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When High-Tech Meets High-Touch: An Evidence-Based Model for Reforming Doctoral Education in the AI Era

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abstract

Background: The rapid spread of artificial intelligence (AI) and digital automation has created an urgent need to transform postgraduate curriculum design. While higher education institutions race to integrate digital analytics, conventional doctoral programs still struggle to balance computational capabilities ("high-tech") with human-centric, relational, and cross-cultural proficiencies ("high-touch").
Aims: This study investigates stakeholder perceptions of ideal doctoral capabilities within an interdisciplinary curriculum and examines how curricular dimensions—specifically Technology Integration, Intercultural Emphasis, and Experiential Pedagogy—predict perceived doctoral program relevance.
Methods: Employing a convergent mixed-methods design (QUAL + QUAN), qualitative data were gathered through semi-structured interviews and focus groups with key academic and corporate stakeholders ($N = 25$) and examined using reflexive thematic analysis. Concurrently, quantitative data collected from 200 key educational and industry stakeholders were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the predictive architecture.
Results: Reflexive thematic analysis identified four interconnected core competencies: Data-Driven Strategic Thinking, Cross-Cultural Leadership, Applied Experiential Learning, and an Innovation Mindset. Quantitative structural validation revealed that the three curricular dimensions accounted for 62% of the variance in perceived program relevance ($R^2 = 0.62$, $Q^2_{\text{predict}} = 0.40$). Crucially, Intercultural Emphasis ($\beta = 0.45$, $p < 0.001$, $f^2 = 0.34$) emerged as the dominant structural predictor, decisively surpassing Technology Integration ($\beta = 0.31$, $p < 0.001$, $f^2 = 0.18$) and Experiential Pedagogy ($\beta = 0.28$, $p < 0.01$, $f^2 = 0.17$).
Conclusion: The findings articulate the "High-Tech Commodity vs. High-Touch Differentiator Paradox": in an era where computational tools are increasingly democratized, interpersonal and intercultural capabilities represent the primary drivers of strategic value. This study offers an empirically validated, contextually adaptable reference architecture to modernize doctoral education and bridge technological and humanistic domains.

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1. Introduction

Doctoral education is undergoing fundamental structural recalibration worldwide. The traditional paradigm of postgraduate training—characterized by insular hyper-specialization focused almost exclusively on academic tenure tracks—has grown increasingly disconnected from an interconnected global landscape characterized by generative digital transformation, cross-border service operations, and complex societal challenges (Botelho & Myers, 2023; Damnet et al., 2024; Mumba et al., 2023; Murray et al., 2023). In modern knowledge-based economies, scholarly excellence can no longer be defined solely by disciplinary publications; it must demonstrate tangible societal impact, civic engagement, and actionable problem-solving (Latif et al., 2024; Nowell, 2025; Sudirjo et al., 2024). Higher education institutions are consequently transitioning from passive intellectual silos into dynamic catalysts of cross-sectoral innovation (Anugrah et al., 2024; Edwards et al., 2025).

Within this emerging paradigm, preparing doctoral researchers to address complex societal challenges demands boundary-spanning capabilities (Murray et al., 2023; Popatia et al., 2026). In the modern service economy, "Service Innovation" requires the collaborative co-creation of novel service architectures by synthesizing technological automation with user-centered design (Kannikar & Sangnak, 2026; Nanthakwang & Sangnak, 2026). Concurrently, "Intercultural Communication" extends far beyond linguistic translation to encompass the cognitive flexibility and cultural empathy needed to establish shared meaning across culturally heterogeneous environments (DiBiasio et al., 2023; Maneethai, 2025; Sabet & Chapman, 2023). Fusing these domains develops scholarly leaders who can steward transformations that are both technologically advanced and culturally grounded (Haskollar & Bagwe, 2022; Jaiswal et al., 2024; Wibowo et al., 2024).

