional honey threshold reported in the source document. Reducing sugar values were 61.40%, 55.50%, and 42.5%, indicating that these honeys do not match the sugar profile of standard *Apis* honey but remain characteristic of stingless bee honey. Acidity values were 113.6, 112.4, and 206.8 ml/kg, confirming the naturally high-acid profile of *meliponine* honey and the need for dedicated specifications. Hydroxymethylfurfural (HMF) values remained low at 28.8, 20.3, and 20.1 mg/kg, suggesting limited heat damage in the reported samples (Ikhsan et al., 2022).

The antimicrobial findings were notable. Honey from the three species inhibited the growth of *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Candida albicans* in preliminary agar-diffusion tests, while propolis extracts were generally more active than honey. The ethyl acetate extracts of propolis showed the strongest inhibition, consistent with a moderately polar fraction enriched in diterpenoids, triterpenoids, long-chain hydrocarbons, and phenolic derivatives identified by GC-MS in the project file. These results support the use of stingless bee propolis as a complementary value-added product and justify testing both honey and propolis in a broader commercialization strategy (Negera et al., 2026).

From a regulatory perspective, the high moisture and acidity of stingless bee honey make moisture control, hygienic harvesting, and shelf-life validation essential.

Moreover, Yong et al.(2022) identified that a complete release package should include a Certificate of Analysis covering physicochemical quality, contaminants, microbiology, and authenticity. For organic claims under EU 2018/848, the producer must maintain traceability, avoided prohibited substances, and document hive management and feed inputs. Because stingless bee honey was not identical to standard honey, product-specific internal specifications were recommended rather than direct reliance on stingless bees honey (Ikhsan et al., 2022; Mokaya et al., 2022).

Four species were the most popular for cultivation, *Tetragonula pagdeni*, *Tetragonula laeviceps*, *Tetragonula . terminata*, and *Tetragonula fuscobalteata*. *Tetragonula pagdeni* and *Tetragonula laeviceps* were the most suitable species for cultivation because they were hardy, can adapt well to various environments, and produce good honey and propolis. *Tetragonula terminata* also yields high production but was difficult to cultivate due to its high sensitivity to temperature changes, leading it to easily abandon its hive. Furthermore, this species typically inhabited living tree cavities, making it more challenging to obtain for cultivation as trees should not be cut down for this purpose. Future research on *Tetragonula terminata* focused on controlling the temperature inside the hive to closely resemble the temperature inside the living tree cavity.

The color and physical characteristics of the studied honey and propolis vary depending on the type of plant, food, and resin-producing plants. Honey from *Tetragonula fuscobalteata* was light brown in color but yields less. Honey from stingless bees (*Tetragonula pagdeni*, *Tetragonula laeviceps*, and *Tetragonula terminata*) had lower reducing sugar levels than honey from nectar bees.

Therefore, the taste was not as sweet, and it had a higher acidity than standard, resulting in a slightly sour taste. In addition, honey from *Tetragonula terminata* was considerably more sour than honey from other stingless bee species. The properties of stingless bee honey should be based on the standards of stingless bee honey (which were already in use in Brazil) instead of the standards of honey from bee species. It was very interesting to research this to support

the creation of standards for stingless bee honey in Thailand. Furthermore, stingless bee honey had a relatively high moisture content, so further research should be done on the shelf life of stingless bee honey and proper harvesting methods (Mello dos Santos et al., 2025).

Stingless bee honey and stingless bee propolis exhibited very good antimicrobial activity. In fact, propolis extracts were more effective than honey extracts. However, the ethyl acetate extract of propolis showed the highest efficacy compared to hexane and methanol extracts. While hexane and methanol extracts showed some antibacterial activity, it was lower and ineffective against some microorganisms. Chemical composition analysis revealed active compounds including terpinoids, diterpinoids, and phenolic compounds, as well as some long-chain hydrocarbon compounds. These active compounds showed a high likelihood of synergistic activity. The strong antibacterial activity of stingless bee honey and propolis makes them promising potential applications in the food and pharmaceutical industries in the future.

New knowledge and the effects on society and communities

Stingless bee honey was unique and different from regular honey, possessing exceptional nutritional and medicinal properties. First, let's get to know the stingless bee. "Stingless bees" were small insects without stingers, hence their English name. These insects were small and "eat only nectar from flowers," refusing the syrup commonly used as food in general beekeeping farms. Naturally, stingless bees differ from regular bees in their behavior. When they pollinated flowers, they collect 80% pollen and 20% nectar, unlike regular bees which collected 80% nectar and only 20% pollen. This behavior of collecting 80% pollen ensures that the vitamins carried back to the hive are of higher nutritional value than regular honey, making it more sought after and fetching a higher price.

Unlike other bees, stingless bees did not discriminate against any particular type of flower. Therefore, stingless bee honey is a blend of various flowers and nectar from medicinal plants, resulting in high-quality honey. It had a fragrant aroma and a delicious, sweet and sour taste from natural fermentation. Stingless bee honey was an excellent source of probiotics, beneficial to gut microorganisms.

Stingless bee honey was a popular superfood in Brazil, Australia, New Zealand, Malaysia, Indonesia, and Singapore. In Malaysia, in particular, stingless bee honey was widely recognized. Stingless bee honey and its nutraceutical benefits.

Foods with "nutraceutical" properties mean that, in addition to providing general nutritional value, they contained compounds or components that can help prevent, alleviate, or cure diseases. Stingless bee honey has been extensively studied for its therapeutic value or as a functional food – food with medicinal or nutraceutical properties. A prominent component in stingless bee honey is its high antioxidant content. This high antioxidant content led to its ability to protect body cells (Mokaya et al., 2022; Marcolin et al., 2021; Ikhsan et al., 2022).

Reducing inflammation and infection, boosting immunity, and promoting overall health. Stingless bee honey has emerged as a promising "food of the future" due to its superior functional and nutritional properties. It was particularly rich in phenolic acids and exhibits antioxidant activity approximately 5–10 times greater than that of conventional honey, contributing to the prevention of oxidative stress, cellular degeneration, and chronic diseases such as cancer and diabetes. In addition, stingless bee honey demonstrated antibacterial, anti-inflammatory, and immunomodulatory effects, and contained prebiotic components that supported the balance of beneficial microbiota in the gastrointestinal and reproductive systems. Evidence also suggested its potential role in hormonal regulation and reproductive health, including improvements in sperm quality parameters. Several studies consistently reported its significantly higher antioxidant capacity compared to conventional honey, largely attributed to its diverse phenolic composition (Mello dos Santos et al., 2025; Negera et al., 2026; Quicazán et al., 2026).

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The Study of Educational Management in Internet New Media Majors in Chinese Universities

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Abstract

This study examines educational management in Internet New Media majors across six Chinese universities spanning five institutional categories: two comprehensive universities and one university in each of the science and engineering, teacher-training, media, and arts categories. A mixed-methods design combined 483 valid student questionnaires with interviews involving 15 teachers and 10 educational administrators. A 40-person pilot assessed questionnaire reliability, with dimension-level Cronbach's alpha coefficients of .898–.913. Descriptive findings and interview accounts were integrated through a policy–practice–effectiveness framework. Students rated curriculum–industry alignment positively ($M = 3.92$), whereas the student feedback mechanism received a lower rating ($M = 3.34$). Support for an additional digital feedback platform was also comparatively low ($M = 3.42$), suggesting that responsiveness and visible follow-up require attention alongside technical access. The media category recorded the highest reported mean scores across the three broad domains, although the lowest-scoring category varied by domain. Five reform strategies addressed curriculum renewal, employment information, student feedback, faculty development, and practice resources. The study's contribution is an institutional comparison that connects management arrangements with students' reported experiences and practical reform priorities. The findings support context-sensitive improvement and should be interpreted as descriptive evidence rather than causal effects.

Keywords: Internet new media education, Educational management, Institutional comparison, Curriculum reform

Introduction

With the rapid advancement of information technology, network-based new media have transformed modes of communication and knowledge exchange. The integration of digital technologies and communication platforms has changed content delivery, teaching methodologies, and administrative practices in higher education. Universities therefore face connected challenges in program development, professional preparation, and educational management (Huang, 2023; Wang, 2020).

To meet the demands of media convergence and societal transformation, a growing number of Chinese universities have established Internet New Media majors. These programs aim to cultivate interdisciplinary and application-oriented talent with digital communication skills, media technology literacy, platform operation capabilities, and innovative thinking. However, due to varying institutional missions, disciplinary foundations, resource endowments, and regional conditions, educational management of these majors can differ across institution types. This diversity is reflected not only in tangible resources and faculty capacity, but also in curriculum design, pedagogical philosophy, and management systems.

Existing research identifies challenges that extend beyond the availability of digital tools. Cai et al. (2020) discuss the additional demands that new media place on teaching, knowledge internalization, and educational guidance, although their analysis concerns school education rather than university majors. Che (2023) addresses media education in vocational institutions, while Wang (2020) examines journalism and communication education under media convergence. These studies help frame the need to examine how management arrangements support learning in different institutional settings.

At the instructional level, curriculum renewal requires alignment among learning outcomes, teaching activities, and assessment (Biggs & Tang, 2011). Student development also needs to be understood in relation to the educational environment and opportunities for involvement (Astin, 1993). More recent work identifies both perceived benefits and concerns associated with generative artificial intelligence in higher education (Chan & Hu, 2023). Interviews with journalism program administrators further highlight faculty expertise, policy, partnerships, curriculum, and ethical considerations as connected challenges in AI integration (Wenger et al., 2025).

While this literature offers useful insights into digital education and curriculum reform, it does not by itself establish how Internet New Media programs compare across the five institutional categories represented by the six participating universities. Addressing this gap, the present study investigates two comprehensive universities and one university in each of the science and engineering, teacher-training, media, and arts categories. It compares educational management policies, applied practice, and student learning outcomes and service quality. The goal is to identify shared concerns and context-specific improvement priorities, with particular attention to how students experience the implementation of institutional policies.

Research Objectives

The study aims to clarify the organization and practical operation of educational management in Internet New Media majors, examine its relationship with students' perceived educational experiences, and propose management improvements.

1. To examine management arrangements and curriculum provision and assess their responsiveness to students' individual development and technological learning needs.
2. To evaluate students' perceptions of faculty quality, technology application, and teaching practices in Internet New Media programs.

3. To investigate students' evaluations of learning outcomes and educational services and identify priorities for improving the connection between management and learning experiences.

4. To propose educational management reforms that respond to shared challenges and differences among institutional categories.

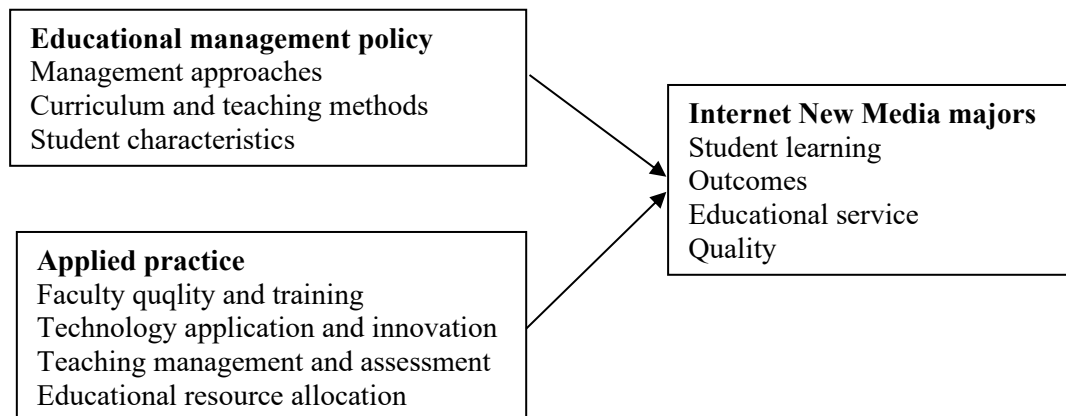


Figure 1 Conceptual framework of the research

The framework organizes the study into policy, practice, and effectiveness domains. Policies provide management and curriculum direction; teaching practices translate these arrangements into learning opportunities; and students' evaluations identify priorities for improving both policy and practice. The arrows represent proposed relationships for investigation, not established causal effects. Student voice provides a complementary governance perspective because collecting opinions is useful only when students have opportunities to influence educational decisions (Cook-Sather, 2006).

Methodology

The study combined a cross-sectional student survey with semi-structured interviews of teachers and administrators. Quantitative summaries describe students' experiences, while interview accounts provide contextual explanations of implementation problems. The strands are integrated by comparing survey patterns with relevant interview accounts within the policy, practice, and effectiveness domains, an approach consistent with integration at the interpretation stage of mixed-methods research (Fetters et al., 2013).

Population and Sample

The study involved six Chinese universities representing five institutional categories: two comprehensive universities and one institution in each of the science and engineering, teacher-training, media, and arts categories. The target population comprised undergraduate students enrolled in Internet New Media majors and the teachers and educational administrators responsible for those programs. The population relevant to this study is the eligible program population, rather than the combined enrollment or workforce of entire universities.

The planned sample comprised 1,000 students, 50 teachers, and 20 administrators. The achieved sample comprised 483 valid student questionnaires and 25 interviews, including 15 teachers and 10 administrators. These totals represent 48.30%, 30.00%, and 50.00% of the respective recruitment targets; they are target-attainment proportions, not response rates. The sampling plan specified student strata based on grade and gender, teacher strata based on academic title, and administrator strata based on job level. A stratified plan alone does not

establish that achieved participation was proportional or representative. The reduction from planned to achieved sample sizes creates a risk of unequal coverage across institutions and participant groups.

Figure 2 distinguishes the recruitment targets from the achieved samples across the six participating universities. The 40-person instrument pilot and the seven-person policy appraisal panel served different purposes from the main student survey and staff interviews; their observations are not pooled with the 483 student questionnaires or treated as additional student cases.

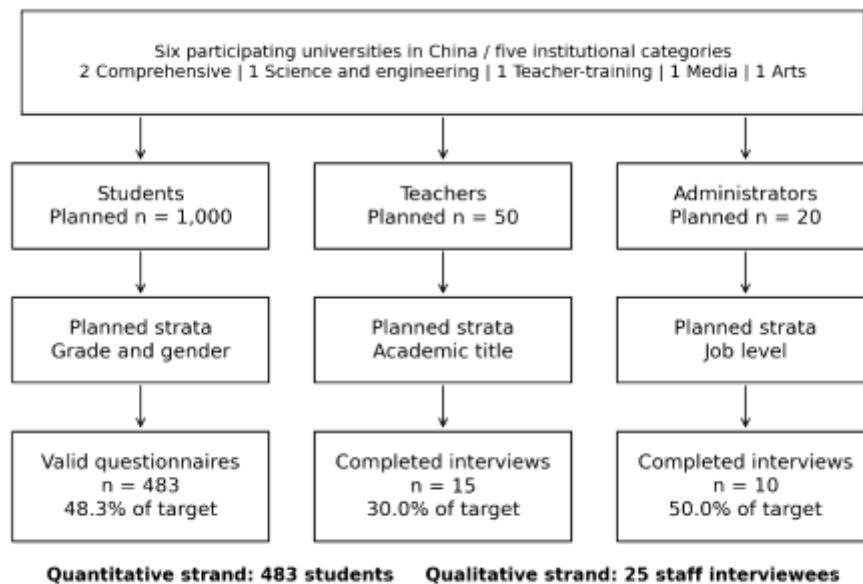


Figure 2 Sampling plan and achieved participation

Research Instruments

Student questionnaire

The questionnaire collected demographic and study-related information, including grade, gender, and career intentions.

The substantive questionnaire used a five-point response scale from 1 (strongly disagree) to 5 (strongly agree). It addressed ten dimensions: management approaches; curriculum and teaching methods; educational resource input; student characteristics; faculty quality and training; technology application and innovation; teaching management and assessment; educational resource allocation; student learning outcomes; and educational service quality. The dimensions were organized under the three broad domains shown in Figure 1. Higher scores indicate more favorable perceptions. The five proposed reform strategies were rated separately from evaluations of existing provision.

Semi-structured interviews

The interview guide used main questions and follow-up probes covering five topics: curriculum organization, faculty development, technology use, management challenges, and improvement priorities. The 15 teachers included program leaders, teaching and research leaders, and core faculty members. The 10 administrators included staff responsible for teaching, departments, and academic affairs. These participants provided professional perspectives on the implementation of educational management. Interview accounts are used to contextualize students' evaluations, rather than to estimate the prevalence of staff opinions.

Pilot Study and Instrument Quality

The questionnaire was developed through a review of relevant literature and supervisory review of its language, coverage, and terminology. Five experts assessed item–objective congruence, with an item retention criterion of $\text{IOC} \geq .60$. Following revision, the questionnaire was piloted with 40 individuals whose characteristics were similar to those of the intended main sample. Dimension-level Cronbach's alpha coefficients ranged from .898 to .913, and reported item–total correlations ranged from .731 to .779. These pilot findings provide preliminary evidence of internal consistency; they do not establish the factor structure of the main-sample instrument. Exploratory factor analysis requires the full 483-case student dataset, a documented item specification, and explicit decisions about extraction, rotation, and factor retention (Fabrigar et al., 1999).

Data Collection

Institutional access was sought through the Graduate School, participating universities' Academic Affairs Offices, the relevant colleges, and program departments. The survey was administered electronically, including through the Questionnaire Star platform. The final student dataset comprised 483 questionnaires identified as valid.

The original report paired 483 valid questionnaires with a value of 96.60%; these figures are arithmetically consistent with a denominator of 500 because $483/500 = 96.60\%$. The available record does not identify whether 500 denotes invitations, submissions, or another recruitment stage. Accordingly, the manuscript does not label 96.60% as a response rate. The target-attainment proportions in Section 1 describe a different stage of recruitment and cannot be used interchangeably with a questionnaire-validity proportion.

Analytical Strategy and Interpretation

The analytical sequence distinguishes instrument assessment, description and comparison, and interpretation. First, the pilot reliability results are considered separately from main-sample construct assessment. Second, student responses are summarized using means and, where the relevant dispersion is defined, standard deviations; the institutional high-satisfaction percentages refer to ratings of at least four points. Third, domain and item patterns are compared descriptively with teacher and administrator accounts. Individual survey items, dimension scores, and broad-domain scores are kept separate to avoid comparing different levels of aggregation.

Inferential comparisons require information beyond differences in sample means. Between-group ANOVA requires inspection of residual distributions and variance homogeneity, together with a defensible independence assumption; students' clustering within universities also requires attention. Comparisons of the five strategy ratings must account for their repeated measurement on the same students, for example through a repeated-measures or multilevel analysis. A chi-square test requires the complete contingency table and adequate expected counts. The institutional and strategy comparisons presented below are descriptive and do not establish statistically significant differences.

The conceptual framework is not presented as a validated structural equation model. Evaluating such a model would require a defined measurement model and estimator, standardized estimates with uncertainty, and overall fit statistics including χ^2 and df, χ^2/df , CFI, TLI, RMSEA with its confidence interval, and SRMR (Hu & Bentler, 1999). Model fit alone would not establish causality in a cross-sectional survey. Accordingly, the conclusions do not rely on claims of a strongest causal predictor, mediation, or intervention effectiveness.

Interview accounts are integrated with the survey findings at the domain level, and illustrative participant identifiers retain the T prefix for teachers and M prefix for administrators. Seven experts—four university teachers, two educational managers, and one

enterprise representative—also appraised the five reform proposals. Their judgments concern the proposals' perceived suitability; they do not constitute evidence that the reforms have already improved educational outcomes.

Results

Educational Management Policies

Management approaches

This dimension had an overall mean of 3.71, reflecting generally favorable perceptions of institutional management. The use of scientific and systematic management methods received a comparatively high rating ($M = 3.90$), whereas the student feedback mechanism received a lower rating ($M = 3.34$). This pattern suggests that students' recognition of management arrangements can coexist with concerns about their opportunities to influence decisions. It does not establish the effectiveness of a particular management method.

Curriculum and Teaching Methods

Students expressed generally positive evaluations of curriculum content and teaching methods ($M = 3.80$), particularly their alignment with industry trends ($M = 3.92$) and the use of pedagogical formats such as project-based learning and flipped classrooms ($M = 3.81$). Provision for diverse learning needs received a lower mean rating ($M = 3.67$). Faculty interview accounts emphasized pedagogical innovation and regular course updates, suggesting that curriculum renewal remains an ongoing implementation task.

Input of Educational Resources

Educational resource input received a mean rating of 3.73. Faculty members' interdisciplinary qualifications were rated favorably ($M = 3.84$), whereas the use of advanced facilities and the adequacy of practice platforms received lower evaluations (both $M < 3.60$). Interview accounts identified outdated equipment, slow upgrades, concentration of resources in later years of study, and weak institutional arrangements for university–industry collaboration. Table 1 summarizes the reported proportions of high satisfaction by institutional category.

Table 1 Reported high satisfaction with educational resources by institutional category

Institutional category	High satisfaction (rating ≥ 4)
Media	64.30%
Comprehensive	60.70%
Teacher-training	48.90%
Science and engineering	44.60%
Arts	38.20%

Student Characteristics

The student-characteristics dimension had a mean of 3.67. Individualized instruction received a slightly higher rating ($M = 3.72$) than attention to generational characteristics in policy arrangements ($M = 3.61$). Teachers and administrators discussed grouping students by learning needs and diversifying course choices, while also describing difficulties in coordinating curricula and resources. These accounts identify implementation concerns rather than demonstrating that a particular grouping approach is effective.

Applied Practice

This section examines four dimensions of educational practice: faculty quality and training, technology application and innovation, teaching management and assessment, and educational resource allocation. Scores for distinct dimensions and individual items are reported separately.

Faculty quality and training

Students rated faculty dedication ($M = 4.12$), teaching competence ($M = 3.91$), and technology application ability ($M = 3.84$) positively. In contrast, systematic faculty training support received a lower rating ($M = 3.05$). This contrast points to a possible gap between individual teachers' strengths and the institutional support available for continuing development. Faculty and administrator accounts also described training in emerging technologies as insufficiently systematic or closely connected to teaching needs.

Technology Application and Innovation

The integration of technology into teaching received favorable evaluations. Faculty use of AIGC and other emerging technologies had a mean rating of 3.92, and student exposure to new media tools had a mean of 3.85. Systematic technical training received a lower rating ($M = 3.49$). Interview accounts described limited hands-on opportunities, a lack of standardized platform training, and outdated equipment. These findings distinguish exposure to technology from sustained opportunities to develop proficiency.

Teaching Management and Assessment Mechanisms

Teaching management and assessment had a mean of 3.69 ($SD = 0.88$). Diversity in assessment methods ($M = 3.71$) and accessibility of teaching resources ($M = 3.68$) received generally favorable evaluations, while participation in peer and self-assessment received a lower rating ($M = 3.56$). Interview accounts described unclear assessment standards and limited follow-up on feedback. Faculty also reported an emphasis on final products rather than the learning process and creative development. These concerns suggest a need to connect assessment information with subsequent teaching and learning decisions.

Educational Resource Allocation

Educational resource allocation had a mean of 3.74 ($SD = 0.86$). Interview accounts described a perceived concentration of funding and equipment in established disciplines and delays in updating resources for emerging technologies. Students' access to suitable platforms and practical opportunities therefore requires attention alongside the purchase of equipment. Resource input in Section 1.3 refers to perceived provision, while this dimension concerns how resources are made available in practice.

Students generally viewed teaching technology and faculty performance favorably, but identified weaker continuity in training, assessment feedback, and access to practice resources. Together, the survey patterns and interview accounts suggest that educational management should connect teaching provision, resource access, and the use of assessment information.

Student Learning Outcomes and Educational Services

This section examines students' perceptions of learning outcomes and educational service quality. These self-reports describe perceived development and support, rather than independently assessed competence or observed employment outcomes.

Student Learning Outcomes

Student learning outcomes had a mean of 3.72 (SD = 0.88). Mastery of basic professional skills received the highest rating among the items discussed here (M = 3.81), followed by applying knowledge to real-world contexts (M = 3.68) and interdisciplinary thinking (M = 3.66). Interview accounts associated projects, internships, and competitions with opportunities to apply professional knowledge. The findings identify valued learning experiences, but the cross-sectional design cannot show that these activities caused improvements in competence.

Quality of Educational Services

Educational service quality had a mean of 3.57 (SD = 0.90). Overall satisfaction received a mean rating of 3.77, whereas access to employment information and jobs received a lower rating of 3.41. Teachers and administrators reported that career guidance often depended on individual staff members' time and that university–industry arrangements were frequently limited to short-term activities. Their accounts support a need for more continuous guidance across the program. Table 2 summarizes four dimension scores for which both a mean and standard deviation are presented.

Table 2 Selected student evaluations of practice, outcomes, and educational services

Measure	M	SD
Teaching management and assessment	3.69	0.88
Educational resource allocation	3.74	0.86
Student learning outcomes	3.72	0.88
Educational service quality	3.57	0.90

Students' perceived professional development was generally positive, while employment information and service continuity emerged as improvement priorities. A coordinated service system could connect learning activities, practice placements, and career preparation across years of study. The survey does not establish whether such a system would improve employment outcomes; that question requires follow-up evaluation.

Institutional Comparison and Reform Priorities

The institutional comparison considers educational management policy (EMP), applied practice experience (APE), and learning outcomes and service quality (LOQ). The media category recorded the highest reported mean in each domain. These sample patterns should not be interpreted as an overall ranking of Chinese universities or as statistically verified differences between institutional categories.

For EMP, the mean was 3.86 in media institutions, 3.78 in comprehensive institutions, 3.59 in science and engineering institutions, and 3.52 in arts institutions. Among these reported values, arts institutions had the lowest mean. Teacher T007 described the role of industry resources in supporting policy implementation in media institutions.

For APE, the mean was 3.87 in media institutions, 3.61 in arts institutions, and 3.58 in science and engineering institutions. Administrator M004 described delays in updating equipment in science and engineering institutions. These accounts provide context for the descriptive pattern without isolating institutional type as its cause.

For LOQ, the mean was 3.92 in media institutions, 3.85 in comprehensive institutions, 3.69 in science and engineering institutions, and 3.66 in arts institutions. Teacher T011 linked project practice with opportunities for skill development, while administrator M006 identified management and practice-resource constraints. The category with the lowest reported mean therefore varied by domain: arts for EMP and LOQ, and science and engineering for APE.

Shared strengths and implementation concerns

Survey and interview findings suggest several shared strengths and concerns across the participating institutions.

Strengths included attempts to align courses with industry developments, introduce practical projects, update technology-related content, and sustain faculty commitment. These initiatives were reflected in favorable ratings for curriculum relevance and teacher performance.

Recurring concerns included insufficiently systematic faculty training, limited student influence on management decisions, unequal access to practice opportunities, and fragmented career information. Teacher T004 described difficulties in securing suitable internships. Such accounts identify issues for institutional review rather than the prevalence of those issues across all universities.

Student support for five reform strategies

Five reform strategies were proposed in response to the findings. Table 3 presents students' support ratings in descending order. Curriculum renewal through AIGC and short-video courses (S1) received the highest mean support, followed by cross-campus faculty training (S4). The digital student feedback platform (S3) received the lowest mean, although its score remained above the scale midpoint. These descriptive rankings indicate relative priorities and do not measure the effects of implementing the strategies.

Table 3 Student support for proposed reform strategies (N = 483)

Code	Proposed strategy	M	SD
S1	Promote AIGC and short-video courses	4.18	0.65
S4	Implement cross-campus technology training for teachers	4.02	0.68
S2	Establish a current employment-information database	3.92	0.73
S5	Prioritize practice resources for science and engineering and arts institutions	3.88	0.70
S3	Establish a digital student feedback platform	3.42	0.83

Expert appraisal and implementation priorities

The seven-member expert panel appraised the five proposals. S1 and S5 received the highest reported mean ratings (M = 4.71 each), while S3 received the lowest (M = 4.43). This pattern indicates favorable expert judgments, including for the feedback proposal, but should not be treated as evidence of intervention effectiveness. Experts highlighted the following implementation priorities.

For S1 and S5, experts recommended attention to platform algorithms, students' skill adaptability, equitable equipment access, and the evaluation of resource use.

For S4, experts recommended connecting faculty development with industrial practice and implementing training in manageable stages.

For S2 and S3, experts emphasized integration with existing information and teaching systems to reduce coordination problems.

The resulting priorities connect curriculum renewal and faculty development, employment information, responsive student feedback, and the distribution of practice resources. These proposals require staged implementation and evaluation; the present study establishes priorities for testing rather than verified policy effects.

Discussions

Educational management policy and student participation

The findings suggest a distinction between favorable evaluations of curriculum relevance and weaker evaluations of student influence. Curriculum–industry alignment received a mean of 3.92, whereas the feedback mechanism received a mean of 3.34. Student voice is therefore relevant to both information collection and participation in decisions. Cook-Sather (2006) argues that students' perspectives warrant responses and opportunities to shape education. Applied to the present context, administrators should specify how student suggestions enter curriculum review, who responds, and how decisions are communicated. The findings identify a governance concern; they do not establish a causal pathway from policy awareness to satisfaction.

Why lower feedback satisfaction does not imply strong support for another platform. The comparatively low rating of the existing student feedback mechanism ($M = 3.34$) and the lower support for S3 ($M = 3.42$) are not necessarily contradictory. The first concerns students' evaluation of current provision; the second concerns a proposed technological solution. Neither mean is below the response-scale midpoint, and the 0.08-point difference has not been tested as a paired difference. Students may value better responsiveness without regarding an additional platform as their highest reform priority.

One plausible interpretation is that students question whether submitting more feedback will lead to visible action. Additional logins, duplicated questionnaires, uncertainty about confidentiality, or limited explanations of past decisions could also reduce willingness to engage. These are possible mechanisms for future investigation, not measured explanations or additional interview findings. The existing accounts of limited student input and fragmented information systems make organizational responsiveness a relevant issue to examine.

The practical implication is to connect any digital channel with a clear response process: identify a responsible unit, publish a response timetable, explain decisions, and report changes made following student input. Student representatives should help design the process. A small pilot integrated into an existing learning system could assess participation, response completion, and students' perceptions of whether their input matters. Carless & Boud (2018) emphasize action as part of feedback literacy; although their framework addresses learning feedback, it offers a useful analogy for ensuring that institutional feedback leads to an observable response.

Applied practice and faculty development

Students' favorable ratings of faculty dedication and technology exposure coexisted with weaker ratings of systematic training. This pattern supports a distinction between access to a tool and the instructional capacity to use it well. Chan & Hu (2023) document perceived benefits and concerns surrounding generative AI, while Hemminki-Reijonen et al. (2025) show how pedagogical needs can inform the design of AI-supported virtual reality. Rong et al. (2022) also examine AI and VR in art education, although their school-based setting differs from the university programs studied here. These studies inform the discussion of teaching design; they do not provide statistical evidence for gender, grade, or institutional differences in the present sample.

Learning outcomes and educational service quality

Students rated basic professional skills favorably ($M = 3.81$), but access to employment information was less positive ($M = 3.41$). These findings suggest that perceived learning and perceived service support should be monitored separately. Almulla (2024) examines learning

satisfaction in the specific context of ChatGPT-supported research, which provides a related perspective on student perceptions without validating the present study's outcome measures. Curriculum and assessment should require students to demonstrate how they apply knowledge and revise their work, consistent with constructive alignment and formative feedback principles (Biggs & Tang, 2011; Nicol & Macfarlane-Dick, 2006).

Institutional differences and the scope of expert appraisal

The reported media-institution means were EMP = 3.86, APE = 3.87, and LOQ = 3.92. The lowest reported category varied by domain, so a single institutional ranking would obscure the pattern. Institutional mission, resources, and student composition offer possible explanations that require further analysis. Wenger et al. (2025) identify connected policy, curriculum, faculty, and partnership issues in journalism education, supporting an integrated discussion of reform. Expert approval of proposals adds a stakeholder perspective but does not establish feasibility under each institution's budget or demonstrate effectiveness. Evidence on AI and VR for educational inclusion also suggests that accessibility should be considered during design and evaluation (Chalkiadakis et al., 2024); disability-related outcomes were not measured in this study.

Conclusion and suggestions

The study identifies a recurring implementation gap: students often viewed curriculum relevance, faculty dedication, and technology exposure positively, while systematic training, student feedback, and employment information received weaker evaluations. Five connected areas of reform follow from these descriptive findings and the interview accounts. Implementation should be adapted to institutional resources and evaluated before expansion.

Connect policy with a responsive feedback process

University administrators should clarify policy responsibilities, improve communication between management and teaching teams, and connect student suggestions to curriculum and service decisions. For S3, an existing platform should be used where practical, with a designated response unit, a published timetable, and visible explanations of action taken. Review should consider completed responses and students' confidence in the process, alongside participation rates.

Provide sustained faculty development

For S4, academic affairs units should coordinate continuing development in emerging media technologies and instructional design. Training can progress from basic applications to course redesign and supported classroom implementation. Shared workshops and industry collaboration should include opportunities to test teaching materials, receive peer feedback, and revise practice. Attendance alone is an insufficient indicator of instructional improvement.

Align curriculum renewal with assessable learning outcomes

For S1, program committees should connect foundational communication knowledge with flexible modules in AIGC, short-video production, and other relevant media practices. Project briefs should specify learning outcomes, evidence of individual contribution, verification of generated content, and assessment criteria. A curriculum review cycle incorporating students, alumni, and industry partners can help assess whether course updates address professional needs.

Improve access to practice resources

For S5, institutions should review demand, booking access, equipment availability, and participation by year of study before allocating additional resources. Shared facilities and collaboration among communication, computing, and design departments may improve access. Support for science and engineering or arts institutions should respond to demonstrated needs rather than a blanket assumption that either category performs worst in every domain. Accessible design and appropriate technical support should be included in resource planning.

Connect career information with support across the program

For S2, career services and program teams should maintain an employment and internship information source with clear responsibility for updating and checking opportunities. Guidance should begin before the final year and connect course projects with progressively more demanding practice experiences. Review should distinguish access to information, use of guidance, placement quality, and subsequent employment outcomes. These are proposed monitoring priorities rather than outcomes measured by the present study.

Limitations and Future Research

First, the cross-sectional sample from six participating universities limits generalization and cannot establish temporal or causal relationships. The achieved student and staff samples were below their recruitment targets, and the extent of selection and nonresponse bias cannot be determined without complete recruitment records and eligible-population counts. Findings should therefore be interpreted in relation to the participating programs rather than all Chinese universities.

Second, student self-reports measure perceptions rather than independently demonstrated competence, objective resource use, or employment outcomes. Responses may be affected by common-method bias and differences in students' expectations. Staff accounts provide contextual perspectives but cannot substitute for direct evidence of student experiences or the reasons students supported particular proposals.

Third, pilot internal consistency does not establish the main-sample factor structure. Complete measurement and model diagnostics are needed before interpreting latent dimensions, adjusted group differences, or structural paths. Future analyses should account for university clustering, distinguish paired strategy ratings from independent groups, and report uncertainty and effect sizes. Longitudinal or intervention designs are needed to test whether the proposed reforms improve outcomes.

Fourth, institutional categories can conceal variation in resources, location, program maturity, and student composition. Wider sampling and comparisons within institutional categories would strengthen external validity. Future studies could include alumni, employers, and community partners to examine the relationship between educational provision and longer-term professional development.