1.1 Digital disruption and the need for high-tech competencies in graduate curricula

The rapid proliferation of artificial intelligence, machine learning pipelines, and cloud analytics has made computational fluency an essential foundation across higher education (Chen & Cheung, 2025; Hughes et al., 2025; Liang et al., 2025; Memon & Kwan, 2025). Recent empirical research emphasizes that introducing generative AI into university curricula requires developing advanced AI literacy and strategic data interpretation rather than merely training students in routine software operation (Fu et al., 2026; Mahajan, 2026; Qian, 2025; Yan et al., 2024). In professional and doctoral programs, cultivating digital capability involves capturing tacit knowledge and applying automated systems toward high-level organizational decision-making (Khafizova et al., 2023; Mahmud et al., 2026; Nanthakwang & Sangnak, 2026; Smith et al., 2025).

However, the rapid adoption of AI technologies in academic curricula frequently outpaces pedagogical frameworks (Kelly et al., 2025; Soleimani et al., 2025). While AI-driven personalization and automated tools can boost analytical productivity, they also pose substantial risks of algorithmic bias, digital anxiety, and ethical governance challenges (Hu et al., 2026; Ismail & Zafira, 2026; Montazeri et al., 2026; Shishehgar et al., 2025; Tamnanwan & Sangnak,

2026a). Consequently, higher education scholars argue that graduate curricula must prepare students to critically evaluate automated models, address algorithmic opacity, and contextualize computational outputs within broader human systems (Kim et al., 2025; Maia & Gregório, 2026; Shimizu et al., 2023; Tolentino et al., 2025).

1.2 The High-Touch Imperative: Intercultural Competence and Experiential Pedagogy

Parallel to technological disruption, the modern service landscape increasingly rewards relational and intercultural intelligence (Dooley et al., 2023; Guillén-Yparrea & Ramírez-Montoya, 2023; Hang & Zhang, 2023). Across internationalized enterprises, digital transformation projects stall not because of algorithmic failures, but because of communicative breakdowns, misaligned cultural values, and an inability to foster mutual trust across multicultural teams (Sagarra-Romero et al., 2024; Tamnanwan & Sangnak, 2026b; VanHoose & Eigsti, 2023). Intercultural competence—defined as the developmental trajectory from ethnocentric defensiveness toward ethnorelative adaptation—serves as the critical operational capability that allows leaders to manage diverse stakeholder coalitions and mitigate cultural friction (Luo & Chan, 2022; Walkowska et al., 2025; Wiersma-Mosley & Garrison, 2022).

To integrate these technological ("high-tech") and relational ("high-touch") dimensions, pedagogical structures must shift from passive instructional models to experiential learning paradigms (Borowczyk et al., 2023; Brauer et al., 2023; Maneethai, 2025; Wibowo et al., 2024). Experiential learning engages candidates in continuous cycles of concrete action, critical reflection, abstract conceptualization, and collaborative experimentation (Gruss et al., 2025; Quintos-Alagheband et al., 2024). When embedded within authentic industry practicums and community-engaged labs, experiential pedagogy equips doctoral scholars to translate theoretical principles into contextualized, sustainable solutions (Hill et al., 2024; Murray et al., 2023; Sangnak, 2025, 2026).

1.3 Conceptual Synthesis and Theoretical Framework

To establish theoretical coherence, this study integrates three foundational conceptual lenses into a unified framework for doctoral curriculum reform:

1. *Technological pedagogical content knowledge and AI literacy* provide the epistemological basis for computational fluency ("high-tech"), positing that graduate researchers must understand algorithmic mechanisms and data architectures to guide strategic decisions (Hughes et al., 2025; Yan et al., 2024).
2. *Intercultural communication competence (ICC)*—grounded in Bennett's developmental model of intercultural sensitivity (DMIS)—provides the human-centric lens ("high-touch"), conceptualizing intercultural capability not as an ancillary soft skill, but as an advanced cognitive and behavioral framework essential for global stakeholder alignment and empathetic leadership (DiBiasio et al., 2023; VanHoose & Eigsti, 2023).
3. *Experiential learning theory (ELT)* and the *Scholar-practitioner-leader (SPL) model* serve as the unifying operational bridge (Kolb, 1984; Mumba et al., 2023). ELT posits that transformative knowledge is generated through continuous cycles of concrete action, critical reflection, and active experimentation. At the same time, the SPL paradigm re-articulates the doctoral graduate's identity beyond pure scholarship toward societal application and transformative leadership.