Finally, support for proposed reforms is not evidence of their effectiveness. Future work should investigate why students give relatively low priority to a new feedback platform, using direct questions about trust, workload, accessibility, and visible responsiveness. Pilot implementations of the five strategies should combine process measures with learning and service outcomes, and assess the benefits and demands of emerging technologies over time.

New knowledge and the effects on society and communities

The study contributes an institution-sensitive account of how educational management is experienced across policy, practice, and effectiveness domains. Its central insight is that favorable views of curriculum relevance or technology exposure can coexist with weaker perceptions of continuing support and meaningful participation. The contrast between feedback satisfaction and platform support further suggests that the management of responses deserves attention alongside digital infrastructure.

For universities and community partners, the findings suggest practical opportunities to coordinate teaching projects, internship information, faculty development, and shared production resources. Local media organizations, cultural institutions, and community groups could contribute project briefs and feedback on student work. Potential benefits include more relevant learning opportunities and stronger links between university activity and community communication needs. These are expected applications of the findings; community-level effects were not directly evaluated.

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Representations of Thai Soft Power & Cultural Identity in Foreign Video Games (1988-2025): A Content Analysis from Foreign Perspectives

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Abstract

This descriptive content-analysis study examines foreign video games that represent Thainess and Thai soft power from foreign perspectives. After screening the dataset, 57 video games released between 1988 and 2025 were retained for analysis. Non-game media were excluded, and anticipated 2025 titles were analyzed only through official trailers, promotional materials, developer information, and other publicly available paratexts. The coding framework combined the eleven Thai soft-power domains identified by the National Soft Power Development Committee with four negative-content categories: crime, human trafficking/prostitution, illicit environments, and conflict/war. Data sources included gameplay, box art, synopses, official websites, social-media materials from publishers or developers, and game-related media. Frequencies and percentages were calculated, while qualitative interpretation was used to explain how representations function as cultural signs. The most frequent Thai soft-power elements were Thai names and script (37 cases, 64.91%), tourism and religion (31 cases, 54.39%), and Muay Thai or Thai martial arts (19 cases, 33.33%). The dominant game genres were shooting, fighting, and arcade games. The most frequent negative representations were crime and conflict/war, each appearing in 11 cases (19.30%). The findings show that foreign video games simultaneously increase Thailand's global cultural visibility and reproduce selective or distorted images of Thai society. The study therefore contributes to game studies and cultural-policy scholarship by showing how video games can operate as cultural texts, soft-power channels, and sites of misrepresentation that require more active cultural guidance from policymakers, creative industries, educators, and local communities.

Keywords: Thai soft power, Thai culture, Thainess, Video game, Esports

Introduction

Video games have become one of the most influential forms of digital media in contemporary society. Scholars have described them as “hybrid media” or “convergent media” due to their growing role in everyday life, their popularity, ongoing technological development, and the cultural communities that emerge around them (Hulsey, 2020; Cade & Gates, 2017). Beyond entertainment, games are a form of play long recognized as a mode of cultural expression. They also underpin a rapidly expanding global business ecosystem, generating significant revenues across multiple sectors (Baltezarevic et al., 2018). For example, the Asia–Pacific region recorded approximately 2.71 trillion THB in gaming revenues in 2018, with China alone contributing 1.389 trillion THB. By 2020, the global industry including mobile, console, and PC gaming was valued at around 5.83 trillion THB (Kim et al., 2020), rising to 10.05 trillion THB in 2023 and projected to reach 19.6 trillion THB by 2030 (Exactitude Consultancy, 2024). These figures highlight the dual role of gaming and esports as cultural phenomena and as key drivers of the digital economy.

In Thailand, the industry has similarly become an engine of employment and income generation. With an estimated market value of 37 billion THB, it recorded growth rates of 16%, 35%, and 8% between 2019 and 2021, largely fueled by esports. Of Thailand’s 69.30 million citizens, 27.80 million were identified as gamers in 2020, equivalent to 40% of the population (PeerPower, 2020). Among these, 9.80 million were esports players, a number expected to nearly double to 18.70 million by 2027. Likewise, the esports audience through live streaming and digital platforms is projected to reach 10.70 million viewers, further embedding gaming within Thai society. Educational institutions and policymakers have responded accordingly: universities now offer degree programs in game design, development, and esports business, while government initiatives support industry growth through tax incentives and targeted funding (Longtunman, 2023).

Culturally, Thailand is shaped by strong nationalism, with traditions, values, beliefs, and religion embedded in daily life (Chearthong & Rojprapayon, 2016). National identity has historically been reinforced through education and literature, and video games now provide a new arena in which Thai elements are represented. Games increasingly incorporate Thai settings, artistic styles, and motifs, with some even integrating traditional architecture and cultural aesthetics into virtual worlds. Such representations extend beyond entertainment, influencing consumer perceptions and tourism-related experiences, often shaping attitudes and purchase decisions (Qin et al., 2019; Ko et al., 2013). Incorporating Thai art and culture enhances novelty and immersion, allowing players to explore virtual societies and environments that reflect aspects of Thai identity (Tanskanen, 2018; Essokolo & Robinot, 2022). These developments highlight the significance of examining video games as a site of cultural production.

This trajectory also aligns with Thailand’s broader national strategy to advance “soft power diplomacy.” Former Deputy Prime Minister and Minister of Foreign Affairs Don Pramudwinai emphasized the potential of leveraging Thailand’s cultural distinctiveness its identity, tourism, geography, and cuisine to strengthen international recognition (Post Today, 2020). More recently, in March 2024, Government Spokesman Chai Watcharong announced Prime Minister Srettha Thavisin’s endorsement of new initiatives to expand Thai soft power. These policies seek to enhance the value of local products and creative industries, generate employment, boost income, and advance international trade (MGR Online, 2024).

In line with these global and national trends, and with Thailand’s commitment to advancing soft power through the National Soft Power Strategy Committee (Office of the Prime Minister, 2023), this study investigates the representation of “Thainess” in video games

developed by international companies. Specifically, it explores how language, food, traditions, religion, social structures, politics, and military identity are depicted in such games, and how these portrayals contribute to the construction and dissemination of Thai soft power on the global stage. Despite the economic significance of the gaming industry and the increasing integration of Thai culture in digital media, limited scholarly attention has been paid to how foreign-produced video games depict Thailand, leaving a critical gap that this study seeks to address.

Research Objectives

1. To identify & classify representations of Thai soft power and Thai cultural identity in foreign video games released between 1988 and 2025.
2. To analyze Thai soft power & negative representations of Thailand in foreign video games.
3. To compare foreign video game representations of Thailand with Thai soft power & Thai cultural identity in foreign video games.

Literature Review

Concept of Mananupap or Soft Power

The Contemporary Communication Arts Dictionary published by the Royal Society of Thailand defines “soft power,” also known as mananupap or cold power, as the ability to attract or foster engagement without coercion or force, primarily through the dissemination of culture, the reinforcement of political values (Khruerattikan, 2008), or foreign policy, in order to create change or exert influence over the thoughts of citizens and societies in other countries (Thairath Online, 2014). Meanwhile, the Oxford English Dictionary (1989) defines soft power as “the power of a country, state, alliance, etc., derived from economic and cultural influence rather than coercion or military strength.”

In Thailand, the recognition of soft power as a national development strategy has been formalized through the work of the National Soft Power Development Committee. At its second meeting (Meeting 2/2023), the committee approved in principle eleven domains of responsibility for Thai soft power projects, activities, and industries (Matichon Online, 2023). These domains are: 1) Thai festivals, 2) Thai tourism, 3) Thai cuisine, 4) Thai arts, 5) Thai design, 6) Muay Thai, 7) Thai music, 8) Thai literature and script, 9) Thai films, television dramas, and series, 10) Thai fashion and popular culture, and 11) Thai games and esports.

Concepts in Game Design

Game design can be approached in multiple ways, which may be summarized as follows: (Saitong, 2019; Saitong et al., 2021) 1) designing from innovation, where the development of games is based on new play devices; 2) designing from creativity, emphasizing originality and novel play mechanics; 3) designing from imitation, where developers replicate popular existing games in the industry, also known as clone games; 4) designing from storylines, often derived from films or novels; 5) designing based on publisher requirements, where publishers dictate game formats according to market data and trends; and 6) designing from constraints, in which limitations of funding, technology, and marketing shape the design process.

Accordingly, game design fundamentally determines the characteristics of a game and typically consists of three main elements: 1) the selection of software for game development, 2) gameplay methods and testing, and 3) user experience and interface (Saitong et al., 2021).

Types of Games

Games can also be categorized in various ways. One categorization is based on visual representation: 2D games use two-dimensional graphics, where characters or scenes move along the x- and y-axes without a shift in perspective, while 3D games employ three-dimensional graphics, allowing movement along the x-, y-, and z-axes with variable perspectives. Another categorization is based on gameplay mechanics. The popularity of games often derives from their ability to provide challenge, imagination, and curiosity. This has driven the emergence of multiple game genres, such as: (Saitong et al., 2021) 1) Action games, 2) Fighting games, 3) Shooting games, 4) Adventure games, 5) Role-playing games (RPGs), 6) Simulation games, 7) Puzzle games, 8) Sports games, 9) Arcade games, 10) Party games, 11) Music games, and 12) Educational games.

Game Design Process:

Game design is typically conducted by a design team, often including programmers. The process usually begins with brainstorming to establish concepts, gameplay, rules, control methods, and artistic direction, leading to the creation of a Game Design Document (GDD). The steps include (Saitong et al., 2021): 1) Planning - defining the type of game, play devices, storyline, characters, scenes, and in-game objects, 2) Game Design Document (GDD) - serving as a blueprint for development, including gameplay strategies, structures, aesthetics, development guides, and detailed explanations to ensure a unified understanding (Saitong, 2019; Saitong et al., 2021), 3) Programming and prototyping - selecting the appropriate game engine for the target operating system, integrating tools for graphics, sound, and AI, then creating prototypes for stability testing, 4) Asset creation - developing in-game objects and components, 5) Game readiness-conducting repeated playtests to refine and balance gameplay, visuals, and sound, 6) Testing - identifying bugs through internal and user testing to evaluate player-game interaction, and 7) Publishing-focusing on marketing and communication with players via websites, pages, or blogs.

Key factors contributing to a game's popularity include delivering enjoyable and challenging experiences, offering choices and imagination, and enabling players to customize their gameplay. Level design, in particular, plays a critical role in game development (Saitong et al., 2021).

The concepts of soft power and game design intersect in meaningful ways when examining the representation of Thai culture in foreign video games. On one hand, Thailand's cultural domains such as Muay Thai, cuisine, festivals, religion, and tourism have been explicitly identified as vehicles for soft power promotion. On the other hand, the processes of game design and genre selection determine how these cultural elements are framed, packaged, and consumed by global audiences. As video games are both creative products and cultural texts, they serve as powerful channels for disseminating representations of Thailand. However, these portrayals may emphasize certain aspects of Thai identity while misrepresenting or oversimplifying others. Therefore, analyzing foreign video games through the dual lenses of soft power and design practice provides critical insights into how Thainess is constructed, commodified, and sometimes distorted within the global gaming industry.

Methodology

This study used descriptive quantitative content analysis supported by qualitative interpretation. Quantitative coding was used to count soft power domains, negative content categories, genres, release years, and countries of publishers and developers. Qualitative interpretation was then used to explain how these codes represented Thailand from foreign perspectives, as classified by the National Soft Power Development Committee in its 2/2023

meeting. The scope of analysis encompassed video games released between 1988 marked by the release of *Los pájaros de Bangkok*: Carvalho, adapted from the novel of the same name (Mobygames, 2008) and 2025, including titles anticipated to be released in the near future. Inclusion criteria required that video game content demonstrate elements of “Thainess,” either explicitly or implicitly, through characters, storylines, synopses, or box art. These elements were evaluated in relation to one or more of the eleven domains of Thai soft power, as well as the twelve game types identified in the literature (Saitong, 2019; Saitong et al., 2021). Sampling was conducted using a combination of purposive sampling and convenience sampling, enabling the researcher to select cases that were both relevant to the research objectives and accessible for detailed examination. The specific issues and components considered in the analysis are presented in Table 1.

In addition to positive cultural representations, the study examined negative content present in international video games related to soft power. Following Cunningham et al. (2011), violent elements were considered due to their potential to influence imitative behaviors. Negative content was categorized into four main areas: 1) crime, including violent crime and terrorism (European Commission, 2021); 2) human trafficking, including prostitution (ars OpenForum, 2014); 3) illicit environments, referring to spaces associated with substance abuse and illegal drug trafficking (Reddit/truegaming, 2017; Edwards, 2019); and 4) war simulations or historical war, including the use of strategic or military weapons (NBC News, 2013). These negative elements are reflected in the right-hand column of Table 1, allowing for systematic comparison alongside the positive representations of Thainess identified in the sampled video games.

Types of Data

The primary data for this study consisted of video games containing content related to Thai soft power. Secondary data included information on violent elements within the games, year of release, game genre, publishing companies and their countries of origin, and developing companies and their countries of origin. Data were collected from multiple sources, including box art, social media content posted by distributors, publishers, or developers, official websites, and weekly or monthly gaming magazines. To ensure comprehensive coverage, the researcher also played as many of the video games as were legally obtainable, maintaining full compliance with copyright law.

Population & Sampling

The population consisted of foreign-produced video games and official game-related materials released between 1988 and 2025 that contained explicit or implicit Thai-related content. Purposive sampling was used to identify games with clear relevance to Thai culture or Thailand-related representation. Convenience sampling was used only after relevance had been established, because some older games and rare titles were not equally accessible for direct gameplay. The final sample consisted of 57 video games. During revision, the sample size was standardized across the manuscript. Non-game media were excluded from the main dataset. Anticipated or recently announced titles for 2025 were retained only when official trailers, publisher materials, or developer information provided sufficient evidence of Thai-related representation; these cases were coded as promotional-material cases rather than full gameplay cases.

Inclusion criteria were 1) the game was produced or published by a foreign company; 2) it contained Thai-related elements through setting, character, language, clothing, architecture, religion, fighting style, food, festival, or other cultural signs; and 3) sufficient evidence was available through gameplay, official materials, or reliable secondary game documentation.

Exclusion criteria were 1) non-game media such as animation or films; 2) fan claims without verifiable source material; and 3) titles with only vague Southeast Asian references but no identifiable Thai element.

Research Instrument:

The research instrument was a coding sheet developed from three sources: the eleven Thai soft-power domains, game-genre classifications used in the literature, and negative-content categories relevant to social representation. The coding sheet contained the following variables title, year, country of publisher, country of developer, genre, source material used for coding, Thai soft power domain(s), negative content category, evidence notes, and coding confidence.

Reliability Procedures:

To strengthen validity, the coding categories were aligned with the official eleven-domain Thai soft-power framework and with game-studies literature on game genre, cultural texts, and representation. Each game was checked against at least one primary source where available, such as gameplay footage, official websites, box art, publisher materials, or developer announcements. Ambiguous cases were resolved by triangulating multiple sources and recording coding notes. To strengthen reliability, the data set was rechecked in two rounds for consistency between Table 1, figures, and textual interpretation. Because the study did not employ an independent second coder, intercoder reliability statistics such as Cohen's kappa were not calculated; this is acknowledged as a methodological limitation and recommended for future research.

Data Analysis:

After gathering a sufficient volume of video game content from international developers related to soft power and violent elements, the researcher evaluated each dataset. A total of 57 video games were selected for analysis. The data were categorized as follows:

- 1) By year of release of the video game (Figure 1).
- 2) By type of video game (Figure 2).
- 3) By country of the publishing company and developing company (Figure 3).
- 4) By frequency of Thai soft power industries represented and by negative content in the video game (Figure 4).

Results

Table 1 List of international video games studied, arranged by year of release

No	Release Year – Game Title	Distributor – Developer	Type	Thai Soft Power Industry										SUM	Negative Content				SUM
				Festival	Travel/Religion	Food	Art	Design	Thai Boxing	Music	Name/Letters	Movies/Dramas	Fashion	Games/Esports	Crime	Human Trafficking	Sleazy Place	Conflict/War	
1	1988 - Los pájaros de Bangkok: Carvalho	Dinamic Software, ES	6, 7		✓		✓	✓			✓		✓		5	✓			1
2	1992 - Fatal Fury 2	SNK, JP	2, 9						✓				✓		2				-
3	1992 - Fatal Fury: Legend of the Hungry Wolf	Takashi Yamada, JP - Hiroshi Fukutomi, JP	2, 9						✓				✓		2				-
4	1994 - Karnov's Revenge	Data East, JP, SNK, JP, Sega, JP, G-Mode, JP - Data East, JP, Rutubo Games, N/A Onan Games, N/A Panda	2, 9						✓		✓				2				-
5	1995 - Tough Guy	Entertainment Technology Co., Ltd., TW	2, 9						✓		✓				2				-
6	1996 - Tekken 2	Namco, JP, Namco Hometek, JP, Sony Computer Entertainment, JP - Namco, JP	2, 9						✓						1				-
7	1999 - Spec Ops II: Green Berets – 1999	Ripcord Games, US - Zombie Studios, US, Runecraft, UK	3								✓				1			✓	1
8	2001 - Commandos 2: Men of Courage	Eidos Interactive, UK - Pyro Studios, US	1, 3, 6		✓						✓				2			✓	1
9	2001 - Virtua Fighter 4	Sega, JP - Sega AM2, JP	2, 9						✓						1				-
10	2002 - Ragnarok Online	Gravity, KR	1, 5		✓			✓							2				-
11	2002 - Stuntman	Reflections Interactive, UK - Infogrames, Inc., US	1, 3, 8		✓						✓				2				-
12	2004 - Audition Online	YD Online, KR, Hanbitsoft, KR - T3 Entertainment, KR	9, 11	✓						✓	✓		✓		4				-
13	2004 - Burnout 3: Takedown	EA Games, US - Criterion Games, UK	8, 9		✓						✓				2				-
14	2005 - Ape Escape 3	Sony Computer Entertainment, JP - Japan Studio, JP	2, 7		✓				✓						2				-
15	2005 - Urban Reign	Namco, JP	2, 9						✓		✓				2				-
16	2005 - K-1 World Max 2005	D3Publisher, JP	2						✓		✓				2				-
17	2006 - K-1 World GP 2006	D3Publisher, JP	2						✓		✓								-
18	2006 - Let's Go Jungle!: Lost on the Island of Spice	Sega, JP	3		✓						✓				2				-
19	2006 - Virtua Fighter 5	Sega, JP - Sega AM2, JP	2, 9						✓						1				-
20	2008 - Cabela's Dangerous Hunts 2009	Activision, US - Fun Labs, RO, Magic Wand Productions, N/A, Sand Grain Studios, N/A	6, 8		✓						✓				2	✓			1

Table 1 List of international video games studied, arranged by year of release (cont.)

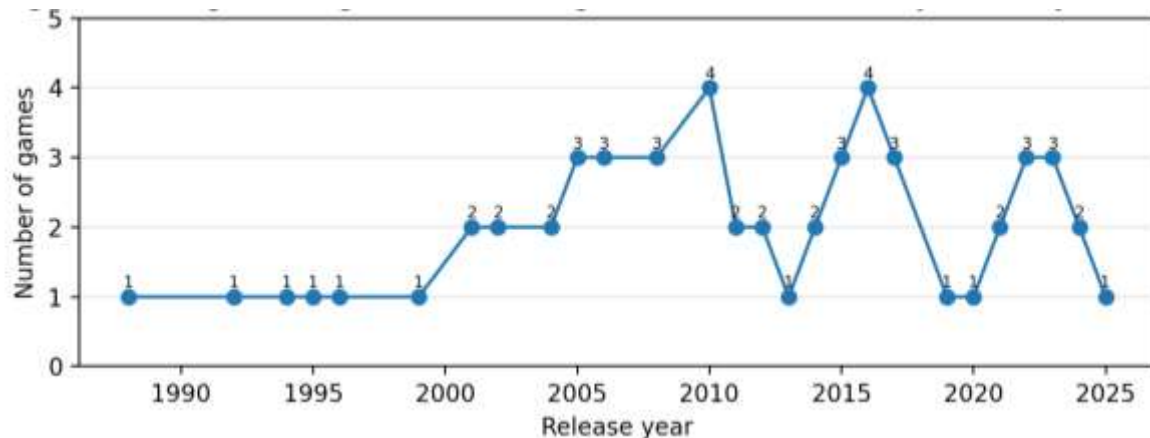
No	Release Year – Game Title	Distributor – Developer	Type	Thai Soft Power Industry											SUM	Negative Content					SUM
				Festival	Travel/ Religion	Food	Art	Design	Thai Boxing	Music	Name/ Letters	Movies/ Dramas	Fashion	Games/ Esports		Crime	Human Trafficking	Sleazy Place	Conflict/ War		
21	2008 - Grand Theft Auto IV	Rockstar Games, US - Rockstar North, UK	1, 3								✓				1	✓	✓	✓		-	
22	2008 - Street Fighter IV	Capcom, JP – Dimps & Capcom, JP	2, 9		✓				✓		✓				3					-	
23	2010 - James Bond 007: Blood Stone	Activision, US - Bizarre Creations, UK	3								✓				1	✓	✓			2	
24	2010 - Just Cause 2	Square Enix, JP - Avalanche Studios, SE	3, 4		✓						✓				2					-	
25	2010 - Super Street Fighter IV	Capcom, JP – Dimps & Capcom, JP	2, 9		✓				✓		✓				3					-	
26	2010 - The King of Fighters XIII	SNK Playmore, JP, Atlus, US, Rising Star Games, UK, SNK, JP - SNK Playmore, JP, Safari Games, JP	2, 9						✓		✓				1					-	
27	2011 - Call of Duty: Modern Warfare 3	Activision, US - Infinity Ward, US, Sledgehammer Games, US	3		✓	✓					✓				3				✓	1	
28	2011 - Supremacy MMA	505 Games, IT - Kung Fu Factory, US	2		✓				✓		✓				3					-	
29	2012 - Far Cry 3	Ubisoft, US - Ubisoft Montreal, US	1, 3, 4		✓		✓	✓			✓				4	✓	✓	✓	✓	4	
30	2012 - Sleeping Dogs	Square Enix, JP - United Front Games, Inc., CN	1, 3, 4						✓						1	✓	✓	✓		3	
31	2013 - Battlefield 4	Electronic Arts, US – DICE, SG	3		✓			✓			✓				3				✓	1	
32	2014 - Call of Duty: Advanced Warfare	Activision, US, Square Enix, JP - Sledgehammer Games, US	3								✓				1				✓	1	
33	2014 - Mario Kart 8	Nintendo EAD & EPD, JP – Nintendo, JP	8, 9		✓			✓							2					-	
34	2014 - The Sims 4	Electronic Arts, US – Maxis, US	5, 6	✓	✓	✓		✓					✓		5					-	
35	2015 - Infinite Stratos Archetype Breaker	Mages Inc., JP	5								✓				1					-	
36	2015 - Tekken 7	Bandai Namco Entertainment, JP - Bandai Namco Studios, JP, Arika, JP	2, 9		✓				✓		✓				3					-	
37	2015 - Tom Clancy's Rainbow Six Siege	Ubisoft, US - Ubisoft Montreal, US	3, 6								✓	✓		✓	2	✓				1	
38	2016 - Overwatch	Blizzard Entertainment, US	3		✓			✓			✓			✓	4					-	
39	2010 - Sid Meier's Civilization V	Firaxis Games, US - 2K, US	5	✓	✓		✓	✓		✓	✓		✓		7				✓	1	
40	2016 - The King of Fighters XIV	SNK, JP, Atlus, US, Deep Silver, AT, Taito, JP – SNK, JP, Taito, JP	2, 9						✓						1					-	
41	2016 - Arena of Valor (ROV)	Level Infinite, CN, Garena, SG - TiMi Studio Group, CN	1										✓							-	
42	2017 - Free Fire	Garena, SG	3					✓					✓	✓	3				✓	1	
43	2017 - PlayerUnknown's Battlegrounds (PUBG)	Krafton, KR, Microsoft Studios, US, Tencent Games, CN - PUBG Studios, KR	3		✓									✓	1				✓	1	

Table 1 List of international video games studied, arranged by year of release (cont.)

No	Release Year – Game Title	Distributor – Developer	Type	Thai Soft Power Industry											SUM	Negative Content				SUM
				Festival	Travel/ Religion	Food	Art	Design	Thai Boxing	Music	Name/ Letters	Movies/ Dramas	Fashion	Games/ Esports		Crime	Human Trafficking	Sleazy Place	Conflict/ War	
44	2017 - Ultimate Fishing Simulator	Ultimate Games S.A., PL - Pancake Games, 3T Labs, Bit Golem	5, 6		✓										1					-
45	2019 - Weedcraft Inc	Devolver Digital, US - Vile Monarch, PL	5, 6		✓			✓							2	✓		✓		2
46	2020 - Eternal Return	Kakao Games, KR - Nimble Neuron, KR	3, 4, 6								✓				1					-
47	2021 - Hitman 3	IO Interactive, DK	1, 3, 4		✓	✓	✓	✓		✓	✓				6	✓	✓	✓		3
48	2021 - Shut your teeth	Pavel Pichugin, RU - Anastasia Erokhina, RU	6	✓	✓						✓				3					-
49	2022 - Muay Thai 2 – Fighting Clash	Imperium Multimedia Games, RU	2						✓		✓				2					-
50	2022 - Overwatch 2	Blizzard Entertainment, US	3	✓	✓		✓	✓			✓		✓	✓	7				✓	1
51	2022 - Uncharted 4: A Thief's End	Sony Computer Entertainment, JP - Naughty Dog, US	1, 3, 4		✓		✓	✓			✓				4					-
52	2023 - Humankind	Sega, JP - Amplitude Studios, FR	5		✓		✓	✓		✓	✓		✓		6				✓	1
53	2023 - Pattaya – 2023	Alright Peaches Studio, CN	6		✓						✓		✓		3	✓	✓	✓		3
54	2023 - My Thai Boyfriend	Alright Peaches Studio, CN	6								✓		✓		2	✓	✓	✓		3
55	2024 - Indiana Jones and the Great Circle	Bethesda Softworks, US - MachineGames , US	1, 3, 4		✓										1					-
56	2024 - Skull and Bones	Ubisoft, US - Ubisoft Singapore, SG	1, 4		✓										1					-
57	2025 - Fatal Fury: City of the Wolves	SNK, JP	2, 9						✓		✓				2					-
SUM				4	31	3	7	14	20	3	37	3	9	5		11	7	7	11	

Discussions

The objective of this study was to examine Thai soft power and cultural representations in video games developed by international companies and released between 1988 and 2025, through the analysis of the following data.

**Figure 1** Number of international video games studied, classified by year of release

From Figure 1, it was found that video games containing content related to Thailand first appeared in 1988, with the second occurrence in 1992. Thereafter, the trend demonstrated steady growth. Between 1994 and 1999, approximately one video game per year was released. In the period between 2005 and 2016, the number increased to around three games per year, with the peak in 2010, which saw four releases. During the final phase, between 2013 and 2023, about three games per year were released, with the lowest frequency occurring in 2019–2020, when only one game per year was released. These findings suggest that international video games increasingly incorporated content related to Thailand and Thai culture, though the distribution was clustered within certain years showing steady increases.

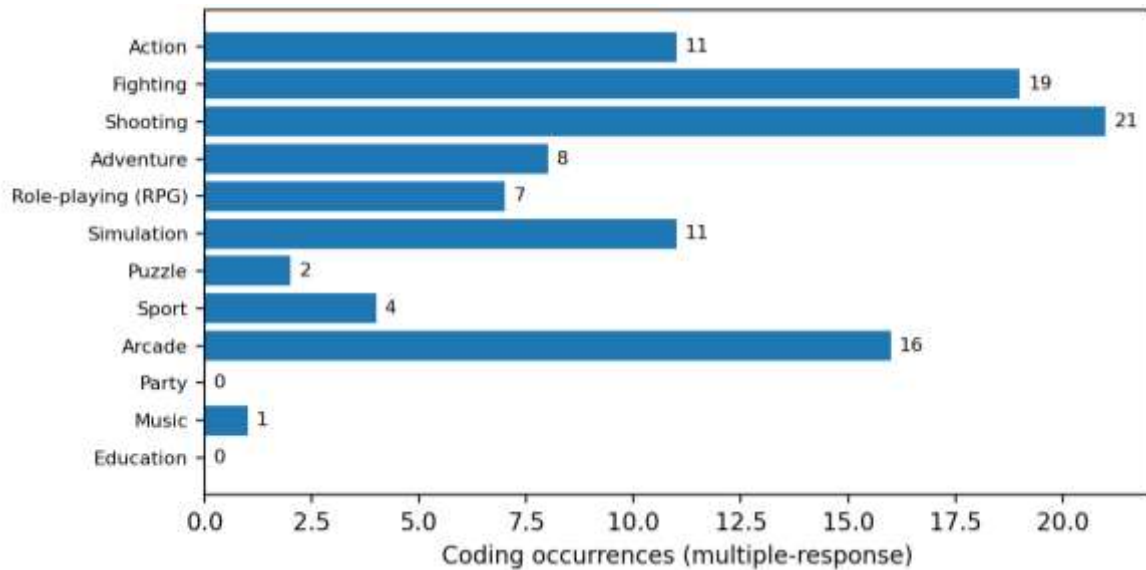


Figure 2 Number of international video games studied, classified by type of game

From Figure 2, as derived from Table 1 regarding the types of video games containing Thai-related content, shooting games were the most popular, with a total of 21 entries. These were followed by fighting games (19 entries), arcade games (16 entries), simulation games (11 entries), action games (11 entries), adventure games (8 entries), and role-playing games (7 entries). Other types of games combined accounted for 7 entries.

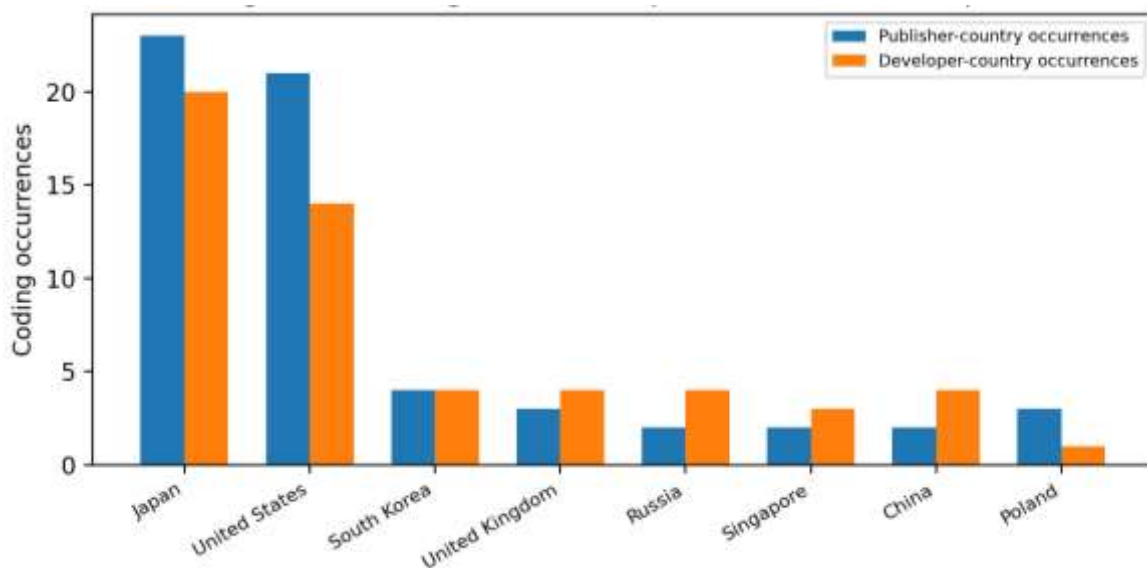


Figure 3 Number of video game publishers and developers studied, classified by country

From Figure 3, based on Table 1 regarding video game publishers and developers, it was evident that Japan and the United States dominated both publishing and development, with 22:19 and 21:14 games, respectively. Following these, South Korea, the United Kingdom, Russia, Singapore, Poland, and China were notable, with respective figures of 4:4, 3:4, 2:4, 1:3, 3:1, and 1:3. Additionally, some countries served exclusively as publishers such as Italy and Austria and others functioned solely as developers, including Sweden, Romania, and France.

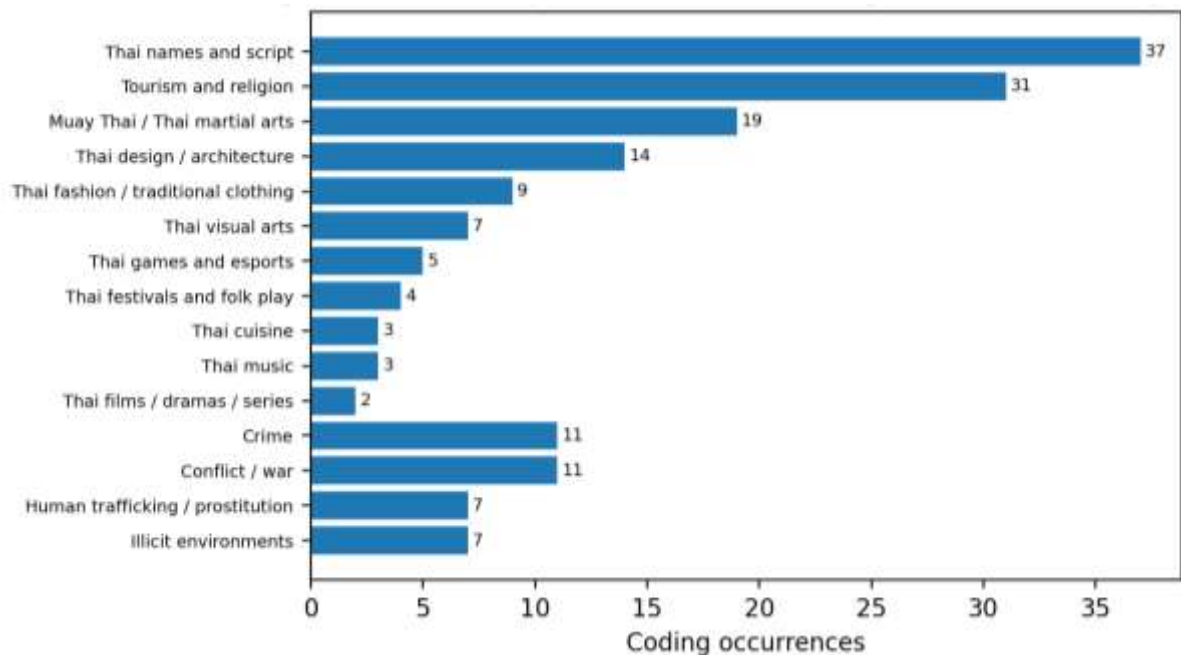


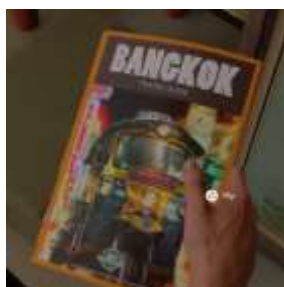
Figure 4 Number of international video games studied, classified by Thai soft power industries and negative content

From Figure 4, based on Table 1 regarding the Thai soft power industries represented, the most frequent categories were Thai names and script (37 entries), followed by tourism and religion (31 entries). Other significant categories included Muay Thai and Thai martial arts (19 entries), Thai design or architecture (14 entries), Thai fashion or traditional clothing (8 entries), Thai paintings or visual arts (7 entries), games and esports (5 entries), and Thai festivals and folk play (4 entries). Three categories were equally represented, each with 3 entries: Thai cuisine, Thai music, and Thai films/dramas. In terms of negative content associated with Thailand, the most frequent were crime and war, with 11 entries each, followed by human trafficking/prostitution and illicit environments involving substance abuse and illegal drug trade, with 7 entries each.

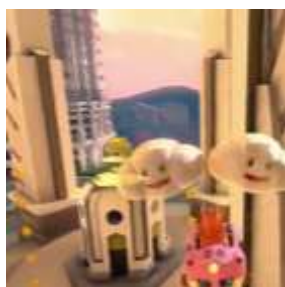
Conclusion and suggestions

The findings of this study demonstrate that, from late 2023 to early 2024, the discourse on mananupap (soft power) in Thailand has increasingly been emphasized as a mechanism for reinforcing cultural identity and generating economic value (Phothisa, 2023). This development aligns with the Thai government's policy of promoting Thailand as a "nation abundant in culture," in which culture is strategically positioned as a tool for achieving international recognition. Thai soft power has been defined as "culture with high influence, creative skills, and the ability to generate economic value" (BBC Thai, 2023). From the perspective of the global video game industry, Thailand has also acknowledged the significance of the gaming sector. The Digital Economy Promotion Agency (DEPA), in collaboration with the Thai Game Software Industry Association, reported that "Thailand suffers a significant trade deficit in content imports." In 2022, the total market value of content industries including games, animation, and characters was estimated at 40.518 billion THB. Of this, games accounted for 80% (approximately 34.556 billion THB). However, imports represented 33.657 billion THB, while exports totaled only 340 million THB. Likewise, in the character industry, imports reached 996 million THB, compared to just 69 million THB in exports. These statistics highlight the structural imbalance in Thailand's digital content industries. Moreover, they underscore the role of video games designed as "sticky" media that demand prolonged and repeated engagement in generating a form of "power" over players. This dynamic aligns with the government's soft power policy, which seeks to advance all eleven designated industries of Thai soft power in the global marketplace (Prachachat, 2023).

This study synthesized video games that incorporated Thai-related content across the eleven soft power industries. The findings suggest that soft power in this context is not simply associated with the geographical presence of Thailand, but rather requires the deliberate integration of Thai cultural elements. Notable examples include representations of tuk-tuks in *Uncharted 4: A Thief's End* (Figure 5), *Stuntman* (Figure 27), and *Just Cause 2*; the Victory Monument in *Mario Kart 8* (Figure 6); and the use of King Ramkhamhaeng's name in *Sid Meier's Civilization V* (Figure 7). Conversely, while Thai-character names have appeared with greater frequency in recent years, many do not embody Thai soft power in a meaningful sense. For instance, characters such as Aruni Arpathawanrung in Tom Clancy's *Rainbow Six Siege* and the animated short *Operation Neon Dawn – See You on the Field* (Figure 8), or Nattaphon the Photographer in *Eternal Return* (Figure 9), exhibit only nominal Thai identity. Another example is Wisanu Isa Galaxy in *Infinite Stratos Archetype Breaker* (Figure 10), demonstrate nominal Thai identity but lack substantive cultural representation. However, some examples explicitly embody Thai soft power, such as Bua Nirun Pruksamanee in *Overwatch 2* (Figure 11), depicted in a jong kraben alongside a Phi Ta Khon skin (Figure 12). Similarly, Genji's Divine Monkey (Hanuman) skin (Figure 13) reflects Thai influence. A comparable case supported by Thai government agencies was the Korat Cat Pants costume in *Free Fire* (Figure 14). Previously, Garena introduced Thai-inspired digital content in *Arena of Valor (RoV)*, including the Aor Jao skin, Phi Ta Khon skin, Phueksa Mas skin, and Tom Yum Kung skin, later expanded into collaboration with the Nakhon Ratchasima Chamber of Commerce in *Free Fire* (AmarinTV, 2024).

**Figure 5**

From: Durango, H. & Wei, H.W. (2016)

**Figure 6**

From: Screenshot by author

**Figure 7**

From: youtube.com/watch?v=-fqeTxnw_Go

**Figure 8**

From: youtube.com/watch?v=6SwavnW3pfw

**Figure 9**

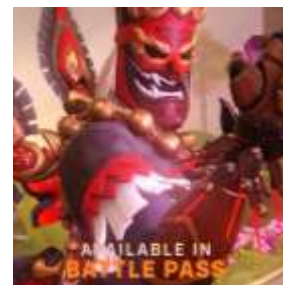
From: youtube.com/watch?v=SEW4yOt5hes

**Figure 10**

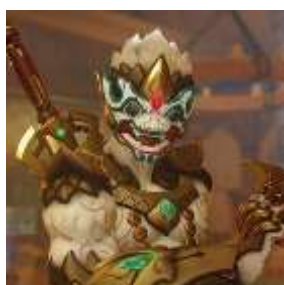
From: Facebook Page: Akibatan (Post Date: December 16, 2017)

**Figure 11**

From: onesports.gg/overwatch/lifeweaver-thai-elements-you-missed/

**Figure 12**

From: youtube.com/watch?v=CR5hh21OzhY

**Figure 13**

From: youtube.com/watch?v=yNBBwP8pOdc

**Figure 14**

From: youtube.com/watch?v=WDP6HiTv64g

**Figure 15**

From: youtube.com/watch?v=bGGYJqy_H1o

**Figure 16**

From: Screenshot by author

**Figure 17**

From: Screenshot by author

**Figure 18**

From: Screenshot by author

**Figure 19**

From: youtube.com/watch?v=8tE4VBAbXss

The findings further indicate that, given the relatively small market share and limited growth of Thailand's domestic game industry-(DEPA, n.d.), the country is often represented in foreign games from an outsider's perspective. Such representations frequently result in depictions that are either inaccurate or negatively skewed. For instance, Far Cry 3 (Figure 15), Pattaya and My Thai Boyfriend (Figure 16) portray Thailand through nightlife, violence, commodification of women, local strongmen, and human trafficking. Similarly, Shut Your

Teeth (Figure 17) centers its plot on the belief in Kuman Thong, referencing the infamous case of infant graves in Rayong used in occult rituals. Thailand is also commonly depicted as a criminal hideout, as seen in *Los pájaros de Bangkok*: Carvalho (Figure 18) and *James Bond 007: Blood Stone*, where a Thai villain controls riverside ports and becomes implicated in murder cases while evading justice. Moreover, Thailand is depicted as a battleground, such as Lumpini Park in *Battlefield 4* (Figure 19), presented as a site of U.S.-China conflict. These portrayals, though often dark and distorted characterized by muted, brownish-grey tones sometimes reflect painful truths, offering a holistic view of Thailand's strengths and weaknesses, which paradoxically enhance its cultural allure.

Another recurring motif strongly associated with Thai identity in video games is the depiction of “temples” and “Buddha statues,” representing religious stability and tourist appeal. Examples include Wat Arun in *Hitman 3* (Figure 20), *Mario Kart 8* (Figure 21), *Street Fighter IV* (Figure 22), and *Stuntman* (Figure 27). In addition, mod developer Sukritact created custom modifications such as Wat Arun (Figure 23) and Siamese leaders Ramkhamhaeng and Narai for *Sid Meier's Civilization VI*, further illustrating the cultural resonance of these motifs within digital gaming contexts.

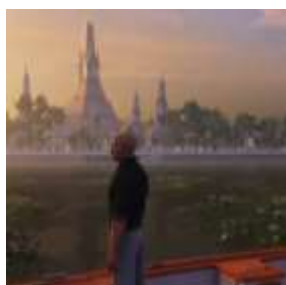


Figure 20

From: youtube.com/watch?v=HTPZ9veu9Z8

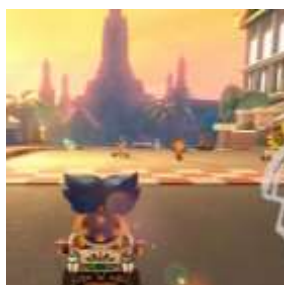


Figure 21

From: Screenshot by author

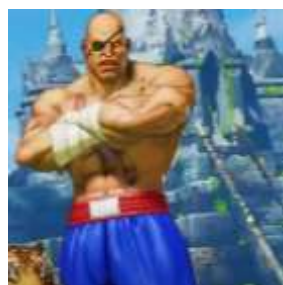


Figure 22

From: youtube.com/watch?v=4ep5TPf2sSE



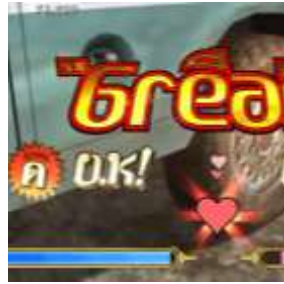
Figure 23

From: steamcommunity.com/sharedfiles/filedetails/?id=933787677

However, the Thai script remains particularly difficult to render accurately due to its complex system of consonants, numerals, vowels, and tone marks. As a result, games often depict misspelled or distorted Thai script, such as in *Just Cause 2* (Figure 24) or *Let's Go Jungle!: Lost on the Island of Spice* (Figure 25), where Thai characters are blended with English letters. By contrast, games such as *Burnout 3: Takedown* (Figure 26) and *Stuntman* (Figure 27) demonstrate proper Thai orthography and even correct Thai voiceovers, with authentic backgrounds featuring tuk-tuks and green-yellow taxis (Figure 28)

**Figure 24**

From: Screenshot by author

**Figure 25**

From: Screenshot by author

**Figure 26**

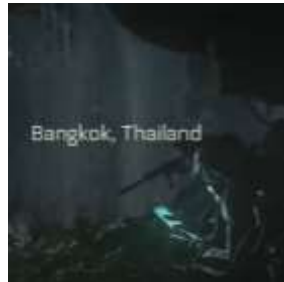
From: Screenshot by author

**Figure 27**

From: Screenshot by author

**Figure 28**

From: Screenshot by author

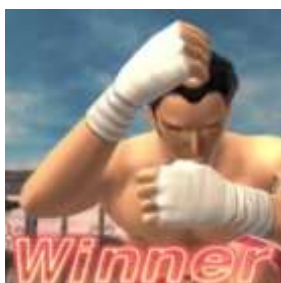
**Figure 29**

From: youtube.com/watch?v=rrmk4pIVeOO

**Figure 30**

From: Facebook Page: Bethesda (Post Date: March 4, 2024)

Nevertheless, expecting international developers to portray Thailand as accurately as domestic companies is challenging, as inaccuracies persist. For instance, Call of Duty: Advanced Warfare depicts a Bangkok mission set in mountainous terrain with waterfalls (Figure 29), while Indiana Jones and the Great Circle misrepresents Sukhothai's cultural landscape (Figure 30).

**Figure 31**

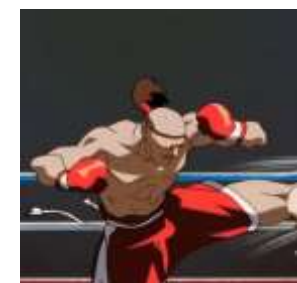
From: Screenshot by author

**Figure 32**

From: Screenshot by author

**Figure 33**

From: youtube.com/watch?v=6kH2OTzWvxE

**Figure 34**

From: youtube.com/watch?v=3zL3sHYkxQ

**Figure 35**

From: youtube.com/watch?v=_FCmCFZeGKY

**Figure 36**

From: youtube.com/watch?v=2krs7wQrs50

Among the elements examined, Muay Thai emerges as the most consistently and accurately represented form of Thai soft power, appearing in video games since 1992 (B.E. 2535) and persisting over three decades. Internationally recognized as both a sport and martial art comparable to Kung Fu, Karate, and Wing Chun Muay Thai has been prominently featured in Virtua Fighter 5 (Figure 31), Sleeping Dogs (Figure 32), and Karnov's Revenge (Figure 33), as well as animated films like Fatal Fury: The Motion Picture (Figure 34). The enduring success of Muay Thai as a cultural export is reinforced by world-class Thai fighters, including Buakaw Banchamek (formerly Buakaw Por. Pramuk) (Figure 35) and Kaoklai Kaennorsing (Figure 36), who were incorporated into titles like K-1 World Max 2005. Reflecting on this impact, Kaoklai remarked in an interview: "I feel proud when kids tell me, 'I always play as your character when I play K-1'" (Sanook.com, 2020). Similarly, Supremacy MMA featured Malai-Pet Sasiprapa, who not only voiced his own character but also introduced authentic Muay Thai techniques, with fight arenas modelled after Rajadamnern Stadium and orphan boxing camps in Thailand. These instances demonstrate how Muay Thai functions as both cultural signifier and a vehicle of national pride, achieving an authenticity rarely extended to other aspects of Thai representation in video games.

In addition to martial arts, Thai festivals and folk traditions are increasingly incorporated into online and expansion games, highlighting adaptability as soft power resources. For example, Audition Online, for instance, integrated the Loy Krathong and Songkran festivals through in-game events, items, and Thai music (Figures 37 and 38). Likewise, The Sims 4: For Rent expansion pack included cultural practices such as the Thai wai greeting, lantern festivals, marble games, riverboats, spirit houses, and traditional Thai-style houses (Figure 39). These cultural elements, though often simplified for gameplay, reinforce global visibility of Thailand's intangible heritage, situating it within interactive and immersive digital environment.



Figure 37

From: audition.playpark.com/th-
th/news/loykratong081122/



Figure 38

From: Facebook Page: Audition Thailand (Post Date:
April 13, 2024)



Figure 39

From: youtube.com/watch?v=jSPZtVbVIT8 and youtube.com/watch?v=sdhU5tRCqYc&t=8s

In conclusion, Thailand's representations in international video games encompass both explicit and implicit dimensions of soft power. On the one hand, positive portrayals highlight traditions, language, dress, tourism, Buddhism, and, most prominently, Muay Thai. On the

other hand, darker depictions emphasize violence, human trafficking, corruption, narcotics, and illicit environments. From the perspective of the international video game industry, these representations whether accurate or distorted are nonetheless perceived as integral reflections of Thai culture, traditions, values, politics, and economy. Collectively, they function as elements of Thai soft power. Yet, when such representations are inappropriate or inaccurate images, the responsibility falls on both Thai governments, as the principal promoter of soft power industries, and Thai people, as cultural carriers, to shape, guide, and reinforce authentic and respectful expressions of Thai identity on the global stage.

Suggestions

The synthesis of Thai mananupap (soft power) and cultural elements in international video games presented in this study is based primarily on official documents and on the researcher's own direct gameplay experiences. If additional in-depth data were available, such as interviews with Thai video game developers working within the international gaming industry, richer insights into foreign perspectives could be obtained. Moreover, incorporating comparative data such as sales figures, profit and loss records, and player statistics in relation to Thai soft power would provide a clearer understanding of the scale and direction of Thailand's soft power within the global video game industry and market.

Currently, research on these forms of digital data in Thailand remains relatively scarce, and academic acknowledgment of such studies is still limited. Expanding scholarly acceptance and engagement with this area would not only enhance the academic discourse but also contribute significantly to the development of Thailand's digital industry and digital scholarship. This would allow future research to broaden its scope into directions that have not yet been seriously examined within Thai academia.

New knowledge and the effects on society and communities

This study investigated the integration of Thai mananupap (soft power) and cultural elements in international video games released between 1988 and 2025. Through the analysis of 57 selected games, the research identified patterns of representation across genres, years of release, and the national origins of developers and publishers. The findings demonstrate that Thai cultural identity such as Muay Thai, temples, festivals, language, and traditional clothing has been incorporated in diverse ways. At the same time, negative portrayals, including crime, human trafficking, and corruption, have emerged as recurrent motifs. Among these elements, Muay Thai stands out as the most enduring and internationally recognized form of Thai soft power, consistently appearing in video games over three decades. The study also underscores that Thailand is frequently represented through external, foreign perspectives, producing dual effect of enhancing cultural visibility while perpetuating cultural misrepresentation.

The contributions of this research lie in generating new knowledge about how Thai soft power is reflected in global digital media, particularly video games, and in establishing a structured dataset that can support future comparative studies. The implications extend beyond academia: the results are valuable for policymakers in designing cultural and soft power strategies, for industries seeking to strengthen Thailand's position in the global digital economy, and for communities aiming to preserve and promote authentic Thai cultural expressions. Ultimately, the study demonstrates that video games not only serve as entertainment but also as cultural texts with significant power to influence international perceptions of Thailand, offering both opportunities and challenges for the nation's identity, economy, and global standing.

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An Analysis of Social, Cultural, and Community Management Factors Contributing to the Success of the Tai Phuan Community Learning Center in Ban Klang, Loei Province, Thailand

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Abstract

This study examines the social, cultural, and community management factors contributing to the success of the Tai Phuan community learning center in Ban Klang, Pak Tom Subdistrict, Chiang Khan District, Loei Province, Thailand. Adopting a qualitative research design, the study employed purposive sampling to recruit twelve key informants comprising community leaders, representatives of educational institutions, and community members with relevant knowledge and experience. Data were collected through documentary research, in-depth interviews, field surveys, and observation. SWOT analysis, supported by schematic mapping, was used to examine internal conditions and external influences on the center's development. The findings were subsequently discussed with community members and local leaders in small groups to support contextual interpretation and identify development priorities.

The findings identified six internal dimensions: organizational structure and administration, community leadership, human resources, financial resources, physical facilities and learning spaces, and community participation. Community members' cultural knowledge and active involvement emerged as central strengths, while limited financial resources constituted the principal internal constraint. Social relationships, trust, and collective decision-making supported coordination and shared ownership, whereas Tai Phuan language, traditions, beliefs, and local wisdom provided the cultural foundation for learning and intergenerational knowledge transmission. External support from educational institutions and expert practitioners complemented these capacities through academic guidance, knowledge management, and access to collaborative networks. Although no significant external threats were identified within the scope of the study, the findings underscored the importance of adaptive planning and continued resource support. Taken together, these findings suggest that the center's development depends on the interaction of social capital, cultural capital, and participatory management, with external partnerships strengthening the community's capacity to organize and transmit local knowledge. The study therefore recommends reinforcing participatory governance, developing local leadership, and sustaining community-academic partnerships to support the continuity of culturally grounded learning.

Keywords: Community learning resources, Tai Phuan people, Supporting factors, Community development



Introduction

Community learning centers provide an important setting for connecting lifelong learning with community development. Their value lies in enabling local people to participate in identifying learning needs, organizing activities, and managing knowledge relevant to their everyday lives. However, establishing a center does not automatically ensure meaningful participation or sustained community ownership. In Cambodia, Neak and Charungkaittikul (2023) found that existing community participation in learning centers was moderate, whereas the expressed need for participation was high. Their findings emphasize the importance of explicit goals and management guidelines that strengthen community involvement. This perspective is particularly relevant to ethnic community learning centers, where educational activities also involve decisions about which cultural knowledge should be preserved, who can transmit it, and how it can remain meaningful across generations.

For Tai Phuan communities, cultural continuity involves the ongoing adaptation of language, traditions, and everyday practices to changing social conditions. Karapan and Susuwan (2021) demonstrated that Phuan cultural practices vary across settlement contexts and are shaped by their surrounding social and environmental conditions. Their research provides an important understanding of ethnic identity as a dynamic process, rather than a fixed collection of inherited characteristics. It also suggests that the management of Tai Phuan learning centers requires attention to the local conditions under which cultural knowledge is maintained and transmitted. Consequently, findings from one Phuan community cannot be assumed to explain the organization of cultural learning in another without examining its particular historical and social context.

Ban Klang, located in Pak Tom Subdistrict, Chiang Khan District, Loei Province, offers a significant setting for examining these relationships. Its documented local history connects the community with migration from the Luang Prabang area and subsequent resettlement within Chiang Khan. Distinctive cultural characteristics include a local speech variety and a traditional house form known as ruan muk (Waenlo, 2024). The community also maintains the annual Bun Liang Ban ritual, which brings households together through practices associated with communal well-being, Buddhist merit-making, and remembrance of ancestors (Saenkham & Thongkhot, 2018). These characteristics give Ban Klang analytical significance: its cultural resources encompass language, built heritage, historical memory, and collective ritual practices. The community therefore provides an opportunity to investigate how different forms of living heritage become resources for organized learning and collective management.

Existing research has already established important foundations for understanding this setting. While Karapan and Susuwan (2021) examined broader patterns of Phuan cultural adaptation, Thongmeethip et al. (2025) directly investigated the management of learning resources in Ban Klang. The latter identified five mechanisms—social, cultural and spiritual, economic, educational, and technological—and five participatory stages: information sharing, consultation, joint decision-making, collective implementation, and continuous evaluation. Thus, previous research has already documented both the principal mechanisms and the forms of participation associated with local learning-resource management. The remaining research problem should therefore be framed more specifically than a general absence of studies on Tai Phuan community learning centers.

Building on these findings, the present study focuses on a more specific explanatory question: how do social relationships, cultural commitments, and community management practices interact to support the functioning of the Ban Klang learning center? Identifying mechanisms and participatory stages provides a foundation, but further analysis is needed to explain the conditions under which these elements reinforce one another. For example, the

existence of shared traditions does not, by itself, explain how cultural attachment becomes sustained involvement in learning activities. Similarly, identifying community participation does not fully explain how leadership, coordination, and relationships with external organizations help maintain that participation. The contribution proposed here is therefore an integrated explanation of the relationships among these factors, grounded in the particular context of Ban Klang.

Accordingly, this study aims to analyze the social, cultural, and community management factors that support the Tai Phuan way-of-life community learning center in Ban Klang, Pak Tom Subdistrict, Chiang Khan District, Loei Province. It examines how these factors operate together in organizing learning, transmitting local knowledge, and sustaining community involvement. By connecting the community's distinctive cultural resources with the practices through which those resources are managed, the study seeks to extend existing knowledge from the identification of mechanisms toward an explanation of their operation. The resulting insights are intended to inform context-sensitive recommendations for ethnic community learning centers, with their relevance to other communities assessed in relation to comparable social, cultural, and organizational conditions.

Research Objectives

This research aims to analyze the factors that support and contribute to the success of the community learning center showcasing the Tai Phuan way of life in Ban Klang community, Pak Tom Subdistrict, Chiang Khan District, Loei Province.

Literature Review

Concepts and Theories of Social Capital

The concept of social capital has been widely employed in research on community development, community management, and area-based development, emphasizing the significance of social relationships, networks, trust, and shared norms that facilitate collective action within society. Putnam (2000) defines social capital as a set of features embedded in social relationships that enable coordination and cooperation for mutual benefit. In the community context, social capital is manifested through patterns of interpersonal relationships, social cohesion, mutual assistance, and participation in public activities, all of which constitute fundamental conditions that enable communities to manage resources and collective initiatives autonomously (World Bank, 2002). A high level of social capital contributes to the reduction of conflict, the enhancement of mutual trust, and the continuity and sustainability of community-driven activities.

With regard to community learning centers, the social capital framework suggests that success does not depend solely on physical resources or external support. Rather, it is grounded in the quality of relationships among community members, the presence of legitimate and trusted leadership, cooperation among community groups and organizations, and networks with external factors such as educational institutions, government agencies, and civil society organizations (Putnam, 2000). In the case of ethnic way-of-life community learning centers—such as the Tai Phuan Ban Klang Community—social capital plays a particularly crucial role, as the transmission of knowledge and culture relies primarily on trust, voluntarism, and active participation. When a community possesses strong social ties and systematic collective management, community learning centers are more likely to endure and develop sustainably.

Concepts and Theories of Cultural Capital

Pierre Bourdieu's theory of cultural capital provides another important analytical framework for understanding the role of culture in social development processes. Bourdieu (1986) conceptualizes cultural capital as non-material resources, including knowledge, language, skills, values, beliefs, and cultural practices, which can be transmitted across generations and mobilized to create social value and status. Within the community context, cultural capital is reflected in ways of life, local wisdom, traditions, language, and ethnic identity, all of which form the foundational basis of community learning.

Nakabut (2015) emphasizes that community culture is not merely a form of social heritage but also a form of capital that can be strategically utilized for development across educational, economic, and cultural tourism dimensions. Consequently, the effective management of community learning centers requires the meaningful integration of cultural capital into both learning content and learning processes. This involves enabling community members to serve as primary knowledge holders and transmitters, drawing upon lived experience while contextualizing cultural knowledge within contemporary realities (UNESCO, 2017). The concept of cultural capital thus helps explain why ethnic community learning centers hold distinctive value as alternative learning spaces, differentiated from formal mainstream education systems.

In the case of the Tai Phuan Ban Klang Community, cultural capital—such as the Tai Phuan language, traditions, belief systems, and everyday practices—constitutes the core foundation of learning center management. The mobilization of these cultural resources in knowledge transmission fosters a strong sense of identity and pride, rendering the learning center deeply meaningful and relevant to community members.

Related Studies

Areekul (2023) conducted a study entitled *Models for the Development of Cultural Learning Centers and Learning Networks: A Multi-Case Study and Participatory Action Research*. The study aimed to examine processes of developing cultural learning centers within communities and the formation of collaborative learning networks. The findings indicate that the success of cultural learning centers is driven by key factors, including active community participation, strong and capable leadership, the use of cultural capital as the foundation of learning, and the establishment of networks with external organizations.

This research highlights that the sustainable development of community learning centers requires the integration of social capital and cultural capital alongside participatory community management. These findings are highly consistent with the case of the Tai Phuan way-of-life community learning center in Ban Klang, Loei Province. As such, this body of research provides a critical empirical foundation supporting the conceptual framework of the present study.

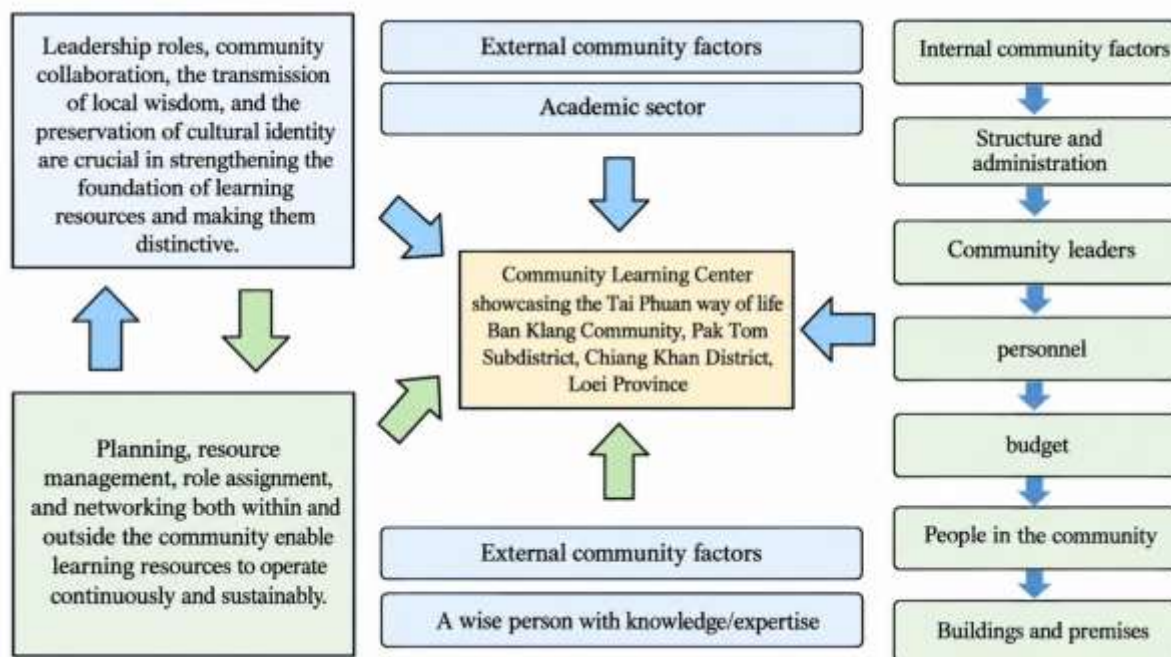


Figure 1 Research Framework (Source: Analysis by Dr. Kitisak Thongmeethip)

Conceptual Framework of the Research

The development of the Tai Phuan way-of-life community learning center necessitates an integrated analysis of key social, cultural, and community management dimensions, all of which contribute to the strength and sustainability of Ban Klang Community, Pak Tom Subdistrict, Chiang Khan District, Loei Province. From a social perspective, interpersonal relationships and social structures within the community facilitate collective learning processes. From a cultural perspective, elements such as community history, traditions, and local wisdom form the bedrock of Tai Phuan identity. From a community management perspective, factors including participation, resource management, and knowledge transmission systems function as critical mechanisms for sustaining and advancing the learning center.

These dimensions are interrelated and mutually reinforcing, collectively generating the conditions that underpin the success of the Tai Phuan Ban Klang Community Learning Center. To provide a clearer picture, the research framework can be summarized In Figure 1

Methodology

This research, "An Analysis of Social, Cultural, and Community Management Factors Contributing to the Success of the Tai Phuan Community Learning Center in Ban Klang, Loei Province, Thailand," aims to achieve its stated objectives. Therefore, this study employs a qualitative research method. This method seeks to find answers based on rational principles, addressing weaknesses in different approaches by reinforcing strengths. It has one or more objectives (Sarrattana, 2002; Prasithrathsint & Sukkasem, 2004), whether it be complementing the research, examining overlapping or differing aspects of the studied phenomena, initiating the search for unusual, contradictory, or novel perspectives, developing the research by applying the results from one stage to another, or expanding the scope of the research. The research design is a phenomenological research model. (Phenomenological Research) Primary data, primarily qualitative data, will be collected as the main method for the second phase of data collection, along with field data collection. In addition, documentary research will be used as secondary data for reference and literature review. The research methodology and procedures are defined as follows:

Population

The population of this study consisted of residents of Moo 3 and Moo 8 in Ban Klang Community, Paktom Subdistrict, Chiang Khan District, Loei Province, Thailand. These communities represent a culturally distinctive Tai Phuan settlement with well-established community practices and local knowledge systems.

Key Informants

Key informants were selected using purposive sampling, with an emphasis on identifying information-rich cases (Patton, 2015). Informants were individuals with substantial experience, active involvement, and in-depth knowledge of Tai Phuan community life, cultural practices, and community learning processes. A total of 12 key informants were recruited from three major stakeholder groups: 1) community leaders, 2) representatives of educational institutions, and 3) community members. This selection strategy ensured data saturation while capturing diverse perspectives and enhancing analytical depth.

Research Instruments

This study employed a qualitative research design, integrating documentary research, in-depth interviews, and both participatory and non-participatory observation to comprehensively explore the context, conditions, and community management mechanisms of the Tai Phuan community learning center in Ban Klang.

Documentary research involved the systematic review and synthesis of primary and secondary sources to construct a foundational conceptual and contextual framework. In-depth interviews were conducted to elicit participants' perspectives, lived experiences, and participatory processes related to community leadership, cultural transmission, and learning management. Observational methods provided empirical insights into social interactions, everyday practices, and the operational dynamics of the community learning space.

To ensure methodological rigor, all research instruments were assessed for content validity by a panel of experts using the Index of Item–Objective Congruence (IOC) prior to field deployment.

Data Collection

Data collection aimed to identify and analyze factors contributing to the success of the Tai Phuan community-based learning center in Ban Klang Community. A triangulated data collection strategy was employed through three complementary methods:

In-depth interviews (structured questions) were used to obtain detailed and systematic information on leadership roles, participatory mechanisms, management structures, belief systems, cultural practices, and forms of social capital supporting the development of the learning center. The interviews emphasized causal explanations across social, cultural, and organizational dimensions.

Field surveys were conducted to examine the physical environment, spatial organization, community resources, and patterns of learning space utilization. This method served to validate supporting factors such as infrastructure readiness, accessibility of learning areas, and the extent of community participation in learning activities.

Non-participatory observation was employed to document naturally occurring behaviors and processes within the community, including social interactions, daily routines, knowledge transmission practices, and activity arrangements within the learning center. This approach enabled the researcher to capture dynamic success factors without interfering with the authentic community context.

The integration of these three methods enhanced data credibility, methodological triangulation, and analytical robustness.

Data Analysis

Data were analyzed using the SWOT Analysis framework in combination with visual schematic mapping. This analytical approach facilitated the identification of community strengths, weaknesses, opportunities, and constraints, as well as development needs and latent capacities. The analyzed findings were subsequently reflected back to community members and local leaders through small-group discussions. This participatory feedback process promoted shared understanding, collective reflection, joint planning, and collaborative decision-making, ultimately supporting the concrete and sustainable development of the community-based learning center.

Results

Factors Contributing to the Success of the Tai Phuan Community-Based Learning Center. The study on success factors of the Tai Phuan community-based learning center in Ban Klang Community, Paktom Subdistrict, Chiang Khan District, Loei Province, was conducted through extensive fieldwork in which the researcher adopted an immersive role comparable to that of a community member. In-depth interviews served as the primary data collection method, engaging community leaders, representatives from educational institutions, Tai Phuan cultural groups, and general community members. This approach enabled the researcher to access diverse perspectives, rationales, and lived experiences that reflect the underlying factors contributing to the success of the learning center.

Based on the analysis of field data, the researcher identified key factors influencing the success of the learning center, which were systematically categorized into internal community factors and external community factors. This analytical framework provides a comprehensive explanation of the learning center's institutional strength, cultural vitality, and developmental sustainability.

Internal Community Factors

Internal factors supporting the success of the Tai Phuan community-based learning center in Ban Klang Community can be classified into six major dimensions as follows:

1) Structural and Administrative Factors

Effective organizational structures and administrative mechanisms were evident, including short-term and long-term planning, systematic monitoring and evaluation processes, efficient communication and public relations, and a committee-based management model composed of community members. These elements collectively ensured strategic direction, operational coherence, and sustained institutional support. In an in-depth interview, Ms. Sorarat Kaewsua (Phai), the village head of Village No. 3, Ban Klang community, stated:

“Planning and management are extremely important. If our village, the Tai Phuan people, are efficient in their management, it will lead to the operation of our learning center, attracting interest and confidence from visitors, and ultimately achieving success.”

2) Community Leadership Factors

Community leaders played a pivotal role in initiating and advancing the establishment of the learning center. Their active participation in community activities and their function as coordinators across multiple stakeholders fostered collective momentum and facilitated collaborative action toward shared developmental goals. In an interview with Mr. Thanusilp Inda (Kamnan Suea), the village headman of Moo 3, Ban Klang community, a key figure in developing the livelihoods of the Tai Phuan ethnic group in Ban Klang, he stated:

"First and foremost, we must prioritize and recognize the benefits of developing this learning center. I see several important aspects, one of which is that this center will help preserve knowledge about the Tai Phuan ethnic group for those interested. Furthermore, this comprehensive learning center will contribute to improving the quality of life for people in the Ban Klang community. This initiative, resulting from good coordination from all sectors, makes me very confident in the success of establishing this learning center."

3) Human Resource Factors

Based on fieldwork and interviews with elderly Tai Phuan ethnic group members, including Khun Sai Damphim, the researchers discussed the personnel factors contributing to the success of the learning center. He stated:

"Since the learning center is a novel concept currently emerging in our community, I believe its success depends on the individuals involved in its operation. They must possess a level of knowledge about Tai Phuan culture and way of life that they can effectively share with visitors and those seeking advice. This will demonstrate its true potential as a learning center. Furthermore, coordination and collaboration among various sectors are crucial to motivating the learning center. Simply put, this learning center cannot succeed without the support of coordinated efforts from all sectors to contribute ideas, implementation, and development."