By synthesizing these frameworks, we conceptualize perceived Curriculum Relevance as a multi-dimensional outcome driven simultaneously by technological capability, intercultural relational mastery, and experiential instructional translation. Despite the theoretical appeal of this synthesis, an empirical gap persists regarding how higher education institutions can design, structurally validate, and operationalize a doctoral curriculum that seamlessly integrates technical analytics with intercultural leadership (Bashirynejad et al., 2025; Farsi, 2025; Prentice et al., 2025). To address this gap, this study investigates an interdisciplinary doctoral curriculum reform at a leading research university in Thailand by addressing two central research questions:

RQ1: What core competency themes emerge from diverse stakeholder perspectives regarding the ideal doctoral graduate profile in service innovation and intercultural communication?

RQ2: How and to what extent do curriculum dimensions reflecting these competency themes quantitatively predict perceived curriculum relevance and effectiveness?

2. Methods

2.1 Research design

This study employed a convergent mixed-methods design ($\mathrm{QUAL} + \mathrm{QUAN} \rightarrow$ Integration) to examine doctoral curriculum reform (Creswell & Clark, 2017). Qualitative inquiry captured nuanced stakeholder perspectives on essential competencies (answering RQ1). Simultaneously, the study collected quantitative cross-sectional data to statistically model the predictive power of the emergent curricular dimensions using Partial Least Squares Structural Equation Modeling (PLS-SEM) (answering RQ2). Finally, the study integrated both strands through a joint-display matrix to derive meta-inferences regarding curriculum transformation.

2.2 Participants

2.2.1 Qualitative informants ($N = 25$)

A purposive maximum-variation sampling strategy captured diverse perspectives across four key stakeholder cohorts: academic faculty, university administrators, corporate executives, and doctoral alumni (Lincoln & Guba, 1985). The selection criteria required: (1) academic faculty to hold a doctorate and have ≥ 5 years of doctoral supervisory experience; (2) educational administrators to hold institutional leadership roles (Dean, Associate Dean, Program Chair); (3) corporate executives to have ≥ 8years of senior leadership experience in technology-enabled service industries; and (4) alumni to have graduated within the past 1–4 years and be active in academic or enterprise research. The qualitative sample comprised 25 key informants (Table 1).

Table 1. Demographic characteristics of qualitative key informants ($N = 25$)

Stakeholder Group	n	Informant Codes	Professional Profile & Selection Criteria	Avg. Experience
Senior Academic Faculty	6	F1–F6	Professors & Associate Professors in Service Management & D5 years of PhD supervision	16.4 Years

Educational Administrators	4	A1–A4	Deans, Associate Deans, & Graduate Curriculum Directors with postgraduate oversight	14.8 Years
Industry & Corporate Executives	8	E1–E8	C-Suite Executives, Managing Directors, & Senior Innovation Leads in AI servitization & banking	18.2 Years
Doctoral Alumni & Senior Candidates	7	AL1–AL7	Ph.D. graduates (1–4 years post-graduation) and final-year candidates in corporate & faculty roles	6.5 Years

2.2.2 Quantitative stakeholder sample ($N = 200$)

A stratified sampling approach was administered to validate the emergent curriculum architecture across relevant stakeholder segments. Of the 255 distributed questionnaires, 200 fully completed and valid responses were retained (effective response rate: 78.4%). As detailed in Table 2, the sample reflected broad representation across industry employers, university faculty, doctoral alums, and enrolled candidates.