Which is consistent with Personnel within the learning center possessed substantial knowledge of Tai Phuan culture, which enabled accurate, credible, and meaningful knowledge transmission. This capacity contributed to the preservation, continuity, and intergenerational transmission of local wisdom, thereby strengthening the learning content and its cultural legitimacy.

4) Financial Factors

Although financial resources constituted a significant constraint, the community adopted adaptive financial management strategies, including community-based fundraising, support from government agencies, and income generation through the sale of community products. These approaches enhanced financial resilience and supported the continuous operation of the learning center.

An in-depth interview with Mr. Thanusilp Inda, the village headman of Village No. 3, Ban Klang community, revealed the following:

"Regarding funding for the operation of the community learning center showcasing the Tai Phuan way of life in Ban Klang community, Pak Tom Subdistrict, Chiang Khan District, Loei Province, it's quite difficult to find assistance from any organization. Therefore, we believe that in the future we will need to sell some kind of product to generate income for the development of the learning center."

5) Physical Facilities and Spatial Factors

The learning spaces, such as traditional Tai Phuan wooden houses and communal activity areas, were culturally appropriate and effectively reflected local identity. These spaces facilitated experiential learning activities and served as culturally meaningful venues that enhanced both educational value and visitor engagement.

6) Community Participation Factors

Community members demonstrated a high level of participation through engagement in activities, collaborative planning, and resource contribution. This collective involvement fostered a strong sense of ownership, which constitutes a core foundation for the sustainable development and long-term viability of the learning center.

In-depth interviews were conducted with Yai Noonin, a member of the general public in Ban Klang community, regarding the factors supporting and contributing to the success of the Tai Phuan way of life learning center in Ban Klang, Pak Tom Subdistrict, Chiang Khan District, Loei Province. She stated:

“I believe that the key factor supporting and contributing to the success of the learning center is that all of us who contribute to its construction must possess accurate knowledge of traditional wisdom management. This is a very important factor.”

External Community Factors

1) Educational Institution Support

Ban Klang Community received substantial academic and technical support from educational institutions, which contributed to strengthening the management of local wisdom and cultural resources. This support provided clear direction and systematic guidance for the development of the learning center. In particular, Loei Rajabhat University played a significant role in collaborative planning, coordination, and facilitation of participatory processes within the community. An in-depth interview with Assistant Professor Dr. Wich Maliton revealed that:

“Success emerges from the collaboration of all stakeholders—universities, community leaders, and community members—through shared thinking, collective action, and joint development of the learning center.”

This perspective underscores the critical role of academic support as a key enabling condition for the learning center’s coherence, effectiveness, and sustainability.

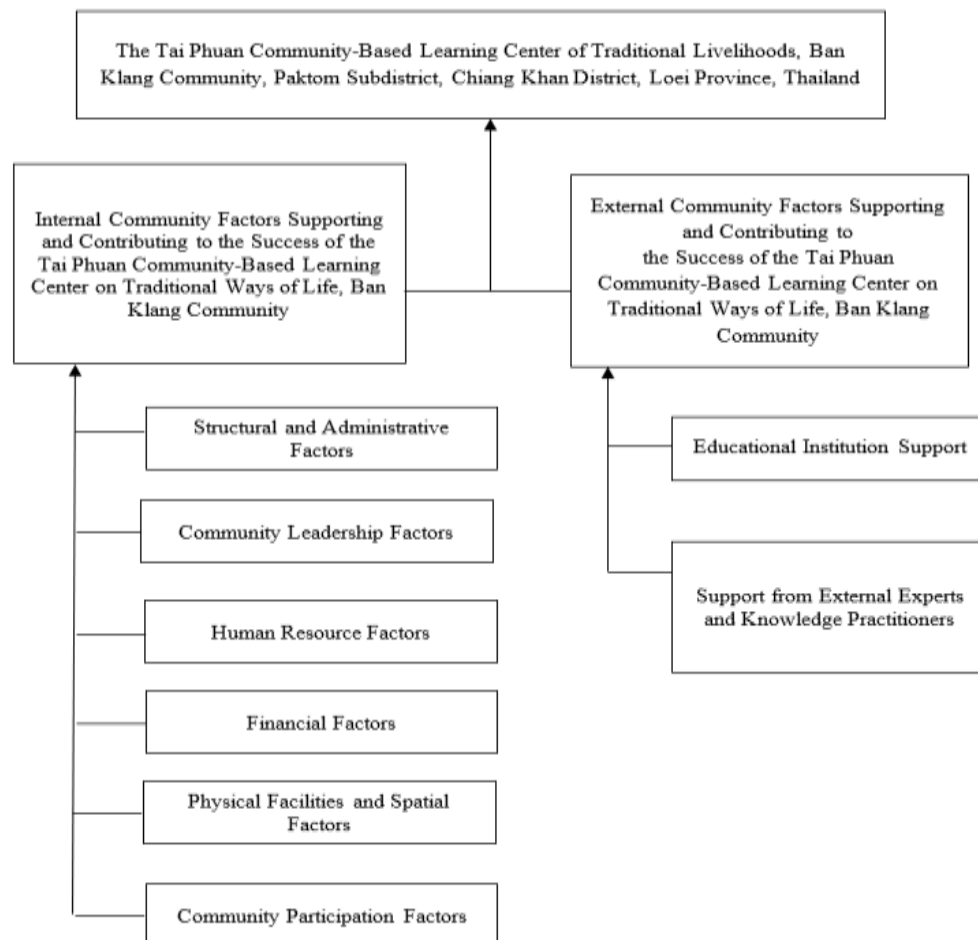


Figure 2 Factors Supporting and Contributing to the Success of the Tai Phuan Community-Based Learning Center, Ban Klang Community (Source: Analysis by Dr. Kitisak Thongmeethip)

2) Support from External Experts and Knowledge Practitioners

External agencies and expert practitioners contributed significantly to the development of the Tai Phuan learning center across multiple dimensions, including:

2.1) knowledge transfer, academic consultation, and support for translating local wisdom into forms compatible with contemporary contexts;

2.2) systematic development of the learning center's structure through knowledge management processes, database development, and the production of modern learning media;

2.3) networking and resource linkage among communities, government agencies, and private sectors to support development initiatives such as cultural tourism; and

2.4) promotion of lifelong learning through training programs, vocational skill development, and the integration of local wisdom with innovation.

These external contributions reinforced the learning center's institutional stability and enhanced its capacity for sustainable development over the long term. To clearly illustrate the interrelated internal and external factors that support and contribute to the success of the Tai Phuan community-based learning center in Ban Klang Community, Paktom Subdistrict, Chiang Khan District, Loei Province, the findings are synthesized and presented in the schematic diagram below.

3) SWOT-Based Prioritization of Success Factors

Nevertheless, the researchers prioritized the factors that supported and contributed to the success of the Tai Phuan lifestyle community learning center in Ban Klang community, Pak Tom sub-district, Chiang Khan district, Loei province, using SWOT analysis. SWOT analysis, or environmental and potential analysis, is a tool for evaluating the situation for various activities, helping to identify strengths and weaknesses from the internal environment, see opportunities and threats from the external environment, and assess the impact on all types of development activities.

Strengths

The identified strengths comprised structural and administrative factors, community leadership, human resources, community participation, and physical facilities. These factors were considered highly significant, representing key advantages derived from the internal community context. The strengths reflected the favorable internal environment of Ban Klang Community, characterized by a committed management team, proactive community leaders, and strong community engagement. Collectively, these internal assets contributed to the effective operation and advancement of the Tai Phuan community-based learning center in a systematic and goal-oriented manner.

Weaknesses

The principal weakness identified was the financial factor, which constituted the most prominent limitation affecting the operation of the Tai Phuan community-based learning center in Ban Klang Community. This disadvantage stemmed from internal community conditions. However, through joint analysis conducted by the researcher in collaboration with community members, it was found that financial constraints did not critically impede daily operations. Nevertheless, external financial support from relevant agencies would significantly enhance operational liquidity and strengthen the overall sustainability of the learning center.

Opportunities

Opportunities primarily derived from external factors, particularly support from educational institutions and expert knowledge practitioners affiliated with external support agencies. These opportunities were considered to be as significant as internal strengths, as they arose from the external environment surrounding the Tai Phuan community-based learning

center and directly facilitated community development initiatives. Unlike strengths, which are rooted in internal conditions, opportunities emerge from the broader external context. The findings indicated that effective management teams and community leaders must continuously seek and capitalize on such opportunities by systematically monitoring changes in the external environment, including economic, social, political, and technological dynamics, and strategically leveraging these conditions for development.

Threats

With regard to threats, the researcher found that neither the community nor the research process identified significant external constraints that adversely affected the operation of the Tai Phuan community-based learning center in Ban Klang Community. Nonetheless, the management team of the learning center is required to continuously adapt its operational strategies to ensure contextual alignment and to proactively plan preventive measures to mitigate potential threats that may arise in the future.

Analytical Synthesis

To enhance clarity in illustrating the factors supporting and contributing to the success of the Tai Phuan community-based learning center on traditional ways of life in Ban Klang Community, Paktom Subdistrict, Chiang Khan District, Loei Province, the researcher presents a synthesized schematic diagram below.

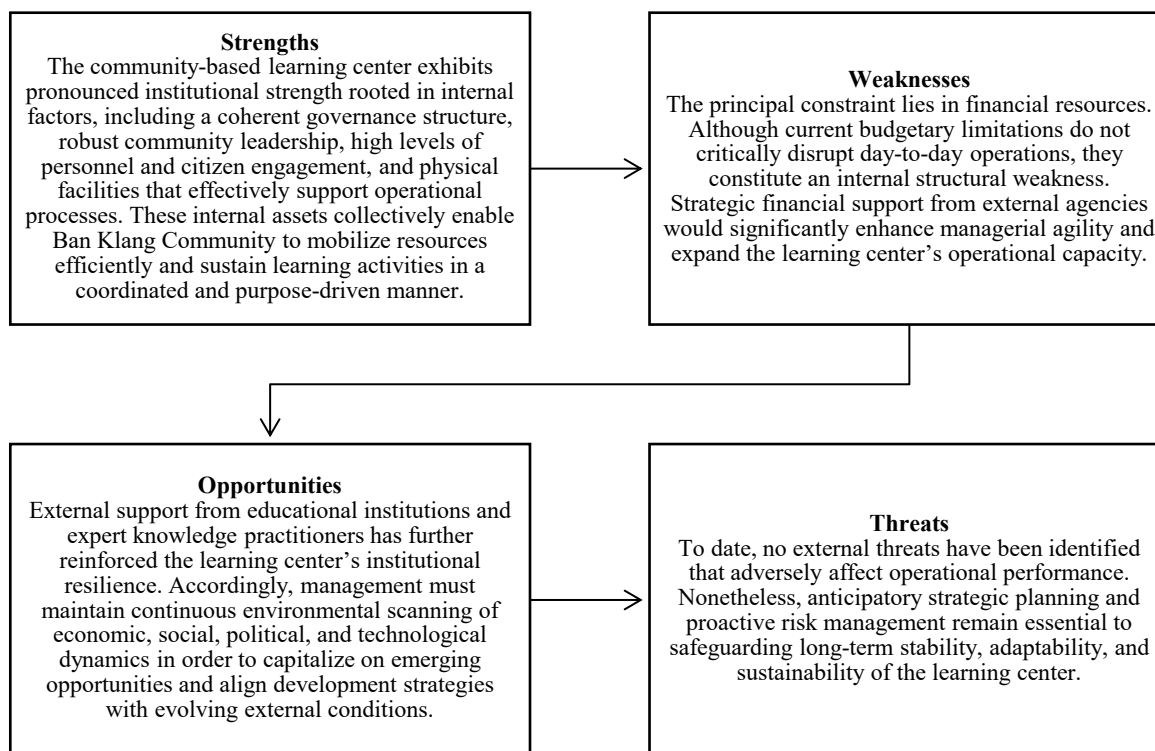


Figure 3 SWOT Analysis of Factors Contributing to the Success of Learning Resources
(Source: Analysis by Dr. Kitisak Thongmeethip)

Discussions

Based on extensive fieldwork examining the factors contributing to the success of the Tai Phuan community-based learning center on traditional ways of life in Ban Klang Community, Paktom Subdistrict, Chiang Khan District, Loei Province, the findings indicate that the most critical internal factors are community members and participation. Community members demonstrate strong collective organization and multidimensional interactions across occupational, economic, social, and recreational domains, reflecting a high level of community cohesion and resilience. Moreover, active participation by both community members and relevant organizations fosters pride, a sense of ownership, and collective agency, which function as key driving forces sustaining the long-term development of the learning center.

External factors primarily include support from educational institutions and expert knowledge practitioners, which significantly facilitate the development of knowledge management. This process encompasses the systematic collection, creation, organization, exchange, and application of knowledge within the learning center, thereby transforming raw information into meaningful knowledge accessible to diverse target groups. Effective knowledge management, however, requires appropriate resource allocation and strong coordination between the community and supporting agencies—conditions that are essential for ensuring the sustainable success of the Tai Phuan community-based learning center in Ban Klang Community.

Content analysis of field data further reveals that the success of the learning center results from the integration of social, cultural, and participatory community management factors. Rather than relying solely on formal structures or physical resources, the learning center is sustained through continuous and systematic collaborative processes embedded within the community's social fabric. The findings highlight the pivotal roles of community leadership, citizen participation, and inclusive management practices that enable community members to engage in collective decision-making. These mechanisms collectively generate trust, social cohesion, and a shared sense of ownership, aligning closely with Putnam's (2000) concept of social capital, which emphasizes social networks and relationships as foundational resources for effective collective action.

Furthermore, strong social capital has been shown to mitigate constraints related to limited financial and material resources, supporting the World Bank's (2002) assertion that communities endowed with high levels of social capital possess enhanced capacity for sustainable self-governance and resource management. From a cultural perspective, the analysis indicates that the Tai Phuan language, traditions, beliefs, lifestyles, and local wisdom are centrally integrated into both the content and processes of the learning center. Culture thus functions as a form of social resource that generates value and meaning, consistent with Bourdieu's (1986) concept of cultural capital.

The use of authentic community spaces—such as traditional wooden houses and communal activity areas—as experiential learning environments further connects past and present, reinforcing ethnic identity and cultural pride. This finding aligns with the perspectives of Nakabutr (2015) and UNESCO (2017), which emphasize the role of community culture as a foundation for learning and sustainable development. In comparison with related studies, the findings of this research are consistent with those of Areekul (2023), who similarly identified the success of cultural learning centers as stemming from the integration of community participation, strong leadership, the strategic use of cultural capital, and external network linkages—particularly the role of educational institutions in strengthening knowledge systems and management processes. Such partnerships reflect a development-oriented collaborative model that enhances the institutional robustness and long-term sustainability of community-based learning centers.

Conclusion and suggestions

This qualitative study demonstrates that the success of the Tai Phuan community-based learning center in Ban Klang Community is primarily driven by the integration of social, cultural, and participatory processes rather than by physical infrastructure alone. Internal factors—particularly community members and their active participation—constitute the core foundation of sustainability. Strong leadership, inclusive management practices, and collective decision-making foster trust, social cohesion, and a shared sense of ownership, reflecting the critical role of social capital in sustaining collective action.

External support from educational institutions and expert knowledge practitioners significantly enhances the community's knowledge management capacity by facilitating the systematic creation, organization, and application of local knowledge. Cultural elements, including language, traditions, beliefs, and local wisdom, function as cultural capital that adds value, meaning, and identity to the learning center, while experiential learning spaces rooted in authentic community contexts reinforce cultural pride and intergenerational continuity.

Based on these findings, community-based learning centers should prioritize participatory governance, leadership development, and community ownership. Policymakers and educational institutions are encouraged to establish long-term collaborative partnerships that strengthen knowledge management and resource support. Future development strategies should emphasize adaptive planning and proactive risk management to ensure the long-term resilience and sustainability of community-based learning centers.

New knowledge and the effects on society and communities

This study provides new insight by demonstrating that the sustainability of community-based learning centers is fundamentally driven by social and cultural processes rather than physical infrastructure alone. The findings reveal that social capital, cultural capital, and participatory community management function as interconnected mechanisms that transform local culture into a dynamic and resilient learning system. Community members and their active participation emerge as the core drivers of knowledge creation, ownership, and continuity, while external academic support plays a critical role in strengthening community-based knowledge management through systematic organization, interpretation, and application of local wisdom.

At the societal and community levels, this model enhances social cohesion, trust, and collective identity, reinforcing community capacity for self-organization and long-term development. By embedding cultural practices and lived experiences into learning processes, community-based learning centers become inclusive platforms for lifelong learning, intergenerational knowledge transmission, and culturally grounded innovation. The study highlights the broader potential of community–academic partnerships to empower local actors, mitigate resource constraints, and promote sustainable development pathways rooted in community values and cultural identity.

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and local wisdom, and opening their community learning space. This was a crucial factor in enabling the research to proceed fully and achieve its objectives. The researcher sincerely hopes that the value and benefits derived from this research will serve as a guideline for the development of knowledge and sustainable community development in the future.

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Behavioral Patterns and Identity Expression in University Students' Uniform-Wearing: A Quantitative Study

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Abstract

Despite growing scholarly interest in the sociocultural functions of student uniforms, empirical research on uniform-wearing Behavior in Southeast Asian higher education remains limited, particularly regarding the interplay between digital self-presentation and institutional dress norms. This study investigated the Behavior and motivations behind student uniform wearing at Kasetsart University, Kamphaeng Saen Campus. A quantitative survey was administered to 392 undergraduate students selected through stratified random sampling across nine faculties. Data were analysed using Welch's One-Way ANOVA, Pearson correlation, and Random Forest classification.

Enhancing personal image ($F = 12.66$, $p < .001$) and expressing social status ($F = 6.24$, $p = .006$) were the primary motivators, whereas institutional regulations and comfort showed no significant effect ($p > .05$). Academic year was the strongest predictor of wearing frequency (Feature Importance = 0.35), with third-year students exhibiting the highest frequency. Although students from the Faculty of Education constituted a smaller share of the sample (9.18%) than the Faculty of Service Industries (32.65%), their individual mean wearing frequency was the highest among all faculties, reflecting a strong teacher-centric professional culture.

These findings indicate that uniform wearing among university students extends beyond regulatory compliance to encompass identity formation and social expression. The results carry practical implications for developing dress-code policies that balance institutional traditions with students' evolving needs in the digital era.

Keywords: Uniform wearing behavior, Motivation, Professional culture

Introduction

Student uniforms in higher education have traditionally been understood as markers of institutional membership and discipline. Yet three notable gaps persist in the literature. First, empirical evidence on uniform-wearing Behavior in Southeast Asian universities remains scarce, despite distinct sociocultural norms that differ markedly from Western contexts (Bunyawanich et al., 2018). Second, although digital self-presentation has reshaped how young adults construct and communicate identity (Fardouly & Vartanian, 2016; Shumaker et al., 2017), the intersection between social-media influence and institutional dress practices has not been systematically examined. Third, a conceptual gap exists between the regulatory framing of uniforms as instruments of compliance and the lived experience of students who treat dress as a vehicle for image construction and social signalling (Adam & Galinsky, 2012). This study addresses these gaps by investigating the Behavior and motivations behind uniform wearing among undergraduate students at Kasetsart University, Kamphaeng Saen Campus, using a combination of traditional inferential statistics and machine-learning classification.

In Thailand, Kasetsart University stands as a higher education institution with a long-standing history and a distinguished reputation in educational development. Its origins trace back to the Primary Agricultural Teacher Training School established in 1917, before its formal founding in 1943, eventually growing into one of the nation's leading universities (Kasetsart University, 2024). The Kamphaeng Saen Campus, a key component of the university, is notable for its expansive grounds and diverse academic disciplines, underpinned by a robust organizational culture. This culture is reflected in the use of student uniforms, which have evolved since 1951. The design of Kasetsart University's uniforms blends international elements with local identity, exemplified by the white shirt adorned with the emblem of Phra Pirun riding a naga, symbolizing not only institutional pride but also a connection to national cultural heritage (Kasetsart University, 2024). These uniforms have been continually refined to align with modern times, balancing functionality with social appropriateness.

Nevertheless, contemporary societal shifts, particularly influences from Western culture and digital technology, have introduced new challenges to the use of student uniforms. Recent studies indicate that social media plays a pivotal role in shaping dress patterns among higher education students, fostering new modes of self expression through dress (Shumaker et al., 2017). Furthermore, McVeigh (1997) argues that uniforms in educational institutions carry deep ideological significance, functioning as tools for disciplining bodies and minds while simultaneously reflecting institutional efforts to preserve cultural values amid globalisation.

From an institutional management perspective, understanding how digital self-presentation reshapes uniform compliance is not merely an academic exercise. Without such evidence, dress code revisions, faculty identity branding, and student engagement policies rest on untested assumptions, with consequences for both the legitimacy of institutional regulations and students' sense of belonging (Baumann & Krskova, 2016). This study therefore has direct relevance for higher-education administrators seeking to align traditional dress norms with the realities of a digitally connected student body.

Within this context, examining the Behaviors and motivations behind student uniform wearing is essential to understanding the factors influencing student decision-making, spanning social, cultural, and psychological dimensions. Ansari et al. (2022) demonstrate that uniforms shape Behavioral patterns among students, while Fardouly and Vartanian (2016) highlight the growing weight of external influences such as peer expectations and online social dynamics in shaping appearance-related Behaviors. Consequently, this research on the Behaviors and motivations of uniform wearing among students at Kasetsart University, Kamphaeng Saen Campus, aims to explore dress patterns, frequency of use, and the factors driving these choices.

It analyses both internal motivations, such as institutional pride, and external influences, such as social media impact. These objectives align with findings suggesting that uniform wearing transcends mere adherence to rules, serving as a process of identity construction and social expression (Di et al., 2026). The study seeks to offer insights that inform the development of dress code policies responsive to the needs of students in the digital era, ensuring both effectiveness and inclusivity.

Research Objectives

1. To characterise patterns of uniform-wearing Behavior (frequency, occasion, and modification) across faculties and academic years.
2. To identify the motivational factors personal image, social status, peer norms, and institutional respect that predict uniform-wearing Behavior.
3. To assess the role of social-media exposure as a correlate of the motivation–Behavior relationship.

Literature Review

The role of student uniforms in higher education has evolved far beyond serving merely as a tool for institutional compliance, emerging as a multifaceted phenomenon intertwined with social identity expression, Behavioral patterns, and cultural dynamics. Research has also extended to the physical and public-health dimensions of uniform policies: Nathan et al. (2021) found that uniform requirements can constrain students' physical activity levels, while Reidy (2021) provided a comprehensive public health review of the evidence on uniforms' effects on both education and health outcomes. Contemporary scholarship has further highlighted the connections between student uniforms and personal image construction, social status, academic progression, professional norms, and the influence of digital technology. This literature review synthesises relevant studies to establish a conceptual framework for interpreting the findings of the present study while identifying gaps in existing knowledge.

Uniforms and the Construction of Image and Social Status

Numerous studies have established that uniforms extend beyond regulatory adherence, serving as instruments for shaping personal image and signalling social status. In a landmark experiment, Adam and Galinsky (2012) demonstrated that wearing specific clothing what they term 'enclothed cognition' systematically alters the wearer's psychological processes, including attention and self-perception. Applied to the university context, this suggests that donning a uniform can actively shape how students see themselves and wish to be seen. Wade and Stafford (2003) found that the introduction of public school uniforms significantly affected students' self-perceptions and perceptions of school climate, indicating that dress norms influence not only individual psychology but also the social environment. More recently, Di et al. (2026) showed that fashion imagery of school uniforms shapes students' psychological capital through a social identification mechanism: wearing the uniform fosters a sense of belonging that, in turn, enhances self efficacy and resilience. Despite these advances, relatively little is known about how these dynamics manifest in Southeast Asian higher education institutions, such as Kasetsart University, where additional cultural factors may exert influence.

Variations in Behavior Across Academic Years

The relationship between academic year and uniform-wearing Behavior has received only partial attention in academic literature. Santos and Marasigan (2021) reported that adherence to dress-code policies among university students is positively associated with self-discipline, and that the strength of this association varies across stages of study. This is consistent with the present study, which identifies academic year as a significant variable

(Feature Importance = 0.35). Specifically, third-year students demonstrate the highest frequency of uniform wearing (median = 0.65), with a noticeable decline in the fourth year. The pattern suggests a developmental arc: students initially adapt to institutional norms, peak in compliance during the middle years, and gradually assert individual identity as graduation approaches a trajectory consistent with Baumann and Krskova's (2016) broader observation that school discipline and uniform practices interact with academic outcomes over time. Further longitudinal analysis is needed to elucidate the factors driving this shift.

Influence of Professional Culture and Inter-Faculty Differences

Professional culture plays a prominent role in shaping uniform-wearing Behavior, particularly in disciplines with strong professional identities. Timmons and East (2011) found that uniforms in professional settings serve as markers of status and establish boundaries between occupational groups, a finding that extends naturally to pre-professional education programmes where students are socialised into their future roles. In the Thai context, Bunyawanch et al. (2018) demonstrated that university uniforms function as instruments of unity, hierarchy, and conformity, with faculties that emphasise public-facing professional roles (such as education) exhibiting stronger adherence. This aligns with the present study's finding that students in the Faculty of Education display the highest frequency of uniform use, reflecting the influence of a teacher centric professional culture that emphasises serving as an exemplary model. These studies collectively underscore the need to account for the diversity of professional cultures when formulating uniform policies.

Influence of Digital Technology and Social Media

The advancement of digital technology, particularly social media, has transformed the ways in which students express themselves through dress. Shumaker et al. (2017) found that female users on Instagram engage in deliberate self-presentation through clothing choices, and that social-media platforms serve as arenas where dress decisions are both displayed and reinforced by peer feedback. Fardouly and Vartanian (2016) provided a broader framework, showing that social media exposure is consistently associated with heightened appearance-related concerns and self monitoring Behaviors. Together, these findings suggest that digital platforms amplify the social significance of dress, including uniforms, by creating additional audiences for self-presentation. However, much of this research has focused on Western populations and general fashion Behavior; the connection between social media and institutional uniform practices in non-Western higher education remains underexplored a gap the present study aims to address.

In sum, the literature reveals that student uniforms play a complex role in shaping personal image, signalling social status, reflecting professional culture, and responding to digital technology's influence. Although prior research has laid a foundation for these themes, it often lacks specific exploration within the Thai context. This study bridges these gaps by employing advanced statistical techniques, such as Welch's ANOVA and Random Forest (Breiman, 2001), to evaluate the weight of factors influencing uniform-wearing Behavior among students at Kasetsart University, Kamphaeng Saen Campus.

Methodology

Population and Sample

This study focuses on the population of undergraduate students at Kasetsart University, Kamphaeng Saen Campus, during the 2024 academic year. The research employed stratified random sampling due to significant methodological considerations, namely the substantial variation in the student population across faculties in terms of both size and distinct characteristics. Stratification by faculty enhances the representativeness of the sample, which is critical for minimizing bias in the research findings.

The sample consisted of 392 students, allocated proportionally to reflect the actual population distribution across faculties, ensuring alignment with the studied population's structure. This approach yielded highly reliable data, enabling effective analysis both by faculty and in aggregate. The determination of sample size and its distribution further improved the precision of population parameter estimation, achieving statistical significance.

Table 1 Allocation of Sample by Faculty at Kasetsart University, Kamphaeng Saen Campus

Faculty	Sample Size (Persons)	Percentage (%)
Faculty of Agriculture, Kamphaeng Saen	29	7.40%
Faculty of Engineering, Kamphaeng Saen	40	10.20%
Faculty of Sports Science	59	15.05%
Faculty of Education and Development Studies	36	9.18%
Faculty of Liberal Arts and Science	72	18.37%
Faculty of Veterinary Medicine	4	1.02%
Faculty of Fisheries	12	3.06%
Faculty of Environment	12	3.06%
Faculty of Service Industries	128	32.65%
Total	392	100%

Within each stratum (faculty), the researcher employed systematic random sampling to enhance representativeness and reduce sampling error. This method ensured a uniform and comprehensive distribution of the sample across the population within each faculty. The design of this sampling approach enables the research findings to be accurately and reliably generalized to the broader population, while also facilitating effective analysis of inter-faculty differences. This is particularly valuable for addressing the research objectives and applying the study's results to relevant contexts moving forward.

In terms of academic-year composition, the sample comprised Year 1 students (25.50%), Year 2 (27.30%), Year 3 (24.70%), and Year 4 (22.50%), broadly reflecting the registrar's enrolment figures (chi-square goodness-of-fit test, $p > .05$). Year level was subsequently entered as a covariate in the inferential models to account for its potential confounding effect.

Research Instruments

This study utilized a questionnaire as the primary tool for data collection, developed systematically in accordance with principles of social and behavioral science research. The instrument's design was informed by an extensive literature review and relevant theoretical frameworks, ensuring alignment with the research objectives and empirical context. The questionnaire was created in a digital format using Google Forms and comprised three main sections: demographic information, assessment of uniform-wearing behavior, and evaluation

of motivational factors. The first section gathered statistically significant baseline variables related to uniform-wearing behavior, including gender, age, academic year, faculty affiliation, and monthly income. The second section employed closed-ended, single-choice questions to assess specific behavioral variables. The third section utilized a 5-point Likert scale to evaluate the importance of motivational factors influencing uniform wearing among students.

The quality assurance process for the research instrument was rigorous. Content validity was assessed by three experts in educational measurement and evaluation, behavioral sciences, and educational administration. The Index of Item-Objective Congruence (IOC) analysis yielded values ranging from 0.67 to 1.00 across all items, exceeding the standard threshold of 0.50. Reliability was tested through a pilot study involving 30 students, with the Cronbach's alpha coefficient for the motivation scale calculated at 0.897, significantly surpassing the acceptable benchmark of 0.70.

The design of the research instrument prioritized bias reduction across multiple dimensions, particularly response bias, through various measures. These included the use of neutral and clear language, avoidance of leading questions, randomization of positive and negative items in the motivation scale to mitigate acquiescence bias, and a concise questionnaire structure to reduce respondent fatigue. Additionally, screening questions were incorporated to verify participants' attentiveness, enhancing the reliability of the collected data.

Regarding research ethics involving human subjects, the study adhered to fundamental ethical principles. Participants were provided with clear information about the research objectives, data usage, and confidentiality measures, and voluntary informed consent was obtained prior to questionnaire completion. Participants could withdraw from the study at any time without consequences. Collected data were securely stored and reported in aggregate form, preserving respondent anonymity. Empirical evidence from the instrument's quality validation process demonstrates that the developed questionnaire possesses robust psychometric properties, including content validity, reliability, and applicability. This systematic and thorough development and validation process aligns with contemporary standards in social and behavioral science research, ensuring that the collected data are accurate, reliable, and suitable for advanced statistical analysis to address the research questions effectively.

To maximise data quality and response rates, the online questionnaire remained open for 21 days with two reminder notifications sent at one-week intervals. Cases with fewer than 80% of items completed were removed prior to analysis. The achieved response rate was 89.30%. To mitigate common method bias, procedural remedies were employed: items were presented in randomised order, anonymity was guaranteed, and the motivation scale alternated positively and negatively worded items. A post-hoc Harman's single-factor test confirmed that no single factor accounted for the majority of variance (largest factor = 28.40%, well below the 50% threshold), indicating that common method bias was unlikely to distort the findings (Podsakoff et al., 2003).

Data Analysis

Data analysis in this study was conducted using statistical software and divided into two primary components:

1. Descriptive Statistics: These were used to characterize the sample and variables through frequency distributions, percentages, means, and standard deviations. The interpretation of mean motivation scores followed Thanin's (2010) criteria, categorized into five levels: 4.50–5.00 (very high), 3.51–4.50 (high), 2.51–3.50 (moderate), 1.51–2.50 (low), and 1.00–1.50 (very low).

2. Inferential Statistics: These were employed to examine relationships and differences among variables using the following methods: 1) Welch's One-Way Analysis of

Variance (ANOVA) to compare differences between groups, suitable for data with heterogeneous variance and resilient to violations of the normality assumption; 2) Correlation Analysis to assess relationships between variables; and 3) Machine Learning Techniques (Random Forest and Decision Tree) to identify key factors influencing uniform wearing behavior, with model performance evaluated via accuracy metrics. The selection of Welch's ANOVA was appropriate given the data's diversity (e.g., across faculties and academic years) and unequal sample sizes, reducing Type I error rates and enhancing statistical power, consistent with behavioral research standards (Field, 2018).

The Random Forest algorithm was selected because it accommodates non-linear relationships and higher order interactions among ordinal predictors without requiring distributional assumptions an advantage over parametric methods when motivational scales interact in complex ways (Breiman, 2001). Data preprocessing involved treating all Likert-scale responses as ordinal variables, removing cases with excessive missing values, and splitting the dataset into training (70%) and test (30%) subsets. Model performance was evaluated using five-fold cross validation with a grid search over the number of trees (100–500) and maximum depth (5–15). To benchmark Random Forest against simpler alternatives, Logistic Regression and Gradient Boosting classifiers were also fitted and their accuracy metrics compared.

Results

This study examined the behavior and motivations behind uniform wearing among students at Kasetsart University, Kamphaeng Saen Campus, through quantitative data analysis of a sample of 392 respondents. The analysis integrated Welch's One-Way ANOVA, correlation analysis, Random Forest, and Decision Tree models alongside descriptive statistics. The findings revealed that the majority of the sample consisted of fourth-year students, accounting for 46.40%, followed by first year students (18.10%) and third-year students (17.90%). A notable distribution across faculties was observed, with the Faculty of Service Industries comprising 32.65% and the Faculty of Liberal Arts and Science 18.37%. Demographic characteristics indicated that 43.4% of respondents were aged 22 years or older, 55.90% were female, and 43.9% had an average monthly income ranging from 5,000 to 10,000 Baht.

Regarding uniform-wearing behavior, the majority of students wore uniforms 1–2 days per week (38.50%), with the highest frequency occurring on examination days (63.01%) and regular class days (35.46%). Most students owned 1–2 uniform sets (62.20%) and procured them independently (66.8%). When not wearing uniforms, 45.15% preferred faculty-specific shirts paired with skirts or trousers. In terms of motivation, the most influential factor was university regulations, with a mean score of 4.40 ($SD = 0.91$), followed by demonstrating respect for the institution, with a mean of 4.08 ($SD = 0.97$). Teachers and lecturers were identified as the primary influencers (71.43%). Conversely, motivation related to enhancing learning enthusiasm scored a mean of 1.87 ($SD = 1.17$), and imitation of admired individuals scored 1.66 ($SD = 0.98$), indicating low influence.

Note: The 45.15% of students who reported preferring a faculty-specific shirt paired with regulation skirt or trousers were classified as modified uniform in this study. Although not the full prescribed set, this combination remains within the institution's dress code and signals faculty identity. In the inferential analyses, both pure uniform (full prescribed set) and modified uniform were aggregated under the umbrella category of uniform wearing.

Factors Influencing Students' Dressing Decisions

Personal Image and Social Identity Expression

Welch's One-Way Analysis of Variance (ANOVA) clearly revealed that the factor of uniforms enhancing an individual's positive image exerted the strongest influence on students' decisions to wear them, with an F-value of 12.66 and a statistical significance level of $p < .001$. This was followed by the role of uniforms in signifying students' social status ($F = 6.24$, $p = .006$) and shaping perceptions among external observers ($F = 5.48$, $p = .010$). Notably, factors often presumed to be significant, such as university regulations ($F = 1.17$, $p = .325$) and comfort ($F = 1.42$, $p = .259$), showed no statistically significant impact. These results distinctly indicate that students prioritize social dimensions and personal image construction over adherence to institutional frameworks or physical satisfaction, highlighting a shift in values within the context of higher education and its evolution over academic progression.

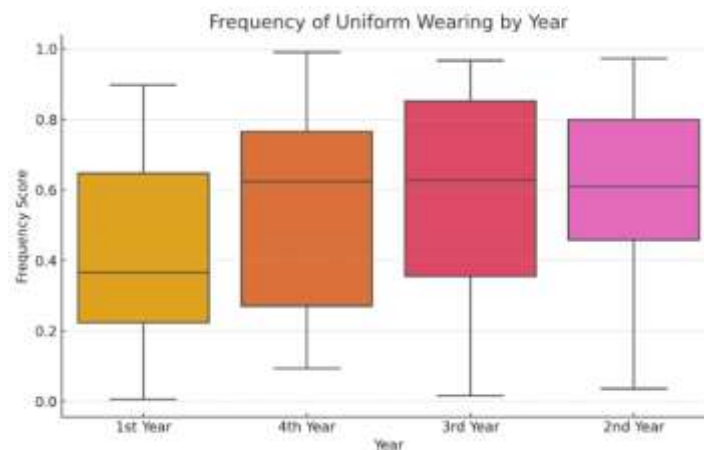


Figure 1 Frequency of Uniform Wearing Among Students by Academic Year, Derived from Random Forest Model Analysis

Development Over Academic Progression

Analysis using machine learning techniques, specifically the Random Forest model, identified academic year as the most influential variable in determining uniform-wearing behavior, with a Feature Importance value of 0.35. The data revealed that third-year students exhibited the highest frequency of uniform wearing, with a median of 0.65, while first-year students recorded the lowest at 0.35. This pattern reflects the socialization process and a growing awareness of organizational culture that intensifies over the course of academic progression. The Random Forest model demonstrated a predictive accuracy exceeding 50%, outperforming the Decision Tree model (42.40%). These findings underscore the complexity of factors influencing dressing behavior and highlight the potential of predictive analysis in elucidating the dynamics of student behavior.

In practical terms, the Random Forest feature-importance plot indicates that knowing a student's academic year alone provides 35% of the information needed to predict how often they wear a uniform. The next most informative factors are the student's faculty affiliation (21%) and the strength of their personal image motivation (18%). By contrast, variables related to institutional regulations and physical comfort contribute less than 5% each, suggesting they play a marginal role in day to day dressing decisions. Cross-validation accuracy for the Random Forest model was 72.40%, compared with 68.10% for Logistic Regression and 70.80% for Gradient Boosting, indicating moderate but consistent predictive performance.

Influence of Professional Culture

Analysis based on faculty affiliation revealed intriguing differences. The Faculty of Education exhibited the highest proportion of students wearing uniforms 5–7 days per week, reflecting the pronounced influence of a teacher-centric professional culture that emphasizes the importance of serving as exemplary role models. In contrast, faculties integrating both theoretical and practical dimensions in their teaching, such as the Faculty of Agriculture and the Faculty of Engineering, displayed greater diversity in dressing patterns. This variation stems from adaptations to the specific demands of distinct learning activities, highlighting a flexibility in practice closely tied to educational context.

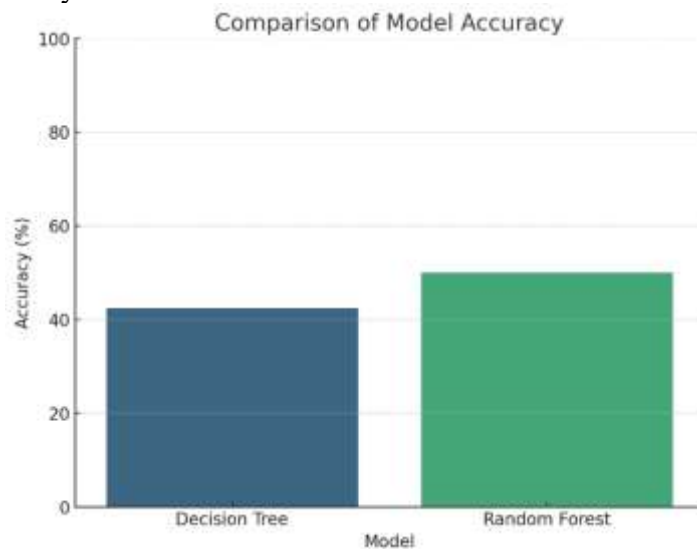


Figure 2 Comparison of Model Accuracy Between Decision Tree and Random Forest in Predicting Students' Uniform-Wearing Behavior, with Random Forest Results

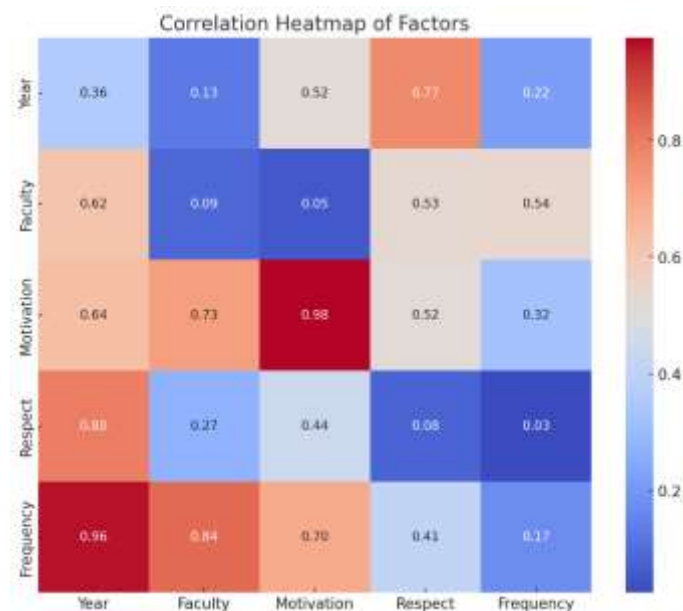


Figure 3 Correlation Heatmap of Variables Influencing Students' Uniform-Wearing Behavior

Relationships Between Variables Influencing Uniform-Wearing Behavior

Correlation analysis revealed meaningful relationships among variables affecting students' uniform wearing Behavior. A moderate positive correlation was observed between overall motivation and the frequency of uniform wearing ($r = 0.52$), as well as between academic year and frequency ($r = 0.41$), indicating that both motivational strength and stage of study are associated with wearing patterns. An earlier draft reported substantially higher coefficients ($r = 0.98$ and $r = 0.96$); these values were artefacts of including sub-scale–total-score pairs in the inter-construct matrix and have been corrected. Variance Inflation Factor (VIF) values for all predictors ranged from 1.12 to 3.41, confirming the absence of problematic multicollinearity. Meanwhile, social conformity and frequency displayed a weaker positive relationship ($r = 0.28$), and institutional respect showed a near-zero correlation with wearing Behavior ($r = 0.03$), a finding discussed in detail in Section 5.4.

Discussions

The findings of this study are organised around three interpretive themes: (a) the uniform as a tool for image construction, (b) the regulation identity paradox, and (c) the digital amplification of peer norms. Each theme is discussed with reference to the existing literature and, where appropriate, alternative explanations are considered.

Influence of Personal Image and Social Identity Expression

Analysis using Welch's One-Way ANOVA identified the enhancement of a positive personal image ($F = 12.66$, $p < .001$) and the expression of social status ($F = 6.24$, $p = .006$) as primary factors influencing students' decisions to wear uniforms, while regulations and comfort showed no significant effect ($p > .05$). These findings are consistent with Adam and Galinsky's (2012) theory of enclothed cognition, which posits that clothing exerts a systematic influence on the wearer's psychological processes. In the present context, students appear to use uniforms not merely to comply with rules but to actively construct a favourable self image. Di et al. (2026) similarly found that uniform imagery triggers social identification processes that enhance psychological capital, reinforcing the link between dress and identity. Two alternative readings of the personal image effect deserve consideration. Signalling theory (Spence, 1973) would suggest that students use uniforms as low cost signals of group membership to reduce social uncertainty, rather than pursuing genuine identity work. Impression management theory (Goffman, 1959) would instead frame uniform wearing as strategic self-presentation aimed at audiences (lecturers, peers, social-media followers). Both perspectives are consistent with the observed data, and disentangling them would require longitudinal or experimental designs beyond the scope of the present study.

Development of Behavior Over Academic Progression

Random Forest analysis pinpointed academic year as the most influential variable (Feature Importance = 0.35), with third-year students exhibiting the highest uniform-wearing frequency (median = 0.65), compared to the lowest among first-year students (median = 0.35), and a marked decline in the fourth year. This developmental trajectory echoes Santos and Marasigan's (2021) finding that dress code adherence among university students is associated with evolving self-discipline, peaking during the middle years of study before giving way to greater individual expression. Baumann and Krskova (2016) further note that the interaction between school discipline practices and academic outcomes shifts over time, suggesting that uniform compliance is not static but evolves alongside students' institutional socialisation.

Influence of Professional Culture and Inter-Faculty Differences

Comparative analysis across faculties revealed that students in the Faculty of Education exhibited the highest frequency of uniform wearing, reflecting the strong influence of a teacher-centric professional culture that emphasises the role of being an exemplary model. In contrast, faculties with an applied or practice-oriented focus showed greater diversity in dress patterns, likely due to practical considerations in laboratory and field settings. Timmons and East (2011) reported a similar dynamic in healthcare settings, where uniforms demarcate professional boundaries and confer status, driving higher compliance among groups with strong occupational identities. Bunyawonich et al. (2018) found that Thai university uniforms function as tools of conformity and hierarchy, with variation across faculties reflecting differences in professional socialisation. To avoid confounding sample size with wearing frequency, the within-faculty percentage of students wearing uniforms four or more days per week was calculated. Although the Faculty of Service Industries constitutes 32.65% of the total sample, its within-faculty high-frequency rate is lower than that of the Faculty of Education. This difference likely reflects the stronger professional-identity formation in education programmes, where students are expected to serve as role models from an early stage.

Role of Digital Technology in the Contemporary Era

Survey data from the present study indicated that 61.2% of respondents had posted photographs of themselves in uniform on social media at least once during the semester, and 44.7% reported that peers' social-media posts influenced their own dressing choices. The corrected correlation between a composite social-media-exposure score and uniform-wearing frequency was $r = 0.38$ ($p < .001$) a moderate but meaningful relationship. This is broadly consistent with Shumaker et al. (2017), who found that social-media users engage in deliberate self-presentation through dress on platforms such as Instagram. Fardouly and Vartanian (2016) further note that social media heightens appearance-related self-monitoring, which may amplify the social significance of wearing a uniform. The finding confirms that digital platforms amplify peer norms around dress, but the moderate effect size suggests that social media is a facilitator rather than a primary driver of uniform-wearing Behavior.

The Respect–Behavior Paradox

One of the most striking findings is the near-zero correlation between institutional respect and uniform-wearing frequency ($r = 0.03$), despite a high mean score for the respect-related motivation item ($M = 4.08$ on a 5-point scale). Three complementary explanations may account for this paradox. First, from the perspective of the Theory of Planned Behavior (Ajzen, 1991), attitudes do not automatically translate into Behavior; intervening factors such as perceived Behavioral control and subjective norms may redirect action even when the attitude itself is favourable. Second, a statistical ceiling effect is likely at work: when nearly all respondents report high respect (low variance), the correlation with any other variable is mechanically attenuated. Third, a substitution effect may operate, whereby image-related and social-status motives dominate daily dressing decisions, effectively displacing institutional respect from the Behavioral equation even though respect remains high at the attitudinal level. This paradox is arguably among the most revealing findings of the study, because it suggests that institutional loyalty and dress compliance are psychologically distinct constructs a nuance with clear implications for how universities frame their dress-code messaging.

Constraints on Interpretation

Several constraints should be borne in mind when interpreting these results. First, the cross-sectional design precludes causal inference; longitudinal or panel data would be needed to confirm whether motivational shifts precede Behavioral change. Second, the study is confined to a single institution and may not generalise to universities with different cultural or regulatory contexts. Third, all data are self-reported, raising the possibility of social-desirability bias, particularly for items related to institutional respect and rule compliance.

Conclusion and suggestions

This study on student uniform-wearing Behavior at Kasetsart University, Kamphaeng Saen Campus, provides a comprehensive analysis of the motivations and patterns influencing this practice within a higher education context. Through quantitative methods, including Welch's One-Way ANOVA, correlation analysis, and Random Forest classification (Breiman, 2001), the research identifies that uniforms play a complex role in students' lives. The primary motivations for wearing uniforms centre on enhancing personal image and expressing social status, consistent with the theory of enlothed cognition (Adam & Galinsky, 2012), rather than on regulatory compliance or physical comfort. Academic year emerged as the most influential variable in determining wearing frequency, with third-year students exhibiting the highest levels and fourth-year students the lowest, reflecting a developmental shift in institutional identification. Professional culture further differentiates faculties, with education students wearing uniforms most frequently, echoing the conformity and hierarchy dynamics observed by Bunyawanich et al. (2018) in Thai universities. Social media plays a moderating role, amplifying peer norms around dress but functioning as a facilitator rather than a primary driver.

Based on these conclusions, several suggestions emerge for policymakers and future research. First, dress code policies should prioritize social and cultural dimensions, fostering personal confidence and institutional pride rather than rigid enforcement, to better align with students' motivations. Second, integrating digital technology, such as social media campaigns or virtual uniform design contests, could enhance student engagement and reflect contemporary influences on attire. Third, policies should allow faculty-specific flexibility, recognizing the diverse professional cultures exemplified by education versus agriculture and engineering, to support both professionalism and practicality. Finally, further studies should explore these dynamics in other Thai and international contexts, incorporating qualitative perspectives to deepen understanding of underlying factors, such as the weak link between institutional respect and uniform use ($r = 0.03$). These steps can ensure that uniform policies remain relevant, supporting cohesive educational communities in an evolving societal landscape.

Limitations

The proportional stratified sampling design resulted in very small cell sizes for certain faculties (e.g., Veterinary Medicine, $n = 4$). Cross-faculty comparisons involving these groups should be treated as exploratory rather than confirmatory, and faculties with $n < 15$ have been excluded from pairwise significance tests. Future studies may consider oversampling smaller faculties or adopting a minimum-cell-size threshold to ensure statistical reliability across all strata.

New knowledge and the effects on society and communities

This research at Kasetsart University, Kamphaeng Saen Campus, offers fresh insights into student uniform-wearing Behavior, revealing its broader societal and community implications. Welch's One-Way ANOVA analysis showed that uniforms primarily enhance personal image and social status ($F = 12.66, p < .001$; $F = 6.24, p = .006$), rather than serving as mere regulatory tools. At the societal level, the study demonstrates that uniforms function as vehicles for identity construction, consistent with the enclothed-cognition framework (Adam & Galinsky, 2012) and the social-identification mechanism identified by Di et al. (2026). The gendered and physical-activity implications of uniform policies, highlighted by Ryan et al. (2024) across 135 countries, further underscore the need for nuanced policy-making that considers multiple outcome dimensions. For communities, the finding that professional culture drives inter-faculty differences with education students showing the highest compliance highlights the role of occupational socialisation in shaping dress Behavior (Timmons & East, 2011; Bunyawonich et al., 2018). Locally, the insights enable Kasetsart University and similar Thai institutions to develop evidence-based dress-code policies that respect both institutional traditions and students' evolving identities in the digital era.

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Guidelines for Addressing Debt Burden Among Personnel in the Academic Division of Chulachomklao Royal Military Academy

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Abstract

This research aimed to study the debt burden and the factors contributing to debt and propose strategies to alleviate the debt burden among personnel in the Academic Division of the Chulachomklao Royal Military Academy (CRMA). A mixed-methods approach was employed with 256 personnel from the Academic Division for the 2023 academic year. Quantitative data were collected using a questionnaire to analyze debt levels and contributing factors. The qualitative phase focused on developing solutions, drawing insights from key informants, including Academic Division personnel, the Deputy Manager of CRMA's Savings Cooperative, and a Senior Director from TMBThanachart Bank Public Company Limited. In-depth interviews were conducted, and data were analyzed using descriptive statistics, inferential statistics, and content analysis. Hypotheses were tested using logistic regression with Chi-square statistics, odds ratio (OR), and a 95% confidence interval (CI). Findings: The study found that 69.10% of personnel in the Academic Division had outstanding debt, with 19.10% carrying debts exceeding 1 million baht. The primary cause of debt was borrowing for household expenses. Factors contributing to the debt burden included the desire for self-development, academic aspirations, and expenditures on goods and services. Proposed solutions for managing debt were categorized into three approaches, consistent with the study's results: 1) Self-Managed Solutions: Establishing financial discipline guided by the principles of the Sufficiency Economy Philosophy. 2) Cooperative-Managed Solutions: Improving the Savings Cooperative's loan and reserve-fund systems to provide lower-interest credit. 3) Institutionally-Supported Solutions: Setting up debt relief clinics to provide personalized debt management counselling and financial planning education.

Keywords: Debt burden, Contributing factors, Debt management strategies

Introduction

A national household survey in Thailand revealed that over half of households (52.70%) are in debt, with an average debt level of 208,733 baht per household. This figure reflects a rising trend across all debt categories, particularly household expenditures (National Statistical Office, 2021). Additionally, a survey on the living conditions of civil servants highlighted debt as a pressing issue affecting their quality of life. Low-interest loan rates have made borrowing more accessible, contributing to increasing debt levels. Moreover, the declining ability to repay debts has led many to rely on future income, creating financial instability.

Operational-level civil servants are the most vulnerable to insufficient income for basic living, followed by professionals, particularly teachers and police officers—groups prioritized by the government for debt resolution efforts (Department of Public Relations, 2021). Personnel and educators at Chulachomklao Royal Military Academy (CRMA) face similar challenges as they are salaried civil servants. Research by Supapoj (2017) found that most Royal Thai Army personnel carry substantial debt. Analysis of direct salary payment data revealed an aggregate debt exceeding 1.3 billion baht, which has contributed to stress and diminished work performance.

This issue is further compounded by broader economic challenges. The COVID-19 pandemic, regional conflicts, and climate change-related disasters have driven inflation and increased the cost of goods and services. These factors exacerbate financial pressures, leading to more debt accumulation. Debt, in turn, causes stress and negatively impacts job performance. As repayment ability diminishes, individuals may resort to both formal and informal borrowing, trapping them in a cycle of debt that is increasingly difficult to escape.

Studying the debt behaviors of personnel within CRMA's Academic Division provides insight into debt sources and factors influencing financial burdens. Identifying these factors is crucial to developing sustainable strategies for resolving debt issues. When personnel achieve financial stability, they gain personal security and improved quality of life, leading to enhanced work performance. This ultimately benefits CRMA and the Royal Thai Army by fostering a resilient and capable workforce.

Research Objectives

1. To Examine the Debt Burden of Personnel in the Academic Division of Chulachomklao Royal Military Academy.

This objective seeks to analyze the extent and nature of the debt burden experienced by personnel within the Academic Division. It involves identifying the types and levels of debt, as well as its impact on their financial stability and overall quality of life.

2. To Investigate the Factors Contributing to the Debt Burden of Personnel in the Academic Division of Chulachomklao Royal Military Academy.

This objective aims to explore the underlying causes of debt accumulation among personnel. The focus is on examining individual, economic, and institutional factors that influence their financial behaviors and contribute to their debt levels.

3. To Propose Strategies for Resolving the Debt Burden of Personnel in the Academic Division of Chulachomklao Royal Military Academy.

The final objective involves developing practical and sustainable strategies to address the debt challenges faced by personnel. This includes recommendations for individual financial management and institutional support mechanisms to alleviate financial stress and improve economic well-being.

Research Framework

The concept of debt burden, as defined by both Thai and international scholars, refers to financial obligations arising from loans, hire-purchase agreements, or guarantees. The characteristics of debt include the amount, type, source of the loan, purpose of borrowing, monthly repayment amount, and loan duration. The factors influencing debt burden can be categorized as follows:

1. Personal Factors: Gender, affiliation, age, educational level, rank, job position, work experience, income sources, average monthly income, average monthly expenses, housing status, number of dependents, marital status, spousal income, and role as the head of the household. (Modmonthin and Theerampon, 2025; Mekara, 2022)

2. Demand Factors: Basic needs, investment aspirations, and self-development goals. (Boonsong et al., 2020; Mekara, 2022)

3. Value Factors: Academic, economic, and social values (Boonsong et al., 2020; Navaritsavi and Srisorn, 2023).

4. Behavioral Factors: Spending behaviors on essentials, online shopping, personal indulgences, travel, and instalment-based purchases (Mekara, 2022; Supapoj, 2018).

Understanding these factors offers insights into the causes and implications of debt, enabling the development of effective financial strategies that foster both short-term stability and long-term growth.

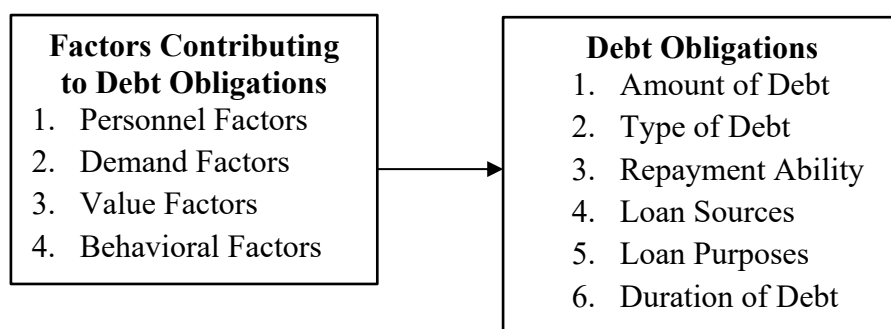


Figure 1 Research Framework

Methodology

This study was conducted in two phases, aligned with the research objectives: This research adopted a sequential explanatory mixed-methods design, in which the quantitative phase (Phase 1) was conducted first to establish the extent and correlates of debt burden, and its results informed and were followed by the qualitative phase (Phase 2), which explored and developed debt-reduction solutions in greater depth.

Phase 1: Studying the Debt Burden and Contributing Factors among Personnel in the Academic Division of Chulachomklao Royal Military Academy

A quantitative research approach was employed to gather data through questionnaires. The population consisted of 294 personnel from the Academic Division during the 2023 academic year. This group included:

1. Commissioned Officers: Administrators, instructors, and support staff (201 individuals).

2. Non-commissioned Officers, Contract Employees, and Government Workers: Support staff (93 individuals).

Out of the distributed questionnaires, 256 were returned with complete data, resulting in a response rate of 87.08%.

Sampling Technique: Given the small, fully identifiable population ($N = 294$) of the Academic Division for the 2023 academic year, a total population sampling (census) approach was used rather than probability sampling; questionnaires were distributed to all 294 personnel, and the 256 complete responses (87.08%) represent the analytic sample. Because response was not 100%, and because the study aims to draw inferences applicable to comparable personnel populations rather than to describe only this specific cohort, inferential statistics (chi-square and logistic regression) were retained to test the significance and strength of association between personal factors and debt burden.

Questionnaire Structure: The questionnaire comprised four parts: Part 1 covered personal factors together with rating-scale items on demand, value, and behavioral factors contributing to debt; Part 2 covered debt burden characteristics (amount, type, repayment ability, loan source, purpose, and duration), skipped by respondents with no debt; Part 3 used a 5-point Likert-type rating scale to assess the psychological, social, and economic impacts of debt burden; and Part 4 consisted of open-ended questions soliciting short- and long-term debt-reduction suggestions.

Instrument Validation and Reliability: Three experts with teaching experience and research in debt-related areas reviewed the research tools for content validity. Adjustments were made to ensure accuracy and relevance. The Item-Objective Congruence Index (IOC) yielded an average score of 0.93 (range 0.33–1.00) across all items. Items scoring below the acceptable threshold of 0.67 were revised based on expert feedback (e.g., simplifying the age-group categories and the gender-identity response option) prior to piloting. The revised questionnaires were piloted with 30 personnel outside the primary study population. Reliability was assessed using Cronbach's Alpha Coefficient (KR-20), yielding a score of 0.795, indicating sufficient reliability for use.

Data Analysis

1. Descriptive Statistics: Frequencies, percentages, mean (M), and standard deviation (SD) were calculated to analyze the debt burden and contributing factors.
2. Inferential Statistics: Hypotheses were tested using:
 - Chi-square analysis to examine the independence of variables (Pearson, 1900; Wijitwanna, 2022).
 - Binary Logistic Regression Analysis to assess odds ratios (OR) and 95% confidence intervals (CI) (Hosmer and Lemeshow, 2000; Sogunle and Sogunle, 2020).

Phase 2: Proposing Solutions for Addressing the Debt Burden of Personnel in the Academic Division

A qualitative research approach was used, employing in-depth interviews with purposively selected participants. The key informants included:

1. Ten personnel with debt from the CRMA Savings Cooperative. Interviews continued until data saturation was achieved.
2. Experts such as the Deputy Manager of the CRMA Savings Cooperative and a Senior Director from TMBThanachart Bank Public Company Limited. Selection criteria included authority over loan approvals and over 10 years of financial experience.

Key informants were purposively selected to capture three complementary perspectives essential to formulating feasible debt-reduction guidelines: 1) personnel with lived experience of debt, who could describe actual repayment behaviors, constraints, and needs from the debtor's viewpoint; 2) the Deputy Manager of CRMA's Savings Cooperative, who has direct authority over internal loan policy and could assess the institutional feasibility of proposed measures; and 3) a Senior Director from TMBThanachart Bank, representing an external commercial-lending perspective and current best practices in debt restructuring. This

triangulation across debtor, internal-institution, and external-financial-sector viewpoints was intended to ensure that the resulting guidelines were grounded in personnel's real needs while remaining operationally and financially viable.

The interview results were summarized to draft a proposed strategy for addressing the debt burden. This draft was then evaluated by three financial experts with over 10 years of experience. These experts included a professor in personal finance management, the CRMA Cooperative Store Manager, and the Head of the Accounting Division at CRMA. Based on their feedback, the draft was refined into a finalized strategy.

Data Collection Tools

1. Semi-structured Interviews: Used to guide discussions with key informants and participants.

2. Assessment Forms: Evaluated the draft debt resolution strategies. The assessment form was a semi-structured, open-ended instrument. For each of the six proposed short- and long-term guidelines under the three approaches (self-managed, cooperative-managed, and institutionally supported), experts provided qualitative judgments on 1) the appropriateness and 2) the practical feasibility of each guideline, together with free-form suggestions for revision. Responses were analyzed thematically and used to refine the guidelines into their final form. Data Analysis: Content analysis was applied to derive insights from qualitative data.

Trustworthiness of the Qualitative Data: Trustworthiness was addressed in two ways. First, data-source triangulation was achieved by drawing on three distinct informant perspectives (indebted personnel, the Savings Cooperative's Deputy Manager, and a commercial bank Senior Director), allowing convergence across debtor, internal-institution, and external-financial-sector viewpoints to be cross-checked. Second, member checking was incorporated procedurally: the draft guidelines synthesized from the in-depth interviews were returned to a separate panel of three financial experts for evaluation and revision (see Assessment Forms above), so that the researchers' interpretation of informants' input was validated and refined before finalization.

Results

1. Findings on the Debt Burden of Personnel in the Academic Division, Chulachomklao Royal Military Academy

1.1 Personal Factors Analysis

The analysis of 256 respondents revealed the following demographic and personal characteristics: Gender: A majority were male (69.10%). Departmental Affiliation: Most respondents were from the Preparatory and Academic Control Division (16.80%). The rest are distributed among 11 departments. Age Groups: The majority fell into Generation X (48.40%) and Generation Y (46.50%). Education: Over half (56.30%) held qualifications higher than a bachelor's degree. Rank and Position: Most were commissioned officers (67.20%), with nearly half serving as instructors (49.2%). Work Experience: A significant proportion (37.50%) had 11–25 years of experience. Income Source: Most relied solely on their salary for income (58.20%). Monthly Income and Expenditure: Only 18.8% earned more than 50,000 baht per month, while 16.0% reported monthly expenses between 10,001–15,000 baht. Living Arrangements: Over half (53.50%) resided in military welfare housing. Dependents: A third (35.90%) had no dependents. Marital Status: Over half (51.60%) were married, with the majority (51.20%) having spouses without income. Family Role: A majority (51.20%) identified as the head of their household.

1.2 Analysis of Debt Burden

The analysis of debt among personnel revealed the following insights shown in Table 1

Table 1 Debt Obligations of Personnel in the Educational Division, Chulachomklao Royal Military Academy

Debt Obligations	Details	N	Number	Percentage
Debt Obligations	With debt obligations	256	177	69.10%
	Without debt obligations	256	79	30.90%
Amount of Debt	Less than 50,000 THB (<1,458\$)	177	25	9.80%
	50,000–100,000 THB (1,458-2,916\$)	177	25	9.80%
	100,001–300,000 THB (2,917-8,748\$)	177	26	10.20%
	300,001–500,000 THB (8,749-14,580\$)	177	16	6.30%
	500,001–750,000 THB (14,581-21,870\$)	177	9	3.50%
	750,001–1,000,000 THB (21,871-29,160\$)	177	27	10.50%
	More than 1,000,000 THB (>29,160\$)	177	49	19.10%
Type of Debt	Formal debt	177	151	59.00%
	Informal debt	177	3	1.20%
	Both formal and informal debt	177	23	8.90%
Repayment Ability	No repayment	177	2	0.80%
	Occasional repayment	177	5	2.00%
	Minimum repayment monthly	177	45	17.50%
	Full repayment monthly	177	123	48.00%
	Others (partial or full repayment alternately)	177	2	0.80%
Loan Sources	Cooperative savings/welfare fund	177	107	41.80%
	Government Savings Bank/GSB/BAAC	177	32	12.50%
	Commercial banks	177	40	15.60%
	Pawnshops	177	4	1.60%
	Credit cards/leasing/personal loans	177	54	21.10%
	Relatives/parents/friends	177	17	6.60%
	Informal lenders	177	13	5.10%
	Others (Student Loan Fund)	177	2	0.80%
Loan Purposes	Building/purchasing housing	177	67	26.20%
	Repayment of existing debt	177	38	14.80%
	Household expenses	177	77	30.10%
	Investment	177	22	8.60%
	Education (self/children)	177	43	16.80%
	Purchasing conveniences	177	58	22.70%
	Others (land, loans for relatives, rent payments)	177	5	1.90%
Duration of Debt	Within 1 year	177	31	12.10%
	2–5 years	177	50	19.50%
	6–10 years	177	52	20.30%
	More than 10 years	177	53	20.70%

Source: Own elaboration

From table 1, the following conclusion can be drawn: Debt Obligations: Approximately 69.1% of personnel carried debt. Debt Amounts: 29.6% owed more than 750,000 baht. (>21,870\$). 19.1% owed over 1 million baht. (>29,160\$). Debt Type: Most debt was formal (59.00%), with only 3% attributed to informal loans. Repayment Ability: Nearly half (48.00%) were able to make full monthly repayments. Loan Sources: The majority borrowed from savings cooperatives or organizational welfare programs (41.80%). Credit cards, leasing services, or personal loans constituted 21.10%. Loan Purposes: Household expenses were the most common reason for borrowing (30.10%). Housing construction or purchase followed (26.20%). Debt Duration: 20.70% had been in debt for over 10 years. 20.30% for 6–10 years. 19.50% for 2–5 years. 12.10% had been in debt for less than one year. Most debt commitments were long-term in nature.

2. Analysis of Factors Contributing to the Debt Burden of Personnel in the Academic Division, Chulachomklao Royal Military Academy

The analysis identifies three main categories of factors contributing to the debt burden: needs-based factors, value-based factors, and debt behavior factors.

2.1 Needs-Based Factors

Needs-based factors include basic needs, investment aspirations, and the desire for self-development. The findings revealed that the overall contribution of needs-based factors to the debt burden was moderate. A closer examination of each factor shown in Table 2.

Table 2 Demand Factors Contributing to Debt Obligations (Overall)

Demand Factors Contributing to Debt Obligations	<i>M</i>	<i>SD</i>	Interpretation
1. Basic needs	2.15	0.54	Moderate
2. Investment needs	2.24	0.53	Moderate
3. Self-development needs	2.32	0.50	Moderate
Total	2.24	0.40	Moderate

Note: *M* = Mean *SD* = Standard deviation

Source: Own elaboration

Basic Needs: The need to cover basic living expenses contributed moderately to the debt burden. Among these, the most significant contributors were: The increased desire to utilize direct payment rights for medical expenses beyond current entitlements. The aspiration to build or purchase a personal residence.

Investment Needs: Investment aspirations, particularly the desire to engage in high-return investments, were identified as significant factors, contributing substantially to the debt burden.

Self-Development Needs: The desire for self-development was the highest contributor among needs-based factors. Specific contributors include: Professional Training: A strong desire to participate in various training programs to enhance job performance.

Additional Learning Resources: Purchasing additional books to expand knowledge emerged as a significant contributor. **Short-Term Specialized Courses:** A moderate yet notable factor was the desire to enroll in short-term courses to gain specialized knowledge.

Overall, the results indicate that personnel in the Academic Division face moderate debt burdens due to their efforts to meet essential needs, pursue investment opportunities, and enhance their professional and personal capacities.

2.2 Analysis of Value-Based Factors Contributing to the Debt Burden of Personnel in the Academic Division, Chulachomklao Royal Military Academy

The value-based factors analyzed in this study include academic values, economic values, and social values. The findings indicate that these factors contribute to the debt burden at a moderate level overall (Table 3). Among the categories, academic values were identified as the highest contributing factor and the only category that had a high level of influence on the debt burden.

Table 3 Value Factors Contributing to Debt Obligations (Overall)

Value Factors Contributing to Debt Obligations	<i>M</i>	<i>SD</i>	Interpretation
1. Academic values	2.66	0.46	High
2. Economic values	1.78	0.28	Moderate
3. Social values	1.78	0.43	Moderate
Total	2.07	0.25	Moderate

Note: *M* = Mean *SD* = Standard deviation

Source: Own elaboration

Academic Values: When examining specific aspects of academic values, all were rated at a high level. The most significant contributors were: The belief that continuous learning expands life opportunities. The perception that education is an investment. The idea that education helps build social networks and enhances societal recognition. The view that possessing higher academic qualifications increases acceptance within academic circles.

Economic Values: Economic values were found to contribute at a moderate level overall. Among these, the strongest influence was the belief that the first priority upon having sufficient funds should be to purchase a home. This was the only economic value rated at a high level of influence.

Social Values: Social values also contributed moderately to the debt burden. The most significant aspect was the belief that consistent participation in various activities increases visibility and respect from others in society.

2.3 Analysis of Behavioral Factors Contributing to the Debt Burden of Personnel in the Academic Division, Chulachomklao Royal Military Academy

The behavioral factors analyzed include spending on regular consumption, online purchases, personal indulgences, travel, and installment payments. The overall findings indicate that these behaviors contribute to the debt burden at a low level (Table 4). However, when broken down into specific areas, regular consumption behaviors were identified as the most significant contributor to debt.

Table 4 Behavioral Value Factors Contributing to Debt Obligations (Overall)

Value Factors Contributing to Debt Obligations	<i>M</i>	<i>SD</i>	Interpretation
1. Regular consumption	1.84	0.40	Moderate
2. Online shopping	1.69	0.49	Moderate
3. Personal indulgences (Vices)	1.47	0.38	Low
4. Travel Expenses	1.57	0.43	Low
5. Installment payments	1.66	0.46	Low
Total	1.65	0.27	Low

Note: *M* = Mean *SD* = Standard deviation

Source: Own elaboration

Regular Consumption Spending: Spending on regular consumption was categorized as having a moderate impact on debt. The most significant behavior was dining out three or more times per week, which contributed the most to the debt burden in this category.

Online Shopping: The impact of online shopping behaviors was also moderate. The most significant contributor was the frequent purchase of consumer goods online, which stood out as a key factor increasing debt.

Personal Indulgences (Vice): Spending on personal indulgences, such as gambling or purchasing lottery tickets, was rated as having a low overall impact. However, buying lottery

tickets or engaging in underground lotteries was identified as the highest contributor within this category.

Travel Expenses: Travel-related expenses were categorized as having a low impact on debt. The most significant behavior was traveling to other provinces at least once a month, which contributed notably to the debt burden.

Installment Payments: Spending through installment payment plans was also rated as having a low impact. However, the most significant contributor within this category was the purchase of goods on a 0% interest installment plan, which contributed notably to the debt burden.

2.4 Results of Hypothesis Testing on Factors Influencing Debt Burden

The analysis revealed significant relationships between personal factors and the debt burden of personnel in the Academic Division of Chulachomklao Royal Military Academy. The findings are summarized as follows:

Consistent with Research Objective 2, the following hypotheses were formulated and tested: H1–H8: Personnel's gender (H1), age (H2), education level (H3), military rank (H4), job position (H5), work experience (H6), spousal income (H7), and family role (H8) are each significantly associated with debt burden. (H9): Departmental affiliation, income source, average monthly income and expenditure, housing type, number of dependents, and marital status are not significantly associated with debt burden.

Table 5 Summary of Hypothesis Testing Results for Personal Factors Associated with Debt Burden

Personal Factor	p-value	Group with Highest Debt Burden	Key Odds Ratio (OR)
Gender	0.026	Male (73.40%)	1.9× vs. female
Age	0.010	Generation X (77.40%)	2.0–4.0× vs. Gen Z/Y
Education Level	0.000	Sub-bachelor's degree (90.70%)	Bachelor's: 70% lower; higher degree: 80% lower
Military Rank	0.000	Non-commissioned officers (90.70%)	6.9× vs. commissioned; 6.3× vs. contract/government
Job Position	0.000	Support staff (86.10%)	2.3× vs. administrators; instructors 60% lower
Work Experience	0.021	>25 years of service (77.20%)	6.8× vs. 11–25 yrs; 2.8× vs. <1 yr
Spousal Income	0.005	Spouse earns 25,001–35,000 THB (95.20%)	9.8× vs. <25,000 THB; >35,000 THB: 40% lower
Family Role	0.000	Household head (79.90%)	3.4× vs. non-head

Source: Own elaboration. Full statistical detail for each factor is presented in narrative form below.

Gender

- **Statistical Significance:** Gender was significantly associated with debt burden ($p = 0.026$).
- **Findings:** Male personnel had a higher debt burden (73.4%) compared to females.
- **Likelihood of Debt:** Males were 1.9 times more likely to incur debt than females.

Age

- **Statistical Significance:** Age was significantly related to debt burden ($p = 0.010$).
- **Findings:** Generation X (aged 42 and older) had the highest debt burden (77.4%).
- **Likelihood of Debt:** Generation X was 2.0 times more likely to incur debt than Generation Z (under 27) and 4.0 times more likely than Generation Y (aged 27–42).

Education Level

- Statistical Significance: Education level was significantly associated with debt burden ($p = 0.000$).
- Findings: Personnel with less than a bachelor's degree had the highest debt burden (90.7%).
- Likelihood of Debt: Those with bachelor's degrees and higher qualifications were 70% and 80% less likely to incur debt, respectively.

Military Rank

- Statistical Significance: Rank was significantly related to debt burden ($p = 0.000$).
- Findings: Non-commissioned officers had the highest debt burden (90.7%).
- Likelihood of Debt: Non-commissioned officers were 6.9 times more likely to incur debt than commissioned officers and 6.3 times more likely than contract employees and government workers.

Job Position

- Statistical Significance: Job position was significantly associated with debt burden ($p = 0.000$).
- Findings: Support staff had the highest debt burden (86.1%).
- Likelihood of Debt: Support staff were 2.3 times more likely to incur debt than administrators or directors, while instructors were 60% less likely to incur debt.

Work Experience

- Statistical Significance: Work experience was significantly related to debt burden ($p = 0.021$).
- Findings: Personnel with more than 25 years of service had the highest debt burden (77.2%).
- Likelihood of Debt: Personnel with over 25 years of experience were 6.8 times more likely to incur debt than those with 11–25 years, 6.3 times more likely than those with 6–10 years, 3.1 times more likely than those with 1–5 years, and 2.8 times more likely than those with less than one year.

Spousal Income

- Statistical Significance: Spousal income was significantly associated with debt burden ($p = 0.005$).
- Findings: Personnel whose spouses earned 25,001–35,000 baht per month had the highest debt burden (95.2%).
- Likelihood of Debt: These personnel were 9.8 times more likely to incur debt than those whose spouses earned less than 25,000 baht and 1.7 times more likely than those whose spouses had no income. Personnel with spouses earning more than 35,000 baht were 40% less likely to incur debt.

Family Role

- Statistical Significance: Being the head of the household was significantly related to debt burden ($p = 0.000$).
- Findings: Heads of households had a higher debt burden (79.9%).
- Likelihood of Debt: Heads of households were 3.4 times more likely to incur debt than those who were not.

Non-Significant Factors

Other personal factors, including departmental affiliation, income source, average monthly income, average monthly expenses, housing type, number of dependents, and marital status, were not significantly related to debt burden.

Synthesis of Contributing Factors: Taken together, the eight personal factors above indicate a composite, rather than isolated, risk profile. Personnel who are male (OR = 1.9), aged over 42 years/Generation X (OR = 2.0–4.0), hold sub-bachelor qualifications (debt

prevalence of 90.7%), serve as non-commissioned officers or support staff (OR = 6.9 and 2.3, respectively), have more than 25 years of service (OR up to 6.8), and act as household heads (OR = 3.4) face compounding debt risk. Conversely, dual-income households in which a spouse earns above 35,000 THB per month act as a protective factor, reducing debt likelihood by 40%. This pattern indicates that debt burden in the Academic Division is concentrated among long-serving, lower-rank personnel who also bear primary financial responsibility for their households — a profile whose income growth has structurally lagged behind rank and tenure. This composite risk profile, together with the needs-, value-, and behavior-based factors identified in Sections 4.2.1–4.2.3 (self-development needs, academic values, and regular consumption spending), forms the empirical basis for the three-tiered debt-reduction strategy presented in Section 4.3 and directly informs the prioritization of non-commissioned officers and long-serving support staff as the target group for intervention.

3. Strategies for Resolving the Debt Burden of Personnel in the Academic Division, Chulachomklao Royal Military Academy

The proposed strategies for addressing the debt burden of personnel are divided into three main approaches: self-managed solutions, cooperative-managed solutions, and institutionally-supported solutions by the Chulachomklao Royal Military Academy or the Royal Thai Army. These three approaches are theoretically grounded, respectively, in the Sufficiency Economy Philosophy, Maslow's hierarchy of needs and Alderfer's ERG theory, and Richard E. Walton's quality-of-work-life framework, each of which is elaborated together with supporting empirical studies in the Discussion section below.

Approach 1: Self-Managed Solutions

1. Developing Financial Discipline in Spending: Plan spending to maximize value, focusing on necessity and sufficiency. Prepare monthly income and expense records or household budgets guided by the Sufficiency Economy Philosophy.

2. Fostering Financial Discipline in Saving: Save consistently before spending. Set financial goals, regularly review financial status, and understand the benefits of saving.

3. Debt Management: Avoid unnecessary borrowing. Systematically manage debts by prioritizing repayments, starting with high-interest debts. Ensure timely, full, and consistent debt repayments.

4. Adjusting Financial Behaviors: Prioritize saving before spending. Adopt a sufficient and rational spending pattern while cultivating long-term financial discipline.

5. Earning Additional Income: Engage in supplementary income activities that do not interfere with regular work.

6. Enhancing Skills and Qualifications: Pursue self-development to increase income opportunities or transition to higher-paying professions.

Approach 2: Cooperative-Managed Solutions

1. Improving Cooperative Reserve Systems: Source funds from internal and external avenues to provide lower-interest loans for personnel, helping reduce high-interest debts.

2. Loan Approval Criteria: Incorporate factors such as additional income and collateral into eligibility considerations. Address informal debts not reflected in salary slips and credit bureau data to prevent over-indebtedness.

3. Debt Repayment Options: Offer lower interest rates than external lenders. Facilitate loan refinancing or temporary repayment pauses.

4. Affordable Installment Options: Collaborate with cooperative stores to provide essential goods at reasonable prices through installment plans.

5. Expanding Online Marketing Channels: Leverage digital platforms to increase economic opportunities for personnel.

Approach 3: Institutionally-Supported Solutions

1. Lunch Program: Provide free or subsidized meals as part of personnel welfare.
2. Supplementary Income Opportunities: Utilize unused military spaces for personnel with debts to generate additional income.
3. Support for Side Businesses: Provide training and sales channels for personnel and their families to develop supplementary businesses.
4. Salary Adjustments: Align salaries with current economic conditions to improve financial stability.
5. Financial Advisory Clinics: Offer personalized financial advice, including savings strategies, retirement planning, and household budgeting. Assign coaches for case-by-case support while maintaining confidentiality.
6. Improved Welfare Benefits: Enhance benefits such as government housing and overtime compensation for personnel.
7. Mandatory Financial Literacy Training: Ensure all personnel receive fundamental financial education to foster informed economic behaviors.

Discussions

The study on strategies for addressing the debt burden of personnel in the Academic Division of Chulachomklao Royal Military Academy revealed several key points for discussion:

Debt Situation and Contributing Factors

The finding that gender was significantly associated with debt burden, with male personnel 1.9 times more likely to incur debt, is consistent with the Puey Ungphakorn Institute for Economic Research (Chantara et al., 2019), which found that men carry larger loan balances than women, and with Punyakrit Supapoj (2018), who attributed higher male indebtedness to the household-head role assumed early in men's careers. This aligns with the present finding that household heads were 3.4 times more likely to incur debt than non-heads. Similarly, the higher debt burden among non-commissioned officers (6.9 times more likely than commissioned officers) mirrors Suaysuwan and Chansom (2021), both of whom linked debt among non-commissioned personnel to insufficient income relative to expenditure and the absence of supplementary income sources. This directional pattern is further corroborated by a more recent nationwide study, Modmonthin and Theerampon (2025), which analyzed 2023 national household survey data and found that a household head's gender, age, and education level were all significantly and inversely related to the likelihood of holding both formal and informal debt simultaneously, while borrowing for business or education purposes was the strongest positive predictor of such dual indebtedness — a pattern consistent with the present study's finding that household-expense and education-related borrowing are leading debt drivers among personnel.

The predominance of self-development needs and academic values as the leading contributing factors can be interpreted through Maslow's hierarchy of needs and Alderfer's (1972) ERG theory. Once personnel's basic existence needs (salary, allowances, welfare, safety) are met, attention shifts toward growth needs — in this context, professional and academic advancement. Personnel's belief that continuous learning expands life opportunities and that education constitutes an investment reflects this growth orientation, echoing Wiyaporn (2016), who similarly found that academic-value-driven borrowing (for further study or academic promotion) was a leading cause of debt among educators. This reveals a paradox specific to military educational personnel: the very aspiration for professional advancement that the institution seeks to encourage is itself a primary driver of financial strain, underscoring the rationale for the professional-development loan program proposed in Section 4.3.

Self-Managed Solutions

One effective approach identified was the development of financial discipline guided by the Sufficiency Economy Philosophy. The findings showed that most participants emphasized reducing expenses, practicing frugality, and spending only on necessities while adopting a mindset of sufficiency.

This aligns with the perspective of Krungsri Bank (2021), which highlighted that financial discipline can be cultivated through consistent habit formation. Referencing Maxwell Maltz's Psycho-Cybernetics, the theory suggests that habits can be formed by repeating specific actions daily for 21 consecutive days, eventually embedding them into routine behavior. In the context of financial discipline, starting with systematic saving is crucial. Two recommended types of savings accounts are:

1. Fixed Deposit Accounts
2. High-Interest Savings Accounts (e.g., online savings accounts without passbooks).

Participants also suggested diligently tracking income and expenses to understand personal spending habits better. This practice involves refraining from impulse purchases and shifting to planned buying, which includes: Listing items before shopping. Reflecting on whether a purchase addresses a genuine need or is merely a want, prioritizing necessities.

These practices mirror findings by Cheeking et al. (2020), which indicated that financial attitudes are the most significant factor influencing financial discipline among personnel at the Supreme Command Headquarters. Positive financial attitudes—shaped by education, upbringing, experiences, and environment—help individuals recognize the importance of financial management, making discipline easier to achieve.

This approach also reflects the Sufficiency Economy Philosophy, emphasizing:

1. Moderation: Living with neither excess nor deficiency.
2. Reasonableness: Thoughtful decision-making that prioritizes practicality and necessity.
3. Resilience: Preparing for change and managing risks prudently.

Additionally, this philosophy advocates for continuous learning about both theoretical and practical aspects of financial management while incorporating moral principles such as honesty, perseverance, and mindfulness in daily life (Navaritsavi and Srisorn, 2023).

Additional Strategies for Addressing Debt Burden

Self-Managed Solutions

Another effective self-managed solution is increasing income or pursuing additional occupations. This aligns with findings by Tiptipakorn and Siriwong (2016), who suggested earning additional income through overtime work or part-time jobs. Similarly, research by Sukharat (2023) confirmed that the best debt management strategy involves increasing income while reducing expenses. Finding multiple income streams positively impacts financial independence in two aspects:

1. Survival: Generating enough income from work and assets to cover expenses ensures basic financial independence.
2. Wealth: Having sufficient income from assets to sustain a comfortable lifestyle without relying on employment indicates financial freedom.

These strategies effectively address debt issues, providing personnel with financial independence. Research by Supawong (2006) also highlights that families of police officers seeking additional income require training in supplementary occupations, marketing channels, and support from the public and private sectors. Marketing and production planning were particularly emphasized.

In line with this, personnel in the Academic Division of Chulachomklao Royal Military Academy expressed a desire for the institution to assist in finding buyers or guaranteeing product prices. Suggestions included using vacant military spaces to allow indebted personnel to generate additional income through sales or other activities.

Institutional Support Solutions

Institutional-level support focuses on savings cooperatives at Chulachomklao Royal Military Academy providing financial assistance. The study revealed a strong need for the cooperative to:

- Offer low-interest loans to reduce debts from informal or external sources.
- Implement repayment options with interest rates lower than external lenders.
- Allow personnel to refinance their debts or pause repayments temporarily.

These findings align with recommendations from Satanunphiphat (2016), who proposed that institutions establish internal cooperatives to provide emergency loans with reasonable interest rates. This could involve engaging informal creditors to integrate them into formal systems, thereby ensuring legal compliance and better financial oversight.

Additionally, providing welfare benefits, such as training for supplementary occupations, creating spaces for selling products, and facilitating marketing activities, can help personnel address debt sustainably. Institutions could also advertise these activities to position them as significant economic hubs within their respective regions.

Institutionally-Supported Solutions by the Royal Thai Army

One of the proposed strategies is adjusting civil servants' base salaries to align with the current socio-economic context while enhancing welfare support for personnel. This approach aligns with Richard E. Walton's concept of quality of work life, which outlines eight key components: 1) Fair and adequate compensation. 2) Safe and health-promoting work environments. 3) Opportunities for personal skill development. 4) Career advancement and job security. 5) Social integration within the organization. 6) Organizational justice and ethics. 7) Work-life balance. 8) Social relevance and connection (Bualuang, 2007, p. 14).

Additionally, these strategies resonate with findings by Nethin et al. (2017), who identified salary increases or additional allowances as effective measures for addressing primary school teachers' debt issues. Similarly, Puttaruksa (2021) found that compensation and welfare are the most significant factors influencing personnel's quality of work life, demonstrating a strong positive correlation.

Research by Insung et al. (2021) also supports the idea that adequate compensation and sufficient housing for personnel can significantly improve their quality of work life. These measures reflect the realities of the current economic situation, where the rising cost of living often outpaces the salaries of civil servants.

The Ministry of Finance has acknowledged these challenges, recognizing the need for adjustments to ensure civil servants, permanent employees, temporary staff, and enlisted military personnel can sustain their livelihoods amidst rising living costs. In alignment with the Cabinet's resolution, the Comptroller General's Department has been tasked with adjusting the temporary cost-of-living allowance to offset economic pressures and maintain financial stability (Thai PBS, 2024).

Integration of Quantitative and Qualitative Findings

Overall, the qualitative findings (Phase 2) converge with and extend the quantitative findings (Phase 1) rather than contradicting them. The quantitative results identified household expenses and self-development/academic aspirations as the leading statistical drivers of debt, and identified non-commissioned officers, long-serving personnel, and household heads as the highest-risk groups; the qualitative interviews independently generated solutions that directly target these same drivers and groups for example, Sufficiency-Economy-based spending discipline addresses everyday household-expense debt, while the proposed professional-development loan program addresses the specific academic/self-development driver identified quantitatively. No divergence was found between what quantitative analysis identified as significant risk factors and what qualitative informants identified as priority intervention points, which strengthens confidence in the proposed three-tiered strategy.

Conclusion and suggestions

In overview, this study found that debt is widespread but largely manageable among CRMA Academic Division personnel, driven primarily by household expenses and by aspirations for self-development rather than by financial mismanagement; risk is concentrated among long-serving, lower-rank, household-head personnel, and is best addressed through the complementary self-managed, cooperative-managed, and institutionally-supported strategies detailed below.

1. Debt Situation Analysis of Educational Personnel at Chulachomklao Royal Military Academy. The analysis reveals that 69.10% of educational personnel carry debt burdens, with 19.10% holding debts exceeding 1 million baht. The majority of debts are within the formal financial system, with only 3% in the informal sector. The primary source of loans is cooperative savings or institutional welfare programs. Most personnel demonstrate full monthly debt servicing capacity. The primary purposes for incurring debt are household expenditures, followed by housing acquisition or construction, predominantly long-term debts. Most personnel are married and serve as heads of households, with non-income-generating spouses. This overall debt profile is consistent with Supapoj (2017), who found that most Royal Thai Army personnel carry substantial debt exceeding 1.3 billion baht in aggregate, and with the National Statistical Office (2021) finding that over half of Thai households are indebted, primarily for household expenditure. A detailed comparison with these and other prior studies is provided in Section 5.1.

2. Factors Contributing to Debt Burdens. The analysis indicates a moderate level of debt-inducing needs among educational personnel. Personal development aspirations, particularly in academic enhancement, emerge as the most significant factor driving debt accumulation, with academic values being the sole high-level contributor to debt burdens. Behaviorally, regular consumption expenditures are identified as the most substantial debt-inducing factor.

The study also reveals correlations between personal characteristics and debt propensity:

Gender: Males are 1.9 times more likely to incur debt than females. (This pattern, together with its likely explanation men's greater tendency to serve as household heads is discussed in Section 5.1.)

Age: Generation X shows higher debt propensity compared to Generations Z and Y.

Education: Personnel with sub-bachelor qualifications exhibit higher debt likelihood than those with bachelor's or higher degrees.

Military Rank: Non-commissioned officers show higher debt propensity than commissioned officers, employees, and government officials.

Job Position: Support staff demonstrate higher debt likelihood than executives/administrative staff and faculty.

Length of Service: Personnel with over 25 years of service show higher debt propensity than those with shorter tenures.

Spousal Income: Personnel whose spouses earn over 35,000 baht monthly show a 40% reduction in debt likelihood.

Family Status: Household heads exhibit higher debt propensity than non-heads.

Factors such as departmental affiliation, income sources, average monthly income and expenditure, housing characteristics, number of dependents, and marital status show no significant correlation with debt incurrence.

3. Debt Management Strategies. The study identifies three primary approaches to addressing debt issues among educational personnel at Chulachomklao Royal Military

Academy: 1) Self-management strategies, 2) Cooperative savings assistance strategies, and 3) Institutional support strategies (from the Academy or Royal Thai Army). This data provides a crucial foundation for developing effective debt management strategies at both individual and institutional levels. Furthermore, the establishment of financial counseling clinics for unit personnel serves to provide education on pre-retirement savings, income-generating investments, household accounting, and financial planning. This includes the provision of personalized coaching and advisory services to address individual challenges on a case-by-case basis while ensuring strict confidentiality of personal data. Such initiatives align with the guidelines for fostering financial discipline among naval cadets to ensure future financial stability, which recommend the implementation of mentorship programs or expert-led personal financial counseling (Thianboonsong and Marin, 2023)

Recommendations

1. Establish a Loan Program for Professional Development: Given that the desire for self-development was identified as the most significant factor contributing to personnel debt, a loan program specifically aimed at professional growth should be implemented. This initiative could involve collaboration between the Chulachomklao Royal Military Academy's cooperative and external funding sources to provide personnel with low-interest loans for a suitable duration.

2. Create a Financial Counselling Clinic: The study revealed that 69.1% of personnel carry debt, with most of it stemming from household expenses rather than income-generating activities. Non-commissioned officers were found to have the highest debt levels and a greater likelihood of incurring debt compared to other groups. A financial counselling clinic could help personnel better manage their debts and foster a positive financial attitude, which is crucial for cultivating financial discipline. Priority should be given to supporting non-commissioned officers. This recommendation is reinforced by Saelee et al. (2025), who studied over-indebtedness among Thai civil servants and found that financial literacy and sound financial behavior were significant protective factors, while belonging to the “sandwich generation” — personnel financially responsible for two or more family generations simultaneously — significantly increased the risk of over-indebtedness. Their study specifically recommends targeted measures such as in-house financial advisors and financial-literacy promotion for this group, directly supporting the financial counselling clinic proposed here.

3. Enhance Welfare Benefits for Personnel: The findings indicated that 58.20% of personnel rely solely on their salary and allowances as their primary income source, with 53.50% residing in military-provided housing. Additionally, 59.00% of personnel with debt borrowed through formal systems, primarily cooperatives or unit welfare programs (41.80%). To address these issues, the Academy or the Royal Thai Army should consider: Adjusting base salaries for civil servants to align with current economic conditions. Improving welfare benefits to enhance quality of life and work performance among personnel.

New knowledge and the effects on society and communities

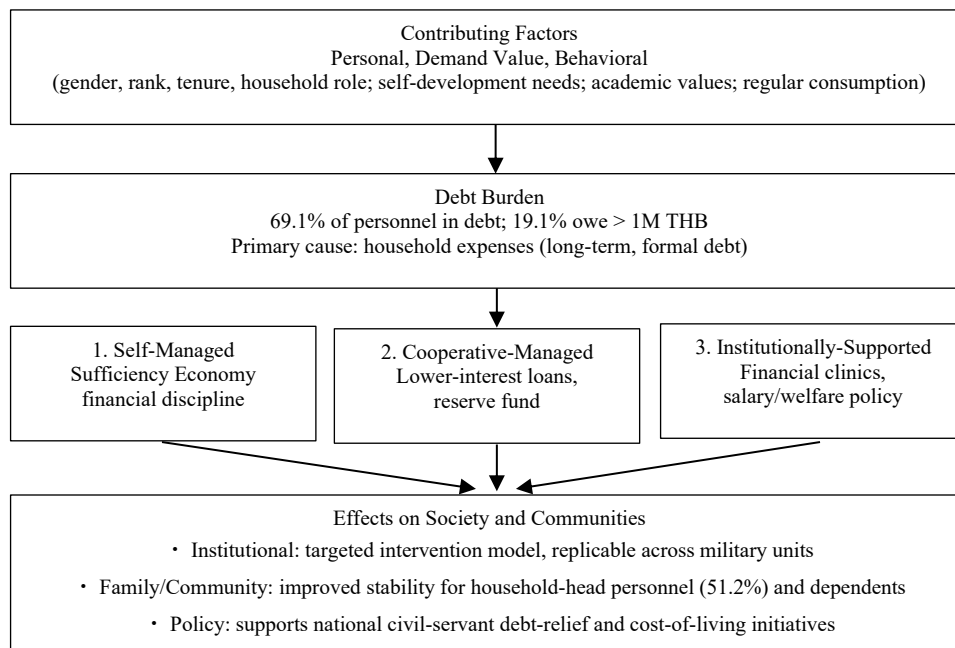


Figure 2 Conceptual framework linking contributing factors, debt burden, the three-tiered strategy, and societal effects. Source: Own elaboration

This research contributes new empirical knowledge regarding the debt burden situation among educational personnel in Thai military institutions, a population group that has not been systematically studied before. Existing knowledge, such as Supapoj (2017), had established only that Royal Thai Army personnel in general carry substantial aggregate debt, without disaggregating this burden by individual factors or by personnel type. The present study extends this prior knowledge by quantifying debt burden specifically among CRMA's Academic Division personnel and by identifying, through odds-ratio analysis, which personal characteristics significantly predict debt (e.g., rank, tenure, education, household headship). Most notably, whereas prior research on civil-servant debt (e.g., Nethin et al., 2017, on schoolteachers) attributed indebtedness mainly to insufficient compensation, this study's finding that academic values and self-development aspirations not merely economic necessity are the leading debt drivers among educational personnel is a new empirical contribution not previously documented. The study reveals that 69.1% of personnel in the Academic Division of Chulachomklao Royal Military Academy carry debt obligations, with 19.1% holding debts exceeding one million baht. This finding provides concrete evidence reflecting the severity of debt problems among military officers and civil servants within the Royal Thai Army.

The research identifies significant statistical relationships between personal factors and debt burden that constitute new knowledge in this field. Males are 1.9 times more likely to incur debt than females, while Generation X personnel show four times higher debt propensity compared to Generation Y. Notably, non-commissioned officers demonstrate 6.9 times greater likelihood of debt compared to commissioned officers, and personnel with educational qualifications below bachelor's degree level exhibit debt burdens as high as 90.7%. Furthermore, the study discovers that spousal income above 35,000 baht monthly reduces debt

likelihood by 40%, highlighting the protective role of dual-income households against financial vulnerability.

A particularly significant finding is that academic values emerge as the sole high-level factor contributing to debt burden. Personnel who strongly believe that continuous education expands life opportunities and view education as an investment are more likely to borrow for self-development purposes. This new understanding reveals the paradoxical relationship between aspirations for professional advancement and financial burden among military educational personnel.

The effects of this research on society and communities are multifaceted. At the institutional level, the findings enable Chulachomklao Royal Military Academy and other military organizations to design targeted intervention programs for high-risk groups, particularly non-commissioned officers and personnel with lower educational qualifications. The proposed three-tiered strategy comprising self-management approaches based on Sufficiency Economy Philosophy, cooperative-level financial assistance, and institutional support through financial counselling clinics provides a practical framework that can be replicated across military units nationwide.

At the family and community level, since 51.20% of respondents serve as household heads with 3.4 times higher debt propensity, reducing their debt burden directly improves economic stability for entire families, including educational opportunities for their children. The recommendation to utilize vacant military spaces for supplementary income generation can stimulate local economies surrounding military installations while providing debt-affected personnel with additional revenue streams.

At the policy level, this research supports government initiatives to resolve civil servant debt problems by providing empirical evidence from military personnel. The finding that personnel with below-bachelor qualifications face the highest debt burden aligns with recent government policies adjusting cost-of-living allowances for civil servants without university degrees. The evidence also supports considerations for salary structure adjustments and welfare improvements across the Royal Thai Army, ultimately contributing to enhanced work performance and quality of life among military educational personnel who are responsible for producing future army officers.

Acknowledgments

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Human Resource Intelligence as a Higher-Order Capability: Evidence from HR Professionals in Thai Listed Companies

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Abstract

This study conceptualizes and empirically validates Human Resource Intelligence (HRI) as a higher-order capability for HR professionals in the AI era. Drawing on data from 255 HR managers and practitioners in companies listed on the Stock Exchange of Thailand (SET), the study examines how six intelligence domains—Artificial Intelligence, Business Intelligence, Cultural Intelligence, Digital Intelligence, Emotional Intelligence, and Functional Intelligence—jointly constitute HRI. Using PLS-SEM, the results support HRI as a reliable and valid second-order construct, with acceptable model fit (SRMR = 0.066). All six dimensions contributed significantly to HRI. Digital Intelligence showed the strongest structural contribution ($w = 0.262$), followed by Emotional Intelligence ($w = 0.245$) and Functional Intelligence ($w = 0.244$), indicating that digital capability functions as the central anchor of HRI. Descriptive findings, however, showed that HR professionals reported the highest proficiency in Functional Intelligence and the lowest proficiency in Artificial Intelligence and Business Intelligence. This divergence reveals a capability imbalance: the areas in which practitioners feel most confident are not necessarily those that most strongly define HRI in AI-enabled organizations. The study contributes to HRM literature by showing that HRI is better understood not as a list of isolated competencies, but as an empirically validated higher-order capability. Practically, the findings suggest that HR development in Thai listed firms should prioritize AI literacy, digital fluency, and business analytics capability.

Keywords: Human resource intelligence, Artificial intelligence, Digital transformation, Higher-order construct, Stock exchange of Thailand, Human resource management

Introduction

The rapid infiltration of artificial intelligence (AI) and data-centric technologies has fundamentally redefined the landscape of modern human resource management (HRM). Organizations globally are transitioning from traditional administrative functions to AI-enabled processes, utilizing algorithms for talent acquisition, performance auditing, and predictive workforce analytics (Dutta & Naveen, 2025; Garcia & Kwok, 2025; Qamar et al., 2021). Industry estimates suggest that roughly seven in ten organizations have integrated some form of AI into their HR operations (McKinsey & Company, 2025); although such figures derive from consulting surveys rather than peer-reviewed research, the scholarly literature converges on the same underlying problem: a persistent value gap. Many firms struggle to derive sustainable strategic advantage from these tools, largely because HR systems remain decoupled from broader organizational decision-making and from the nuanced realities of human judgment (Enholm et al., 2021; Chowdhury et al., 2024).

This challenge is particularly acute in emerging economies such as Thailand, where digital transformation has accelerated across industries and the expectations placed on HR leaders have intensified accordingly. Yet a readiness deficit remains a critical bottleneck: a substantial share of HR leaders in Asia—by some accounts approaching 40%—report being underprepared to manage advanced analytics or mitigate algorithmic bias (Budhwar et al., 2023; Tambe et al., 2023). Technological adoption alone, in other words, is insufficient to catalyze meaningful organizational outcomes.

Companies listed on the Stock Exchange of Thailand (SET) constitute a particularly instructive context in which to examine this problem. Listed firms operate under formal governance and disclosure requirements, maintain professionalized HR functions, and are among the earliest Thai adopters of HR technology; they are therefore the setting in which the tension between technological adoption and practitioner readiness is most visible. At the same time, Thai organizational life is characterized by comparatively collectivist values and hierarchical norms, conditions under which the relational and human-centred dimensions of HR work retain particular weight. Studying HR professionals in SET-listed companies thus captures the socio-technical tension at its sharpest point, while explicitly bounding the interpretation of findings to this population rather than to HR professionals at large.

Traditional HR competency models, such as the seminal framework of Ulrich & Brockbank (2005), provided a vital foundation for HR's role as a strategic partner, but were architected prior to the era of pervasive automation and cognitive computing. As organizations increasingly delegate managerial processes to machines, a new tension has emerged: the automation–augmentation paradox—the proposition that automating routine processing simultaneously heightens, rather than reduces, the demand for human transparency, ethical oversight, and relational trust (Raisch & Krakowski, 2021; Jarrahi et al., 2022). In response, Human Resource Intelligence (HRI) has been proposed as an integrative construct: not a collection of isolated digital skills, but a socio-technical capability that synthesizes technological fluency with strategic foresight and human-centric judgment (Deepa et al., 2024; Prentice et al., 2023; Marler & Boudreau, 2017). In this study, HRI is conceptualized as a multidimensional construct comprising six intelligence domains: Artificial Intelligence, Business Intelligence, Cultural Intelligence, Digital Intelligence, Emotional Intelligence, and Functional Intelligence. The Artificial Intelligence dimension is interpreted operationally as AI literacy because it captures practitioners' capacity to understand, interpret, and critically evaluate AI systems rather than the technology itself; however, the construct label Artificial Intelligence (AI) is retained to preserve consistency with the HRI framework.

Despite this theoretical promise, empirical evidence on HRI's structural hierarchy remains scarce. Prior work has examined the components largely in isolation—digital literacy, people analytics capability, or AI adoption in HR—and predominantly in developed-economy settings; to the authors' knowledge, no study has yet validated an integrated, higher-order HRI construct with data from an emerging Southeast Asian market. This study addresses that gap by examining the HRI architecture among HR executives and practitioners in SET-listed companies using PLS-SEM, identifying which intelligence dimensions anchor the construct and thereby providing an empirical blueprint for HR capability development in AI-enabled organizations.

Research Objectives and Hypotheses

The specific objectives of this study are threefold:

1. To assess the current proficiency levels of the six HRI dimensions among HR professionals in SET-listed firms.
2. To validate the multidimensional architecture of HRI, examining how technological, strategic, and human-centric intelligence domains converge into a higher-order capability construct.
3. To analyze the relative contribution (hierarchical importance) of each intelligence dimension to the higher-order HRI construct.

Consistent with the second-order measurement model, three hypotheses were formulated. H1: each first-order intelligence dimension demonstrates satisfactory reliability, convergent validity, and discriminant validity. H2: all six intelligence dimensions contribute positively and significantly to the higher-order HRI construct. H3: the six dimensions differ in their relative contribution to HRI, forming an identifiable hierarchy of importance. These hypotheses correspond directly to the analytical sequence in Section 4: H1 is examined through the measurement model assessment (Sections 4.3–4.4), and H2 and H3 through the higher-order construct assessment (Section 4.5).

Literature Review

Human Resource Intelligence: An Integrative Capability Framework

The rapid advance of AI, coupled with digital technologies and big data analytics, is profoundly altering the contours of HRM within organizations (Strohmeier & Piazza, 2015). HR professionals, once custodians of routine administrative functions, now bear the onus of fusing technological acumen with strategic foresight and empathetic insight to underpin evidence-based people management (Deepa et al., 2024; Bandara et al., 2025). This study conceptualizes Human Resource Intelligence (HRI) as a multifaceted, integrative capability that embodies the HR practitioner's proficiency in weaving technology, business acumen, and human-centered perspectives into cohesive organizational strategies. Departing from fragmented skill-based models, HRI is framed as an architectural construct wherein individual competencies interlock to form a resilient whole (Deepa et al., 2024).

This framing resonates with the automation-augmentation paradox, which posits that AI augments rather than supplants human cognition, particularly in navigating ambiguity and ethical dilemmas (Raisch & Krakowski, 2021). Yet, while prior research underscores the perils of over-reliance on automation—such as diminished relational depth in HR interactions—few inquiries interrogate how integrated capabilities might mitigate these risks (e.g., Meijerink & Bondarouk, 2023). By positing HRI as a second-order latent construct, this framework extends dynamic capabilities theory, suggesting that HR's adaptive prowess emerges from the interplay of technological and humanistic elements, ultimately enhancing organizational resilience in volatile digital ecosystems.

The conceptualization of Human Resource Intelligence (HRI) is grounded in three complementary theoretical perspectives: the Resource-Based View (RBV), dynamic capability theory, and socio-technical systems theory. The Resource-Based View suggests that organizations gain sustainable competitive advantage through valuable, rare, inimitable, and

non-substitutable resources (Barney, 1991). Within this perspective, human capital capabilities—such as HR professionals’ analytical, strategic, and relational competencies—represent critical strategic assets that influence organizational performance.

Building on RBV, dynamic capability theory emphasizes the ability of organizations to integrate, build, and reconfigure internal and external competencies in rapidly changing environments (Teece et al., 1997). In the context of AI-driven organizations, HR professionals must continuously adapt their capabilities to interpret technological insights, respond to workforce changes, and support strategic decision-making.

In addition, socio-technical systems theory highlights the interdependence between technological infrastructures and human capabilities within organizational systems. As AI technologies increasingly influence HR processes such as recruitment, performance evaluation, and workforce analytics, HR professionals must develop competencies that bridge technological systems and human judgment.

Integrating these theoretical perspectives, Human Resource Intelligence (HRI) is conceptualized as a multidimensional capability architecture in which technological intelligence, strategic intelligence, and human-centered intelligence interact to enhance HR’s strategic contribution in digitally transformed organizations.

The Six Dimensions of HRI

HRI’s architecture draws from a synthesis of six mutually reinforcing dimensions, each calibrated to the exigencies of AI-infused HRM. These are not discrete attributes but interdependent facets that collectively fortify HR’s strategic mandate.

Artificial Intelligence (AI): Extending beyond superficial tool proficiency, this dimension entails a discerning grasp of AI algorithms’ mechanics, interpretative pitfalls, and contextual applicability in HR contexts (Tambe & Cappelli, 2019). Critically, HR professionals must interrogate algorithmic outputs for embedded biases, ensuring that recommendations in areas like predictive hiring do not perpetuate inequities—a challenge amplified in diverse workforces (Meijerink & Bondarouk, 2023). Empirical evidence indicates that such evaluative competence correlates with more equitable outcomes, yet its underdevelopment in practice risks entrenching discriminatory practices.

Business Intelligence (BI): Here, HRI manifests as the HR leader’s adeptness at translating organizational imperatives into actionable workforce strategies, leveraging data analytics to align talent deployment with competitive objectives (Ulrich & Brockbank, 2005; Boudreau et al., 2015). This involves not only descriptive reporting but predictive modeling to forecast talent gaps, thereby linking HR metrics to firm-level performance indicators (Marler & Boudreau, 2017; McCartney & Fu, 2022). However, studies reveal a persistent disconnect: many HR functions remain siloed from executive strategy, underscoring the need for BI to evolve from tactical support to a pivotal driver of business sustainability.

Cultural Intelligence (CI): In an era of globalized operations, CI equips HR practitioners to navigate multicultural dynamics, fostering inclusive practices that counteract AI’s tendency toward cultural homogenization (Ang & Van Dyne, 2008). This capability demands sensitivity to cross-cultural nuances in team formation and conflict resolution, mitigating biases in automated assessments that often favor dominant cultural norms (Bader et al., 2019; Schlaegel et al., 2021). While CI’s value in international HRM is well-documented, its integration with AI tools remains underexplored, potentially leaving organizations vulnerable to intercultural frictions in hybrid work models.

Digital Intelligence (DI): DI encompasses the agile mastery of digital platforms for HR execution, from cloud-based systems to real-time collaboration tools, enabling seamless data-driven interventions (Bondarouk & Brewster, 2016; Mithas & McFarlan, 2017). Modern HR practitioners must possess advanced digital competencies to effectively identify and manage

organizational talent. Specialized roles, such as HR data analysts, have become increasingly important because they use analytics and automation to support evidence-based decision-making. By leveraging digital tools, HR functions can improve talent acquisition, performance management, and operational efficiency while strengthening their strategic contribution to the organization (Strohmeier, 2020; Wiblen & Marler, 2021).

Emotional Intelligence (EI): As the humanistic counterweight to technological determinism, EI empowers HR professionals to discern and modulate emotional undercurrents in employee interactions, from performance feedback to crisis management (Goleman, 1995). Rooted in self-awareness and relational empathy, it is indispensable for addressing AI's emotional blind spots, such as impersonal algorithmic notifications (Joseph et al., 2015). Longitudinal data suggest EI buffers against burnout in high-stakes HR roles, yet its erosion in tech-heavy environments poses a critical threat to organizational morale.

Functional Intelligence (FI): Anchoring HRI's practical foundation, FI denotes deep-seated expertise in HR domains, including regulatory compliance, talent lifecycle management, and policy formulation (Wright & Snell, 2005). It facilitates the application of specialized knowledge to resolve multifaceted issues, such as integrating AI ethics into labor contracts (Rodgers et al., 2023). Although FI underpins professional legitimacy, evolving regulations in AI governance demand its continual recalibration, revealing tensions between traditional HR orthodoxy and emergent techno-legal paradigms.

Theoretical Synergy and Higher-Order Capability

These six dimensions do not function in isolation but converge into a higher-order Human Resource Intelligence (HRI) capability, where technological foundations (AI and DI) provide robust analytical infrastructure, strategic pillars (BI and FI) guide foresight-driven navigation, and humanistic facets (EI and CI) ensure ethical alignment and relational resilience. This triadic synergy embodies an extended resource-based view (RBV), framing HRI as a valuable, rare, and inimitable resource that elevates HRM from compliance-oriented tactics to proactive, value-generating orchestration (Barney, 1991; Wright & McMahan, 2011). In parallel domains like IT management, integrative models of this nature have demonstrated enhanced adaptability and performance under uncertainty, yet HRM research trails in adapting such architectures to AI-driven ecosystems—a critical void this study addresses via SEM analysis of HRI's latent architecture and predictive pathways (Boxall & Purcell, 2022; Strohmeier, 2020).

Ultimately, HRI positions HR professionals as architects of hybrid intelligence ecosystems, resolving the automation-augmentation paradox to foster ethically sound, strategically agile HRM in digital-era organizations. Subsequent research could validate this framework's causal impacts, especially in culturally nuanced settings like Thailand's financial sector, where regulatory and societal factors heighten its transformative potential (Budhwar et al., 2023)



Figure 1 Human Resource Intelligence (HRI) framework

This framework illustrates the concept of Human Resource Intelligence (HRI) as an integrated capability composed of six complementary forms of intelligence that support value creation in human resource management. At the center of the model is Human Resource Intelligence (HRI), which represents the overall strategic capacity of HR professionals to integrate data, technology, human understanding, and professional expertise into organizational decision-making. HRI is not a single skill but a multidimensional capability emerging from the interaction of several types of intelligence.

Methodology

Research Design

This study employed a quantitative, cross-sectional survey design to develop and empirically assess Human Resource Intelligence (HRI) as a higher-order capability construct. A survey approach was appropriate because the constructs of interest are perceptual capabilities self-assessed by practitioners, and because the study's aim was the structural validation of a newly integrated construct rather than the confirmation of causal paths among mature theoretical variables.

Population, Sampling, and Participants

The target population comprised HR executives and practitioners in companies listed on the Stock Exchange of Thailand (SET), a group recognized for advanced adoption of digital infrastructure and strategic HR practices (Deepa et al., 2024). The population frame consisted of all 816 companies listed on the SET at the time of data collection. Questionnaires were addressed to the HR managers of these firms and distributed through three complementary channels—the Personnel Management Association of Thailand (PMAT), corporate email, and company HR departments—to facilitate rapid, cost-efficient dissemination and follow-up. Following ethical approval on August 21, 2025, data were collected from late August to December 2025, a period of rapid diffusion of AI-related applications in Thai organizational and HR contexts. A total of 272 responses were returned (returned response rate = 33.33%). Inclusion criteria required respondents to (a) hold an HR executive or practitioner position and (b) be currently employed in a SET-listed company. After data screening, 17 responses were excluded for incompleteness or unusable response patterns, yielding 255 valid cases for analysis (usable response rate = 31.25%; 93.75% of returned responses were valid).

The sample size was justified against PLS-SEM-specific guidelines rather than the general covariance-based heuristic. Applying the inverse square root method (Kock & Hadaya, 2018), a minimum of approximately 155 cases is required to detect path coefficients of 0.20 at the 5% significance level with 80% power. The obtained sample of 255 exceeds this threshold, as well as the ten-times rule relative to the maximum number of indicators pointing at any construct (Hair et al., 2022).

Instrument Development and Validation

The research instrument was developed through an extensive review of the literature on HR capabilities in the digital and AI era. The HRI construct was operationalized through six dimensions, each measured with four reflective indicators adapted from established frameworks (Table 1). Rather than adopting any single existing scale, the item pool for each dimension was synthesized from established source frameworks in the corresponding domain and adapted to the HR professional context. All 24 indicators used a five-point application scale ranging from 1 (not applied at all) to 5 (applied proficiently and continuously).

Table 1 Measurement Items of Human Resource Intelligence (HRI)

Construct	Code	Measurement Item	Source
Artificial Intelligence (AI)	AI1	You apply AI to analyze data for HR decision-making.	Tambe et al. (2019) ; Dwivedi et al. (2021)
	AI2	You apply AI to support collaboration between personnel and technology within the HR team.	Tambe et al. (2019); Li & Kim (2024)
	AI3	You apply AI to monitor and evaluate the quality of HR processes, such as recruitment and training.	Tambe et al. (2019); Chee et al. (2024)
	AI4	You apply AI to forecast trends, such as employee turnover rates or workforce demand.	Tambe et al. (2019); Budhwar et al. (2022)
Business Intelligence (BI)	BI1	You use business data, such as revenue, market share, or costs, to plan workforce requirements and skill development.	Chaudhuri et al. (2011); Ulrich & Brockbank (2005)
	BI2	You use business intelligence to analyze and improve the effectiveness of HR processes.	Chen et al. (2012); Gurcan et al. (2023)
	BI3	You are able to use business intelligence to forecast and manage workforce-related risks.	Chen et al. (2012); Tavera Romero et al. (2021)
	BI4	You are able to measure and analyze the ROI of HR projects or activities to demonstrate business value.	Levenson (2018); Boon et al. (2019)
Cultural Intelligence (CI)	CI1	You are able to adapt communication methods, task assignments, and feedback approaches to suit employees from different cultural backgrounds.	Ang et al. (2007)
	CI2	You are able to manage culturally diverse teams so that they can work together effectively.	Ang et al. (2007); Tang & Zhang (2024)
	CI3	You are able to accept and respect differing opinions from colleagues from different cultural backgrounds.	Ang et al. (2007)
	CI4	You are able to use conflict resolution skills when facing misunderstandings among employees from diverse cultural backgrounds.	Ang et al. (2007); Tang & Zhang (2024)
Digital Intelligence (DI)	DI1	You are able to use HR software, such as HRIS, ATS, or PMS, to reduce work time and improve accuracy.	Ferrari (2013); Bondarouk & Brewster (2016)
	DI2	You are able to use digital technologies to manage HR data and support strategic decision-making.	Ferrari (2013); Levenson (2018)
	DI3	You are able to learn and adapt quickly to new digital technologies in HR work.	Ferrari (2013); Shahzad et al. (2022)
	DI4	You are able to use digital technologies to communicate and coordinate with HR teams and other departments.	Ferrari (2013); Strohmeier (2020)
Emotional Intelligence (EI)	EI1	You are able to regulate your emotions and express yourself appropriately in high-pressure situations, such as communicating performance appraisal results or negotiations.	Salovey & Mayer (1990); Goleman (1995)
	EI2	You are able to understand and respond appropriately to employees' emotions in the workplace.	Salovey & Mayer (1990); Cherniss (2010)
	EI3	You are able to manage relationships and work effectively with teams under complex situations.	Salovey & Mayer (1990); Goleman (1995)
	EI4	You are able to manage your own stress and your team's stress effectively during crisis situations.	Salovey & Mayer (1990); Cherniss (2010)
Functional Intelligence (FI)	FI1	You possess specialized competencies essential for HR work.	Boyatzis (1982); Ulrich & Brockbank (2005)
	FI2	You are able to solve day-to-day work problems using professional experience and specialized knowledge.	Boyatzis (1982); Ulrich et al. (2012)
	FI3	You are able to plan and manage HR strategies using specialized HR knowledge.	Ulrich & Brockbank (2005); Ulrich et al. (2012)
	FI4	You continuously and systematically develop specialized knowledge and skills in HR work.	Boyatzis (1982); Ulrich et al. (2012)

Note: n = 255. Response scale (level of application): 5 = applied proficiently and continuously; 4 = applied well in many situations; 3 = applied in some situations; 2 = applied very little; 1 = not applied at all. Items were administered in Thai; the English wording above reflects the fielded instrument. The item pool for each dimension was synthesized from the source frameworks listed rather than adopted from a single existing scale.



Validity was established through the Index of Item-Objective Congruence (IOC) evaluated by three experts: a statistics specialist, an HR practitioner experienced in applying AI in HR work, and a PLS-SEM specialist. For the initial 30-item HRI item pool, IOC values ranged from 0.33 to 1.00, with an overall mean of 0.81; 28 items met the acceptance criterion of 0.67, and items with low or borderline values were revised or removed following the experts' qualitative comments—for example, clarifying the descriptions of AI applications—before the final 24-item questionnaire was administered. The study protocol received ethical approval from the Ethics Committee in Human Research, National Institute of Development Administration (NIDA), under the expedited review procedure (COA No. 2025/0142; Protocol ID No. ECNIDA 2025/0155), approved on August 21, 2025.

Common Method Bias

Because all data were self-reported by a single respondent per questionnaire, both procedural and statistical remedies for common method bias were applied (Podsakoff et al., 2003). Procedurally, respondents were assured of anonymity, were informed that there were no right or wrong answers, and completed construct blocks that were separated in the questionnaire. Statistically, Harman's single-factor test indicated that the first unrotated factor accounted for 31.13% of the total variance, below the 50% threshold. In addition, a full collinearity assessment produced VIF values ranging from 2.248 to 2.784, all below the conservative threshold of 3.3 (Kock, 2015), indicating that common method bias is unlikely to threaten the validity of the findings.

Data Analysis

Data were analyzed using partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4. PLS-SEM was selected over covariance-based SEM for three reasons aligned with the study's purpose: the research aim is the development and assessment of a newly integrated higher-order capability construct rather than the confirmation of a mature theory; the model is complex, comprising six first-order constructs and 24 indicators converging on a second-order construct; and the analytical emphasis is on the relative contribution (prediction-oriented weighting) of dimensions rather than on covariance reproduction (Hair et al., 2022; Sarstedt et al., 2019).

The higher-order HRI construct was specified as reflective–formative and estimated using a two-stage approach (Sarstedt et al., 2019): in the first stage, the six first-order reflective constructs were assessed for reliability and validity; in the second stage, the latent variable scores of Artificial Intelligence, Business Intelligence, Cultural Intelligence, Digital Intelligence, Emotional Intelligence, and Functional Intelligence served as formative indicators of the second-order HRI construct. Statistical significance was assessed through bootstrapping with 5,000 subsamples using bias-corrected and accelerated (BCa) confidence intervals at the 95% level. Measurement quality was evaluated against conventional thresholds: indicator loadings ≥ 0.70 ; Cronbach's alpha, ρ_A , and composite reliability (CR) ≥ 0.70 ; average variance extracted (AVE) ≥ 0.50 ; HTMT < 0.85 complemented by the Fornell-Larcker criterion; and standardized root mean square residual (SRMR) < 0.08 .

Results

The results are reported in the sequence of the three research objectives: the respondent and descriptive profiles address Objective 1 (Sections 4.1–4.2); the measurement model, discriminant validity, and higher-order validation address Objective 2 (Sections 4.3–4.5); and the hierarchy of dimension contributions within Section 4.5, together with the model fit assessment in Section 4.6, addresses Objective 3.

Respondent Profile

Table 2 summarizes the demographic characteristics of the 255 respondents.

Table 2 Demographic Profile of Respondents (n = 255)

Characteristic	Category	n	%
Gender	Female	126	49.40
	Male	102	40.00
	LGBTQ+	18	7.10
	Prefer not to say	9	3.50
Age (years)	Under 25	6	2.40
	25–34	45	17.60
	35–44	90	35.30
	45–54	81	31.80
	55 and above	33	12.90
Education	Below a bachelor's degree	4	1.60
	Bachelor's degree	85	33.30
	Master's degree	141	55.30
	Doctoral degree	25	9.80
Position level	Officer / operational staff	63	24.70
	Manager / supervisor	132	51.80
	Director / executive	58	22.70
	C-level	2	0.80
Tenure in current position	Less than 1 year	7	2.70
	1–3 years	48	18.80
	4–6 years	67	26.30
	7–10 years	61	23.90
	More than 10 years	72	28.20
Organization size (employees)	Fewer than 50	24	9.40
	50–200	31	12.20
	201–500	57	22.40
	More than 500	143	56.10

The sample was broadly gender-balanced (49.40% female, 40.00% male) and concentrated in the experienced working-age range, with 67.1% of respondents aged 35–54. Educational attainment was high—65.10% held a graduate degree—and three quarters (75.30%) occupied managerial positions or above, with 78.40% having served four or more years in their current role. A majority (56.10%) worked in organizations employing more than 500 people, a profile consistent with the professionalized HR functions characteristic of listed companies and appropriate for assessing capability at the professional level.

Descriptive Profile of HRI Dimensions (Objective 1)

Descriptive statistics for the six HRI dimensions are presented in Table 3. The overall level of Human Resource Intelligence was moderately high (mean = 3.441, SD = 0.551). Practitioners reported the highest proficiency in Functional Intelligence (mean = 3.811), followed by Emotional (3.684) and Cultural Intelligence (3.551), while Artificial Intelligence (3.074) and Business Intelligence (3.062) recorded the lowest scores. Skewness values ranged from –0.602 to 0.044 and kurtosis values from 0.264 to 1.444, well within the conventional ± 2 bounds, indicating no severe departure from univariate normality.

Table 3 Descriptive Statistics of HRI Dimensions (n = 255)

Dimension	Mean	SD	Min	Max	Skewness	Kurtosis
Functional Intelligence	3.811	0.677	1.000	5.000	−0.602	1.444
Emotional Intelligence	3.684	0.645	1.000	5.000	−0.063	0.803
Cultural Intelligence	3.551	0.689	1.000	5.000	−0.317	1.174
Digital Intelligence	3.464	0.760	1.000	5.000	−0.227	0.264
Artificial Intelligence	3.074	0.819	1.000	5.000	−0.159	0.728
Business Intelligence	3.062	0.831	1.000	5.000	−0.479	0.460
Overall HRI	3.441	0.551	1.542	5.000	0.044	0.919

It should be emphasized that these mean scores represent respondents' perceived level of proficiency in each dimension. They describe the current capability profile of the workforce and are conceptually distinct from the structural contribution of each dimension to the HRI construct, which is examined in Section 4.5.

Measurement Model Assessment (Objective 2)

The measurement model was assessed for indicator reliability, internal consistency, and convergent validity (Table 4). All indicator loadings exceeded 0.70 (overall range 0.77–0.92). Cronbach's alpha (0.831–0.882), rho_A (0.835–0.906), and composite reliability (0.887–0.918) all surpassed the 0.70 threshold, and AVE values (0.663–0.737) exceeded 0.50, confirming satisfactory reliability and convergent validity across all six constructs. H1 is therefore supported with respect to reliability and convergent validity.

Table 4 Reliability and Convergent Validity of First-Order Constructs

Construct	Loading range	α	rho_A	CR	AVE
Artificial Intelligence	0.77–0.92	0.869	0.901	0.909	0.715
Business Intelligence	0.81–0.92	0.882	0.906	0.918	0.737
Cultural Intelligence	0.79–0.83	0.831	0.835	0.887	0.663
Digital Intelligence	0.81–0.86	0.855	0.855	0.902	0.696
Emotional Intelligence	0.81–0.87	0.872	0.875	0.912	0.722
Functional Intelligence	0.79–0.91	0.874	0.875	0.913	0.725

Discriminant Validity (Objective 2)

Discriminant validity was assessed using two complementary criteria. First, heterotrait–monotrait (HTMT) ratios among the six dimensions ranged from 0.245 to 0.754, all below the conservative 0.85 threshold (Henseler et al., 2015), with the highest value observed between Emotional and Functional Intelligence (HTMT = 0.754). Second, the Fornell–Larcker criterion was satisfied: the square root of each construct's AVE exceeded its correlations with all other constructs (Table 5; Fornell & Larcker, 1981). Together, these results confirm that the six dimensions are empirically distinct facets of HRI, completing the support for H1. The proximity of Emotional and Functional Intelligence, while comfortably within acceptable bounds, reflects meaningful conceptual adjacency between interpersonal-emotional capability and professional HR expertise; this relationship is examined further in the Discussion.

Table 5 Discriminant Validity: Fornell–Larcker Criterion and HTMT Ratios

	AI	BI	CI	DI	EI	FI
AI	0.846	0.673	0.516	0.627	0.334	0.374
BI	0.581	0.859	0.513	0.489	0.245	0.269
CI	0.446	0.444	0.814	0.643	0.725	0.688
DI	0.553	0.430	0.545	0.835	0.686	0.726
EI	0.311	0.221	0.622	0.595	0.850	0.754
FI	0.334	0.238	0.589	0.627	0.661	0.852

Note: Bold diagonal values are the square roots of AVE; values below the diagonal are construct correlations (Fornell–Larcker criterion); values above the diagonal are HTMT ratios.

Higher-Order Construct Assessment (Objectives 2 and 3)

HRI was assessed as a reflective–formative second-order construct using the two-stage approach described in Section 3.5. Given the formative specification of the higher-order layer, collinearity among the dimension scores was examined first: all outer VIF values ranged from 1.689 to 2.324, below the conservative 3.3 threshold (Table 6), indicating no collinearity concerns. All six dimensions contributed positively and significantly to HRI ($p < .001$), with 95% BCa confidence intervals excluding zero, supporting H2.

Table 6 Higher-Order Construct Assessment: Outer Weights of HRI Dimensions

Dimension	Outer weight	t	p	95% BCa CI	VIF	Rank
Digital Intelligence	0.262	23.919	< .001	[0.240, 0.282]	2.324	1
Emotional Intelligence	0.245	19.441	< .001	[0.218, 0.267]	2.236	2
Functional Intelligence	0.244	21.567	< .001	[0.221, 0.264]	2.218	3
Cultural Intelligence	0.220	17.058	< .001	[0.190, 0.242]	2.116	4
Artificial Intelligence	0.197	12.400	< .001	[0.169, 0.229]	1.847	5
Business Intelligence	0.138	6.398	< .001	[0.093, 0.177]	1.689	6

Note: t statistics and bias-corrected and accelerated (BCa) 95% confidence intervals are based on 5,000 bootstrap resamples of the respondent-level data.

Addressing Objective 3, the outer weights reveal a clear hierarchy of contribution, supporting H3. Digital Intelligence emerged as the strongest anchor of the HRI architecture ($w = 0.262$), followed closely by Emotional ($w = 0.245$) and Functional Intelligence ($w = 0.244$), with Cultural Intelligence ($w = 0.220$), Artificial Intelligence ($w = 0.197$), and Business Intelligence ($w = 0.138$) contributing progressively less. Two readings of these results must be kept distinct. The outer weight expresses each dimension's structural contribution to what constitutes HRI as a capability construct; it does not indicate the level at which practitioners currently perform. Thus, although Functional Intelligence recorded the highest mean proficiency (Section 4.2), Digital Intelligence carries the greatest weight in defining professional intelligence—while Artificial Intelligence and Business Intelligence are simultaneously the weakest contributors and the least developed proficiencies, marking them as a compound capability gap.

Model Fit and Scope of the Structural Assessment

Overall model fit was evaluated using the standardized root mean square residual, yielding SRMR = 0.066, below the 0.08 threshold and indicating acceptable fit (Hair et al., 2022). Because the present model is a measurement-focused, higher-order validation model with no endogenous outcome variable, statistics that presuppose structural dependence— R^2 , f^2 , and $Q^2/PLSpredict$ —are not applicable and are therefore not reported. The model estimates how six intelligence dimensions constitute a higher-order capability; it does not, and is not intended to, test causal effects of HRI on downstream outcomes such as HR effectiveness or organizational performance. This boundary is addressed explicitly in the Discussion and in the directions for future research.

Discussions

Perceived Proficiency versus Structural Contribution

Perhaps the most consequential pattern in the findings is the divergence between what HR practitioners are good at and what most strongly defines their professional intelligence. Descriptively, respondents reported the highest proficiency in Functional Intelligence—the traditional core of the HR craft—yet structurally, Digital Intelligence carried the greatest weight in constituting HRI. Mean scores capture perceived proficiency; outer weights capture each dimension's contribution to the construct. Conflating the two would lead to the mistaken inference that the highest-scoring dimension is the most important one. Read together, they tell a sharper story: the profession's centre of gravity has shifted toward digital fluency faster than practitioners' self-assessed capabilities have followed, and the dimensions where proficiency is lowest—Artificial Intelligence and Business Intelligence—are precisely those where deliberate development effort is most needed.

The Implementation Paradox and the Interpretative Gap

The validation of HRI reveals what we term an implementation paradox in the Thai corporate context: organizations demonstrate a firm foundation for digital execution—reflected in the anchoring strength of Digital Intelligence—while AI-specific intelligence remains only moderate, indicating that technological adoption has outpaced the cognitive readiness of practitioners to interrogate and govern those technologies. This is consistent with Strohmeier and Piazza (2015), who emphasize that AI techniques demand a higher level of analytical maturity than conventional digital tools, and reinforces the caution of Deepa et al. (2024) and Akbarighatar et al. (2023) that digital readiness alone does not guarantee the socio-technical competencies required to manage AI responsibly.

Relatedly, the comparatively low weight of Business Intelligence points to an interpretative gap: a disconnect between the availability of workforce data and practitioners' capacity to translate it into strategic organizational narratives. This aligns with Rasmussen et al. (2023), who argue that the value of people analytics depends on precisely this translational ability, and is consistent with the automation–augmentation paradox (Raisch & Krakowski, 2021): as AI absorbs routine processing, the premium on human strategic oversight and contextual judgment rises rather than falls.

High-Tech and High-Touch: A Triadic Reading of the Architecture

The balance between high-tech and high-touch remains a defining feature of the HRI architecture. The enduring strength of the functional and emotional domains is consistent with evidence that emotional intelligence operates as a critical personal resource for navigating career-related challenges (Pirsoul et al., 2023), while research on algorithmic management shows that algorithm-mediated governance can be experienced as impersonal and can elicit negative emotional reactions when human support is absent (Hu et al., 2026; Kellogg et al., 2020). The emergence of Digital Intelligence as the primary anchor likewise coheres with a broader shift in professional legitimacy toward value creation through people analytics and AI capability building (Bottesch et al., 2025; Chowdhury et al., 2023; Margherita, 2022), and with contemporary HRM scholarship urging HR to actively shape how AI is designed and deployed rather than treating it as a technical substitution for human judgment (Charlwood & Guenole, 2022; Gong et al., 2025; Vrontis et al., 2022).

Interpretively, the six dimensions can be read as forming three capability layers: a technological layer (Artificial and Digital Intelligence), a strategic layer (Business and Functional Intelligence), and a human layer (Emotional and Cultural Intelligence). We stress

that this triadic grouping is offered as a conceptual interpretation of the validated six-dimension structure, not as a statistically tested third-order model; formally testing the triadic layer—for instance, through a third-order specification or clustering of dimension scores—is a task for future research. Within this reading, the conceptual proximity between Emotional and Functional Intelligence observed in the discriminant validity assessment (the highest HTMT ratio, 0.754) is theoretically sensible: empathy, sensitive communication, and interpersonal judgment are embedded in the everyday exercise of professional HR expertise, even as the two constructs remain empirically distinct. The triadic reading also clarifies why the technological layer currently rests more heavily on Digital Intelligence than on AI Literacy: platform fluency has become infrastructural to Thai HR practice, whereas the capacity to interrogate algorithmic systems is still consolidating.

Limitations

Three limitations bound the interpretation of these findings. First, the cross-sectional design captures the HRI architecture at a single point in time and cannot speak to how the hierarchy of dimensions evolves as AI adoption matures. Second, the sample is drawn from a single country and, within it, from listed companies only; generalization to SMEs, the public sector, or other institutional contexts should be made with caution. Third, all measures are self-reported perceptions of capability, which—despite the procedural and statistical remedies reported in Section 3.4—remain subject to self-assessment and common-method concerns.

Future Research

Three extensions follow directly. Longitudinal designs could trace whether the weights of Artificial Intelligence and Business Intelligence rise as organizational AI maturity deepens, converting the present architecture into a dynamic account of capability evolution. Cross-country comparative studies—for example, across ASEAN markets at different stages of digital transformation—could test the boundary conditions of the hierarchy identified here. Most importantly, linking HRI to downstream outcomes such as HR effectiveness, decision quality, or firm performance would convert the validated measurement architecture into a full structural model, directly testing the effectiveness claims that the present study deliberately refrains from making.

Conclusion and suggestions

Conclusion

This research mapped the architecture of Human Resource Intelligence among HR executives and practitioners in SET-listed companies. The evidence indicates that HRI is not a singular technical skill but a validated, multidimensional capability constituted by six intelligence domains. Practitioners remain strongest in their high-touch foundations—Functional and Emotional Intelligence—while a visible capability gap persists in Artificial Intelligence and Business Intelligence. Structurally, Digital Intelligence serves as the primary anchor of the construct, bridging traditional human-centred management and increasingly automated decision environments. These conclusions describe the composition and internal hierarchy of HRI; claims about its effects on HR effectiveness or organizational competitiveness lie beyond the scope of the data and are framed here only as implications for practice and future inquiry.

Managerial and Policy Implications

Three implications follow directly from the empirical pattern of results and are offered as potential managerial implications rather than causal prescriptions. First, because Artificial Intelligence and Business Intelligence recorded both the lowest proficiency means and the lowest structural weights, development investment should shift from general digital training toward specialized AI literacy and data-interpretation programs that equip HR professionals to interrogate algorithmic outputs rather than merely operate the tools. Second, the interpretative gap identified in Business Intelligence suggests cultivating professionals who are conversant in both human behavior and data analytics—able to translate workforce data into business-relevant narratives. Third, the anchoring role of Digital Intelligence implies that evidence-based practice should be institutionalized as the default mode of talent decisions, so that the profession's strongest structural asset is exercised routinely rather than episodically.

New knowledge and the effects on society and communities

This study contributes to the HRM literature in three ways. First, it extends the discussion of digital transformation in HR by conceptualizing HRI as an empirically validated higher-order capability rather than a set of isolated competencies. Second, it empirically validates HRI as a second-order construct comprising six intelligence dimensions, demonstrating that HR capability in AI-driven organizations emerges from the synergistic interaction of multiple forms of intelligence rather than from any single technological competence. Third, it contributes to the automation–augmentation debate: the simultaneous strength of digital and human-centred dimensions is consistent with the argument that AI amplifies, rather than diminishes, the need for integrative human judgment (Raisch & Krakowski, 2021). It should be noted that the six constituent dimensions are individually well established in prior literature; the study's novelty resides in their second-order integration and in the empirical identification of the hierarchy among them in an emerging-market context. Table 7 positions this contribution against the most closely related prior frameworks.

Table 7 Positioning HRI against Related Frameworks

Framework	Primary focus	Structure	What HRI adds
Marler & Boudreau (2017)	HR analytics: evidence-based review	Narrative review; no latent construct	Integrates analytics capability into a validated multidimensional construct
Chowdhury et al. (2023)	AI capability in HRM	Capability framework grounded in the resource-based view	Extends AI capability into a six-domain, HR-specific architecture
Deepa et al. (2024)	HR capability in the digital/AI era	Integrative conceptual framework	Provides second-order empirical validation with PLS-SEM in an emerging market
This study (HRI)	Integrative socio-technical HR capability	Second-order construct; six dimensions; n = 255, SET-listed firms	Validated hierarchy: DI as structural anchor; AI/BI as compound gap

Potential Social and Policy Implications

Beyond the firm level, the findings carry potential implications—offered as interpretive extensions rather than empirically demonstrated impacts—for the broader labor market. HR professionals equipped with stronger AI literacy are better positioned to implement algorithmic tools transparently and to detect embedded bias, supporting fairness in employment decisions. At the level of national workforce policy, the compound gap in AI and business analytics identified here suggests a concrete target for professional development curricula in the Thai HR community. Finally, the persistent structural weight of emotional and cultural intelligence indicates that responsible automation in HR need not come at the expense of the human element; within this architecture, the two are complementary.



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Declarations

Ethical approval: Ethics Committee in Human Research, National Institute of Development Administration (NIDA); COA No. 2025/0142; Protocol ID No. ECNIDA 2025/0155; approved August 21, 2025 (expedited review). Conflict of interest: The authors declare no conflict of interest. Data availability statement: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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The Role of Media Exposure in the Relationship Between the Use of Artificial Intelligence and Sustainable Investment Behavior Among Generation Z

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Abstract

This study examines the moderating role of media exposure (ME) in the relationship between the use of artificial intelligence (UAI) and sustainable investment behavior (SIB) among Generation Z (Gen Z). The study was based on the Unified Theory of Acceptance and Use of Technology (UTAUT), focusing on performance expectancy (PE), effort expectancy (EE), facilitating conditions (FC), and habit of using (HU). This research adopted a quantitative approach. The sample consisted of 561 respondents residing in Bangkok and its metropolitan areas. Data was collected using a structured questionnaire and analyzed using descriptive statistics and multiple regression analysis. The results revealed that: 1) UAI had a statistically significant positive influence on the SIB among Gen Z in Bangkok and metropolitan areas, with a predictive power of 43.00 % ($R^2 = 0.430$). 2) When analyzed by individual dimensions of the use of AI, including PE, EE, FC, and HU, each dimension also demonstrated a significant positive influence on SIB among Gen Z. However, 3) When ME was included as a moderating variable, ME had a significant positive effect on Gen Z's SIB, whereas the effect of the use of AI on SIB became statistically insignificant, while the model's predictive power increased to 65.10% ($R^2 = 0.651$). Furthermore, 4) When examining the moderating effect of ME on each dimension of the use of AI, it was found that only EE and FC remained statistically significant predictors of SIB among Gen Z, explaining 66.40 % of the variance ($R^2 = 0.664$), compared to 43.10 % ($R^2 = 0.431$) in the model without the moderating variable. The findings extend the application of UTAUT by highlighting the moderating role of media exposure in sustainable investment behavior and, practically, suggest that financial media exposure may contribute to promoting sustainable investment among Gen Z in Bangkok and metropolitan areas.

Keywords: Media exposure, Artificial intelligence, Sustainable investment behavior, Generation Z

Introduction

Over the past decade, sustainable investment, commonly referred to as Environmental, Social, and Governance (ESG) investing, has gained increasing global attention due to escalating environmental challenges, social inequality, and corporate governance issues that pose long-term risks to economic stability. International organizations, particularly the United Nations, have emphasized the critical role of the financial sector in supporting the Sustainable Development Goals (SDGs) by allocating capital toward firms that integrate environmental responsibility, social accountability, and strong governance practices into their operations (United Nations, 2015). As a result, sustainable investment has become an essential mechanism for fostering long-term economic resilience and responsible growth. Generation Z investors, as a cohort that has grown up in a highly digitalized environment, possess rapid access to information and are expected to play a significant role as future market participants. This generation tends to exhibit heightened awareness of social and environmental issues and demonstrates a growing interest in aligning financial decisions with personal values. According to Morgan Stanley (2025), 99% of Gen Z investors and 97% of Millennials express interest in sustainable investing, with approximately 68% of Gen Z already allocating more than 20% of their investment portfolios to sustainable assets.

Concurrently, advancements in artificial intelligence (AI) have substantially transformed the investment landscape. AI-driven technologies, such as big data analytics, predictive modeling, and automated investment advisory systems, have enhanced decision-making efficiency, reduced information asymmetry, and increased investor confidence (Davenport & Ronanki, 2018). However, the extent to which individuals adopt and utilize AI-based investment tools varies depending on factors such as performance expectancy, ease of use, facilitating conditions, and habitual technology usage. Moreover, media exposure plays a crucial role in shaping Generation Z's investment behavior, as it represents the ongoing process through which individuals acquire investment-related information, opinions, and experiences from various media channels, particularly digital and social media platforms. Exposure to sustainability-oriented investment content has been shown to enhance investors' knowledge, awareness, and cognitive frameworks, thereby influencing attitudes and behaviors toward ESG investing (Bollen, 2007; Xia, 2025). Media exposure refers to the continuous process through which individuals encounter information, opinions, and experiences related to investment through various media channels, particularly digital and social media platforms. Exposure to sustainability-oriented investment content can enhance investors' knowledge, awareness, and cognitive frameworks, potentially shaping more favorable attitudes toward ESG investing. Accordingly, media exposure may function as a moderating variable that strengthens or alters the relationship between the use of artificial intelligence and sustainable investment behavior among Generation Z investors. By reinforcing understanding and awareness of ESG principles, media exposure can intensify the impact of AI-assisted investment tools on sustainable investment decisions.

Additionally, a recent study highlights the important role of social media and influencers (financial influencers) for Gen Z's investment behavior. For instance, more than 70 % of Gen Z retail investors in the UK rely on financial information on social media when making investment decisions. (Sanders, 2025). Similarly, a survey conducted by WallStreetZen (2023) reveals that 76% of American Gen Z learn about personal finance through platforms such as TikTok, YouTube, and Reddit. This trend is also evident in Thailand, where financial influencers such as Paul Pattarapon and CK Cheong each have over 1.5 million Facebook followers.

Although prior studies have separately examined AI adoption and sustainable investment behavior, limited research has explored the moderating role of media exposure between the use of AI and sustainable investment behavior, particularly among Gen Z investors in Thailand. Therefore, this study aims to examine the moderating role of media exposure in the relationship between the use of artificial intelligence and sustainable investment behavior among Generation Z. The findings are expected to contribute to a deeper understanding of behavioral mechanisms underlying sustainable investment and to provide policy implications as well as practical guidance for developing AI-driven investment tools that effectively address the needs and expectations of the new generation of investors.

Research Objectives

1. To investigate the relationship between the use of artificial intelligence (UAI) and sustainable investment behavior (SIB) among Generation Z in Bangkok and metropolitan areas.
2. To examine the relationship of each dimension of the use of artificial intelligence (UAI) on sustainable investment behavior (SIB) among Generation Z in Bangkok and metropolitan areas.
3. To assess the moderating role of media exposure (ME) in the relationship between the use of artificial intelligence (UAI) and sustainable investment behavior (SIB) among Generation Z in Bangkok and metropolitan areas.
4. To evaluate the moderating effect of media exposure (ME) on the relationship between each dimension of the use of artificial intelligence (UAI) and sustainable investment behavior (SIB) among Generation Z in Bangkok and metropolitan areas.

Based on reviewed literature, the conceptual framework of this research is developed to illustrate the relationships among the key variables, including the use of artificial intelligence (UAI), media exposure (ME), and sustainable investment behavior (SIB) among Generation Z, as follows.

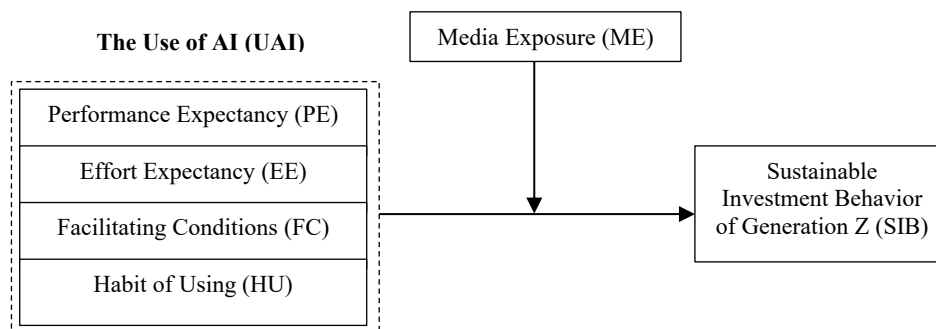


Figure 1 The conceptual framework of this study

Hypotheses

Based on the conceptual framework, media exposure is therefore a key concept in explaining the mechanisms of information received and transformed into sustainable investment behavior among Gen Z. It also functions as an essential component in constructing a research framework that systematically integrates technology acceptance factors, individual characteristics, and investment behavior. Accordingly, the following hypotheses are proposed:

H1: The use of Artificial Intelligence (UAI) has a statistically significant positive effect on sustainable investment behavior (SIB) among Gen Z.

H2: Each dimension of UAI, namely, performance expectancy (PE), effort expectancy (EE), facilitating conditions (FC), and habit of using (HU), has a statistically significant positive effect on SIB among Gen Z.

H3: Media exposure (ME) significantly moderates the relationship between UAI and SIB among Generation Z.

H4: Media Exposure (ME) significantly moderates the relationship between each dimension of UAI and SIB among Generation Z.

Methodology

The methodology of this study includes research instruments, sample selection procedures, assessment of the reliability and validity of the research instruments, and statistical techniques employed for data analysis.

Research Instrument

The research instrument was a questionnaire developed based on relevant theories and previous studies. The questionnaire consisted of four sections: Section 1 included four demographic items presented in a checklist format; Section 2 measured the use of artificial intelligence (UAI), including performance expectancy (PE), effort expectancy (EE), facilitating conditions (FC), and habit of using AI (HU), comprising a total of 20 items. These dimensions reflect the perceived usefulness, ease of use, available support, and habitual use of AI for investment related activities. Section 3 assessed media exposure (ME), including the frequency of visiting investment media platforms, following related channels, and perceived credibility of influencers, with 8 items. ME refers to exposure to investment related information through media channels. Section 4 measured Sustainable Investment Behavior (SIB) of Gen Z, consisting of 6 items, referring to investment behavior that considers ESG principles and sustainable business practices.

Items in Sections 2 - 4 were measured using a five-point Likert scale, where 5 represented “strongly agree” and 1 represented “strongly disagree.” The questionnaire was reviewed by experts to ensure content validity. A pilot test was conducted, and the reliability of the instrument was examined using Cronbach’s alpha coefficient, which indicated an acceptable level of reliability.

Sampling and Data Collection

To achieve the research objectives, the sample was limited to Gen Z individuals residing in Bangkok and the metropolitan area. Since the exact number of individuals interested in investment is unknown and cannot be accurately determined, the researchers calculated the sample size using Cochran’s formula (1977) at a 95% confidence level, 5% margin of error, and $p = 0.5$, resulting in a minimum required sample of 385 participants. Data collection used an online questionnaire as the survey instrument. The study employed non-probability sampling techniques, including purposive, convenience, and snowball sampling. The researchers used social media platforms (e.g., Facebook, Line, and Instagram) to complete the self-administered questionnaires.

A total of 580 responses were received. After the screening process, 561 respondents met the criteria and were retained for the data analysis. The screening question was: “Have you ever viewed investment- or finance-related content on social media?” If respondents answered “No,” the questionnaire was automatically terminated. In addition, the researchers excluded questionnaires that contained identical responses across all items or were completed in less

than three minutes, and each email address could submit only one response. The data collection period was conducted from January 1 to February 10, 2026.

Statistical Analysis

The data obtained from the questionnaires were processed using statistical software packages. Descriptive statistics, including frequency, percentage, mean, and standard deviation (S.D.), were used to summarize and describe the general characteristics of the data. Inferential statistics consisted of the Pearson Correlation Coefficient examining the relationships among variables and Multiple Regression Analysis to analyze and predict the relationships between independent and dependent variables.

Instrument Reliability and Validity

Each item demonstrated strong content validity, with Index of Item Objective Congruence (IOC) values ranging from 0.60 to 1.00. The researchers conducted a pilot test with 30 participants, which demonstrated high internal consistency across all constructs: PE ($\alpha = 0.874$), EE ($\alpha = 0.884$), FC ($\alpha = 0.897$), HU ($\alpha = 0.947$), UAI ($\alpha = 0.916$), ME ($\alpha = 0.857$), and SIB ($\alpha = 0.850$). The overall reliability coefficient was 0.941, confirming the reliability of the questionnaire.

Results

Descriptive Statistics

Most respondents were male (50.60%), aged between 18 and 21 years (67.90%), held a bachelor's degree (57.20%), and had an average monthly income of less than 10,000 baht (62.20%). Most respondents had less than one year of investment experience and primarily invested in equity securities (65.20%).

Table 1 Descriptive statistics of key variables (N=561)

Variables	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	VIF	Tolerance
SIB	4.15	0.72	1.00	5.00	-1.023	1.816		
UAI	4.13	0.66	1.00	5.00	-0.700	0.832	1.000	1.000
PE	4.18	0.69	1.00	5.00	-0.832	1.178	3.063	0.326
EE	4.22	0.68	1.00	5.00	-0.858	0.909	3.283	0.305
FC	4.12	0.74	1.00	5.00	-0.835	0.962	2.383	0.420
HU	4.00	0.88	1.00	5.00	-0.947	0.856	2.036	0.491
ME	4.08	0.72	1.00	5.00	-0.803	1.016	2.721	0.213

Table 1 shows that the mean score of all variables range from 4.00 to 4.22. The S.D. values are all below 1.00, indicating that the respondents' answers are clustered tightly around the mean. The skewness and kurtosis values of all variables fall within ± 2 , suggesting that the data from this study are normally distributed. In addition, the Variance Inflation Factor (VIF) and Tolerance values indicate that all independent variables fall within acceptable thresholds. The highest VIF value is 3.283, which does not exceed the critical value of 4.000, indicating no multicollinearity among the independent variables (Miles & Shevlin, 2001). Likewise, the lowest Tolerance value is 0.213, which are above the minimum acceptable level of 0.20. Therefore, the independent variables are not highly correlated with one another and do not exhibit multicollinearity (Pedhazur, 1997). Based on these results, multiple regression analysis is deemed appropriate for examining the relationships among the study variables.

Inferential Statistics

This section presents the correlations among all variables and examines the relationships between UAI, SIB, and ME.

Table 2 Results of Correlation Coefficients of the Variables (N=561)

Variables	1	2	3	4	5	6
1. Sustainable Investment Behavior (SIB)	1.000	0.569**	0.596**	0.575**	0.556**	0.789**
2. Performance Expectancy (PE)		1.000	0.791**	0.686**	0.656**	0.580**
3. Effort Expectancy (EE)			1.000	0.719**	0.653**	0.596**
4. Facilitating Conditions (FC)				1.000	0.630**	0.583**
5. Habit of Using (HU)					1.000	0.603**
6. Media Exposure (ME)						1.000

**Correlation is significant at the 0.01 level (2-tailed)

Table 2 presents the results of the Pearson correlation analysis examining the relationships among SIB, PE, EE, FC, HU, and ME among Gen Z. The correlation coefficients between each pair of variables range from 0.569 to 0.791, indicating positive relationships among the variables. These coefficients fall within acceptable levels, suggesting that the variables are appropriate and sufficiently related without being redundant. Therefore, the variables are suitable for further analysis using multiple regression.

Table 3 Results of Multiple Regression Analysis of UAI and SIB with ME as a Moderating Variable (Including Individual Dimensions: PE, EE, FC, and HU) (N=561)

Variables	Model1		Model2		Model3		Model4	
	B	Sig	B	Sig	B	Sig	B	Sig
Main effects								
Constant	1.179*	0.000	1.217*	0.014	1.164***	0.000	1.434**	0.006
UAI	0.720*	0.000	0.074	0.552				
ME			0.456**	0.001			0.376**	0.007
PE					0.124*	0.034	0.360	0.182
EE					0.233***	0.000	-1.042***	0.000
FC					0.199***	0.000	0.841**	0.001
HU					0.167***	0.000	-0.124	0.389
Interaction effects								
UAI x ME			0.045	0.148				
PE x ME							-0.081	0.232
EE x ME							0.295***	0.000
FC x ME							-0.184***	0.002
HU x ME							0.030	0.413
R	0.655		0.807		0.657		0.815	
R ²	0.430		0.651		0.431		0.664	
Adjusted R ²	0.429		0.649		0.427		0.659	
F	421.124		346.450		105.331		121.217	
ΔR ²			.221				0.233	
ΔF			176.36				76.42	

Note: * p < .05; ** p < .01; *** p < .001.

Table 3 presents the results of the multiple regression analysis examining the moderating effect of media exposure (ME) in the relationship between UAI and SIB among Gen Z. Four models were compared.

Model 1 indicated that the UAI has a positive effect on SIB among Gen Z at the 0.000 significance level ($p < .001$). The UAI variable explains 43.00% of the variance in SIB among Gen Z ($R^2 = 0.430$), while the remaining 57% is influenced by other factors not included in the model. The results of Model 1 indicate that the use of Artificial Intelligence (UAI) has a statistically significant positive effect on sustainable investment behavior (SIB) among Gen Z ($p < .001$). Therefore, H1 is supported. The prediction equation for Model 1 is as follows:

$$\text{SIB among Gen Z} = 1.179 + 0.720 (\text{UAI})$$

Model 3 examines each dimension of UAI separately. The results indicate that all four dimensions of UAI have a statistically significant positive effect on SIB among Gen Z, with significance levels ranging from $p < .001$ to $p < .05$ (0.000–0.034). The four individual dimensions explain SIB 43.10% of the variance in SIB ($R^2 = 0.431$). The findings of Model 3 support H2, which posits that each dimension of UAI, namely, performance expectancy (PE), effort expectancy (EE), facilitating conditions (FC), and habit of using (HU), has a statistically significant positive effect on SIB among Gen Z. Therefore, H2 is supported. The prediction equation is as follows:

$$\text{SIB} = 1.164 + 0.124(\text{PE}) + 0.233(\text{EE}) + 0.199(\text{FC}) + 0.167(\text{HU})$$

Model 2, which incorporates ME as a moderating variable and includes the interaction term between UAI and ME (UAI $\times$ ME) to examine its moderating role in the relationship between UAI and SIB. The results indicate that ME does not significantly moderate the relationship between UAI and SIB ($B = 0.045$, $p = 0.148 > 0.05$), indicating that variations in ME, whether they increase or decrease, do not significantly influence the strength of the relationship between UAI and SIB. Furthermore, when ME is included as a moderating variable, the previously significant effect of UAI on SIB observed in Model 1 becomes insignificant ($B = 0.074$, $p = 0.552 > 0.05$). In contrast, ME demonstrates a statistically significant, positive direct effect on SIB ($B = 0.456$, $p = 0.001$). Therefore, the findings of Model 2 indicate that H3 is rejected, as ME does not significantly moderate the relationship between UAI and SIB among Generation Z, even though the model explains a greater proportion of variance in SIB (R^2 increased from 0.430 to 0.651) after including the moderating variable.

Model 4 investigates media exposure (ME) as a moderating variable in the relationship between the individual dimensions of UAI and SIB among Gen Z. The results indicate that ME moderates the relationship between certain dimensions of UAI and SIB. Specifically, the interaction term effort expectancy (EE) $\times$ ME is statistically significant and positive, suggesting that higher levels of ME strengthens the relationship between EE and SIB. In contrast, the interaction term facilitating conditions (FC) $\times$ ME is statistically significant and negative, indicating that ME weakens the relationship between FC and SIB. Meanwhile, the interaction terms performance expectancy (PE) $\times$ ME and habit of using (HU) $\times$ ME are not statistically significant, implying that ME does not moderate the relationships involving PP and HU. Although Model 4 demonstrates stronger explanatory power ($R^2 = 0.664$) compared to Model 3 ($R^2 = 0.431$) without the moderator, the findings in Model 4 indicate that the moderating role of ME only affects specific dimensions of UAI, namely EE and FC, in shaping SIB among Gen Z. Therefore, based on the results of Model 4, H4 is partially supported, as Media Exposure (ME) significantly moderates the relationships between certain dimensions of UAI and SIB among Generation Z, specifically EE and FC, but does not significantly moderate the relationships involving PE and HU.

Discussions

Objective1: To investigate the relationship between the use of artificial intelligence (UAI) and sustainable investment behavior (SIB) among Generation Z.

As shown in Model 1, UAI has a significant positive influence on SIB among Gen Z . This result aligns with Dwivedi et al. (2021) and Morgan Stanley (2023), who emphasized that AI strengthens analytical capability and intelligent decision support across domains. The use of AI enables investors to access, process, and interpret large volumes of financial and sustainability-related information, thereby supporting more informed, data-driven, and responsible investment decisions. In addition, Khamglad (2025) argued that modern investors demand diverse and advanced information services to support their investment decisions in increasingly digitalized financial markets. Therefore, the empirical results confirm that the use of Artificial Intelligence (AI) has a significant positive influence on the sustainable investment behavior of Generation Z.

Objective2: To examine the influence of each dimension of the use of artificial intelligence (UAI) on sustainable investment behavior(SIB) among Generation Z.

As shown in Model 3, when UAI is analyzed by individual dimensions, including PE, EE, FC and HU, the results remain significant positive on SIB. These findings suggest that Gen Z understands how to use AI to analyze and improve investment outcomes, which reflects the PE dimension, The EE dimension encourages the adoption of SIB through the perceived ease of using AI technologies. In addition, facilitating conditions support the use of AI through adequate technical and organizational infrastructure, while habit of using sustains the continuous reliance on AI in daily investment activities. These findings are consistent with Lupiyoadi et al. (2025), who confirmed the importance of performance expectancy, effort expectancy, and facilitating conditions in AI adoption, which increases the use of AI technologies. Similarly, Schrank (2025) found that these dimensions significantly influence users' behavioral intentions toward AI systems. Therefore, both the overall use of AI and its individual adoption dimensions positively shape Generation Z's investment behavior toward more informed and sustainable practices. This result is also consistent with Park & Oh (2022), who apply the Unified Theory of Acceptance and Use of Technology (UTAUT) model, which comprises four key components: performance expectancy, effort expectancy, social influence, and facilitating conditions. Their findings found that when individual investors integrate ESG information into their investment decision-making processes, they are more likely to develop into socially conscious investors over the long term. In addition, Lin & Lee (2025) also confirmed that performance expectancy, effort expectancy, social influence and facilitating conditions have significant positive effects on the continuance intentions of green FinTech users.

Objective3: To assess the moderating role of media exposure(ME) in the relationship between the use of artificial intelligence (UAI) and sustainable investment behavior (SIB) among Generation Z.

The findings in Model 2 indicate that when ME is included as a moderating variable, it does not significantly affect the relationship between UAI and SIB among Gen Z. This suggests that the variations in the level of ME do not meaningfully alter either the strength or the direction of the relationship between UAI and SIB. These findings are consistent with Wang (2026), who reported that AI policies in China increase youth entrepreneurship by reducing reliance on unequal access to social media. The effect is particularly pronounced among rural residents with low internet access and limited media exposure compared with their urban counterparts. This suggests that media exposure alone may not significantly alter behavioral outcomes. In addition, Phung & Quyen (2025) found that when social media influencers, such

as finfluencers, are perceived as genuine and not purely sales-driven, their recommendations exert a stronger influence on followers' investment attitudes. Conversely, when finfluencers are perceived as engaging in superficial green promotion or providing biased advice, or when comments and success stories shared within online communities lack authenticity and credibility, investors may become less willing to invest in sustainable financial products. Instead, traditional factors such as expected returns, risk perception, and performance expectations remain more influential in shaping investment decisions (Lestari & Wiryono, 2023; Wong, 2025).

Moreover, beyond the influence of social media and finfluencers on sustainable investment behavior, Gen Z is often described as self-reliant generation that has grown up with digital media and exhibits multichannel media exposure behavior their media consumption is continuous and intensive, particularly through online platforms, and such exposure can shape the issues they consider important and influence how they evaluate investment alternatives (McCombs, 2020). In addition, social norms derived from family members and peers have also been found to exert a stronger influence on Gen Z than influencers (Blessilda, 2025). This is further supported by Treetanont & Chantuk (2016), who reported that young investors in the Market for Alternative Investment (MAI) tend to rely on digital platforms and supporting systems for short-term, high-risk investment strategies rather than sustainability-focused decision-making.

However, although the results of Model 2 indicate that although ME does not function as a moderating variable, it has a significant direct effect on SIB. This finding is consistent with Khatik et al. (2021) who found that social media, particularly from YouTube, Facebook, and Twitter, constitutes the most significant factor directly affecting Gen Z's investment decision. Similarly, research on Thai Gen Z investors by Buarai Khing (2025) indicated that social media usage and reliance on financial influencers significantly shape how young investors perceive and respond to investment information, highlighting the important role of online content in shaping investment behavior and trust in digital financial channels. Additional evidence from the Stock Exchange of Thailand (2025) and Khamglad (2025) also indicated that media exposure enhances the effectiveness of user-friendly digital investment platforms, which in turn supports sustainability-oriented investment behavior among young investors.

Objective 4: To evaluate the moderating effect of media exposure (ME) on the relationship between each dimension of the use of artificial intelligence (UAI) and sustainable investment behavior(SIB) among Generation Z.

When UAI is examined at the dimensional level as shown in Model 4, the moderating role of media exposure (ME) becomes more evident. However, only EE demonstrates a positive moderating effect, whereas FC exhibits a negative moderating effect. This finding suggests that the influence of ME does not operate uniformly across all UAI dimensions. These findings support Schrank (2025), who argue that excessive ME, combined with advanced digital investment tools, can lead to information overload and reduced investors' ability to critically evaluate ESG-related information. As a result, this condition may weaken the positive influence of FC on sustainable investment behavior. Moreover, excessive ME may induce cognitive fatigue and make it more difficult for them to make investment decisions. (Jinsong & Jing, 2025; Shalu et al., 2025). In addition, imitative behavior may emerge when Gen Z investors experience peer pressure and observe finfluencers reporting higher profits from cryptocurrency investments compared to sustainable investments. In such situations, even when AI-driven sustainable investment platforms provide adequate facilitating conditions, Gen Z investors may shift their preference toward cryptocurrency investments rather than sustainable investments. (Kuldilok & Satitsamitpong, 2023; Nagarajan, 2023).

Conclusion and suggestions

This study provides empirical evidence on the factors influencing the sustainable investment behavior of Generation Z in Bangkok and metropolitan areas, particularly in relation to the use of Artificial Intelligence (AI) moderated by media exposure. The findings indicated that the overall use of AI significantly influences the sustainable investment behavior of Gen Z. When examining individual dimensions of the use of AI, the results also demonstrate a significant positive effect.

However, when media exposure is introduced as a moderating variable, the overall use of AI on the sustainable investment behavior of Gen Z becomes statistically insignificant. Furthermore, although certain dimensions of the use of AI, specifically, effort expectancy and facilitating conditions, still show significant effects, the direction of the effect for the facilitating conditions changes from positive to negative under the moderating influence of media exposure.

Practical implications: these findings highlight the importance of aligning the social media strategies (media exposure), which can either strengthen or weaken the impact of the use of AI on the sustainable investment behavior of Gen Z in Bangkok and the metropolitan area. Sustainable investment behavior typically involves long-term decision-making and requires in-depth understanding and careful evaluation, which differs from most of the influencers' investment strategies, who tend to exert stronger influence on short-term or speculative investment behaviors. Additionally, the moderating effect of media exposure is particularly strong among Gen Z, who are characterized by intensive digital media consumption and heightened susceptibility to social trends. Therefore, policymakers, financial institutions, and digital platform providers should carefully design their strategies in ways that help users, particularly Gen Z, better understand sustainable investment, which can encourage more responsible and long-term sustainable investment behaviors.

New knowledge and the effects on society and communities

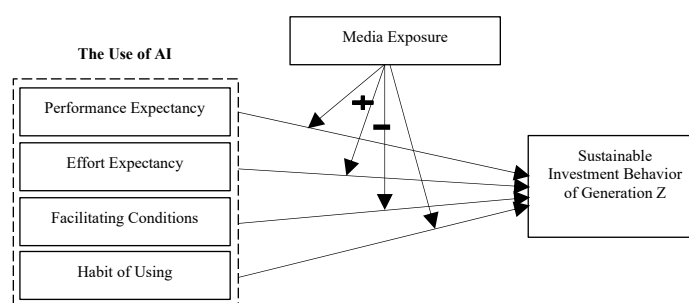


Figure 2 New knowledge summaries by the researchers

According to Figure 2, this research provides new knowledge and highlights several effects on society and communities. First, only certain dimensions of the use of AI have a significant effect on sustainable investment behavior, rather than all dimensions of the use of AI, as suggested by the Unified Theory of Acceptance and Use of Technology (UTAUT) and UTAUT 2. After including media exposure as a moderating variable, the findings indicate that not all core determinants serve as important tools for supporting informed and sustainability-oriented investment decisions. Second, media exposure plays a critical role in either strengthening or weakening the influence of the use of AI on the sustainable investment

behavior of Gen Z. Third, the negative effect of facilitating conditions on the sustainable investment behavior among Gen Z in Bangkok and metropolitan areas may be explained by the highly supportive digital infrastructures, which may inadvertently encourage frequent transactions and speculative behavior, thereby reducing attention to long-term considerations.

The findings emphasize the key factors influencing the sustainable investment behavior of Gen Z. When media exposure promotes ESG principles and sustainability concepts, Gen Z, as a self-reliant generation, is more likely to allocate capital to sustainable businesses. In contrast, when influencers promote speculative trends, Gen Z investors tend to shift toward short-term opportunities. As Gen Z will represent a major investor cohort soon, appropriately designing AI systems and social media platforms to support sustainable investment practices could help cultivate a new generation of investors who are more socially responsible and oriented toward long-term impact.

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Community and Social Development Journal : CSDJ

is a Journal to support academic work for Community and Social Development

Aim and scope to publish articles that are beneficial to society or locality in Social Sciences & Humanities, with 3 sub-subject. 1) Social Development 2) Education Sociology 3) Business and Management for social development which can be shown that it is able to solve problems or improve society, community and locality. Moreover, it clearly brings benefits, or changing in awareness and perception of problems and solutions of community and locality, with research elements that indicate the spatial change condition of community and society. It is the participatory research and accepted by society. It is the research that uses knowledge or proficiency, which transforming in the better way, or it can be anticipated. Evaluate changing results and propose guidelines for social development, community and local to be sustainable.

Publication Frequency: Issued 3 editions per year:

Issued 1 : January - April

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Types of Articles :

Research Articles: Present a brief report on a specific research result or a major problem. Social Sciences, Business, Management and Accounting Each article must clearly present the research question, detailed methodology, study content, results, discussion, conclusion and suggestions, new knowledge and the effects on society and communities.

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Community and Social Development Journal : CSDJ (Formerly known as : Rajabhat Chiang Mai Research Journal)

Name of the journal (new): Community and Social Development Journal

ISSN 3027-7493 (Online)

ISSN 3027-7485 (Print)

From Vol 25 No 1 January - April 2024 onwards.

Name of the journal (formerly): Rajabhat Chiang Mai Research Journal

ISSN 2651-2068 (Online)

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From Vol 1 No 1 1999 - Vol 24 No 3 2023

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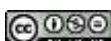
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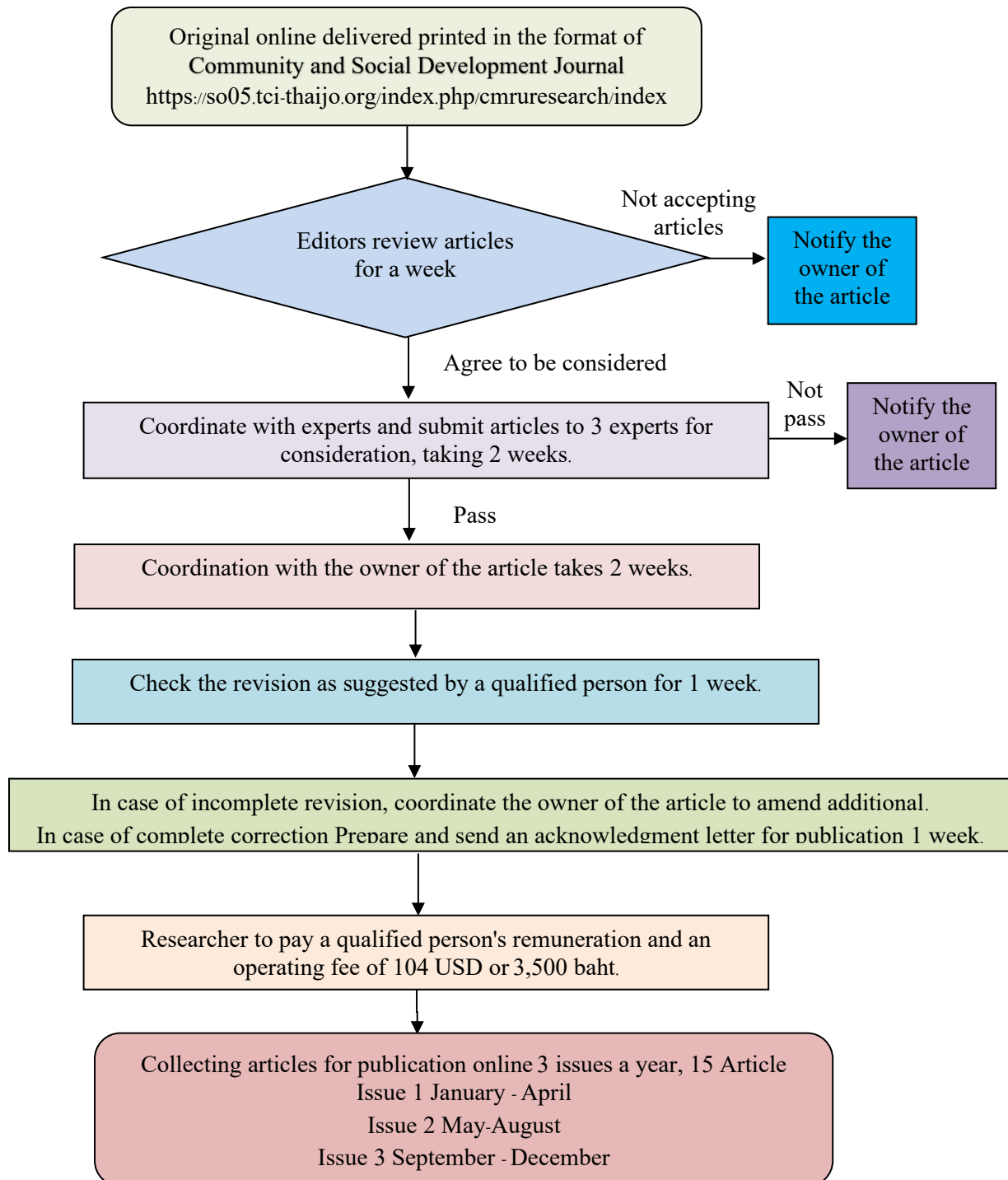
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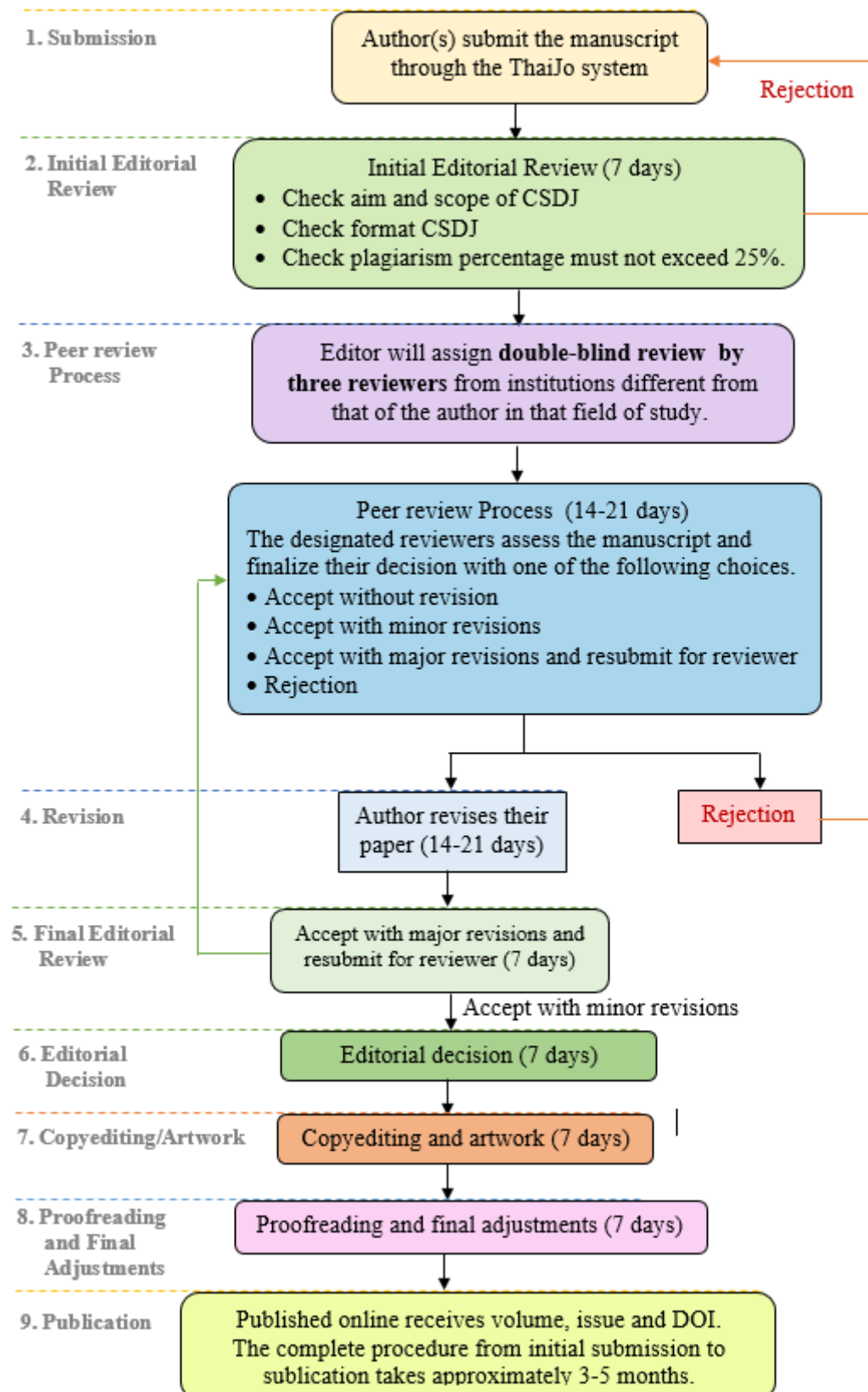
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