Table 2. Demographic profile of quantitative survey respondents ($N = 200$)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Stakeholder Segment	Industry Employers & Executives	76	38.0
	Academic Faculty & Scholars	52	26.0
	Doctoral Alumni	42	21.0
	Advanced Doctoral Candidates	30	15.0
Gender	Male	108	54.0
	Female	92	46.0
Organizational Sector	Private Multinational & Tech Enterprises	84	42.0
	Public & Private Higher Education Institutions	78	39.0
	Government & Public Policy Agencies	38	19.0
Professional Experience	More than 15 years	64	32.0
	10–15 years	72	36.0
	5–9 years	44	22.0
	Less than 5 years	20	10.0

2.3 Research instruments

The quantitative survey instrument was developed through a three-stage operationalization procedure:

Item generation: Latent construct indicators were adapted from established literature and contextualized to reflect the qualitative themes: Technology integration (TECH1–TECH4; adapted from Huang, 2024; Hughes et al., 2025); Intercultural emphasis (CULT1–CULT4; adapted from DiBiasio et al., 2023; VanHoose & Eigsti, 2023); Experiential pedagogy (EXP1–

EXP4; adapted from Maneethai, 2025; Wibowo et al., 2024); and Curriculum relevance (REL1–REL4; adapted from Pakdeearporn & Sangnak, 2026b; Sangnak, 2026).

Content validity: An Item-Objective Congruence (IOC) evaluation was performed by five independent professors of higher education and curriculum design. All 16 retained items demonstrated an IOC score ≥ 0.80, verifying content validity.

Rating scale: All indicators were measured using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The qualitative protocol used a semi-structured interview guide focused on core competency demands, institutional barriers to curriculum innovation, and strategies for balancing digital automation with intercultural human leadership.

2.4 Data collection

Qualitative interviews (45–60 minutes) and three focus group sessions were conducted either in person or via secure teleconferencing. Audio recordings were transcribed verbatim, anonymized, and verified through member-checking with key informants. Quantitative data were gathered using an online survey platform distributed through institutional professional networks, alumni associations, and executive education databases. Participants were informed of data confidentiality, and participation was voluntary.

2.5 Data analysis

Qualitative interview transcripts were examined using Braun and Clarke's (2024) six-phase reflexive thematic analysis, supported by NVivo 14. Coding followed an iterative progression from line-by-line inductive coding to candidate theme development, cross-case boundary definition, and narrative synthesis.

In accordance with Braun and Clarke's (2024) Reflexive Thematic Analysis Reporting Guidelines (RTARG), explicit attention was directed toward researcher positionality and reflexivity. The investigative team included senior academic faculty members and institutional administrators directly involved in graduate curriculum design. While this insider status provided a nuanced understanding of institutional constraints and postgraduate benchmarks, it also carried the inherent risk of confirmation bias. To actively mitigate this, the researchers maintained continuous reflexive memoing throughout all coding phases, interrogating personal preconceptions regarding curriculum value and documenting analytical rationale. Interpretive trustworthiness was further reinforced through an exhaustive audit trail, independent secondary coding checks, peer debriefing sessions with external higher education experts uninvolved in the program, and member-checking procedures wherein transcribed summaries and tentative thematic networks were returned to participant representatives (F3, E2, AL4) to verify interpretive fidelity (Lincoln & Guba, 1985).

Quantitative structural modeling was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.0. PLS-SEM was chosen due to the exploratory and predictive nature of the research questions, the complex structural relationships among curricular constructs, and its robustness with non-normal composite data (Kannikar & Sangnak, 2026; Sangnak, 2026). The measurement model was evaluated for indicator reliability, convergent validity, and discriminant validity, followed by bootstrapping with 5,000 resamples to assess structural path coefficients, effect sizes (f^2), and out-of-sample predictive power (Q^2_{predict}).

3. Results

3.1 Measurement model evaluation

The measurement model was evaluated by examining outer factor loadings, internal consistency reliability, convergent validity, and discriminant validity. As presented in Table 3, all standardized indicator outer loadings exceeded the recommended 0.70 benchmark (ranging from 0.82 to 0.92). Construct reliability was confirmed, with Cronbach's α(0.91–0.94) and Composite Reliability (0.93–0.95) comfortably surpassing the 0.70 threshold across all constructs. Average Variance Extracted (AVE) values ranged from 0.73 to 0.80, exceeding the 0.50 cutoff and confirming convergent validity.

Table 3. Measurement model assessment and survey item operationalization

Latent Construct & Operational Indicators	Item Statement (Rated on 5-Point Likert Scale)	Base Source	Outer Loading	Cronbach's α	CR	AVE
Technology Integration		Hughes et al. (2025)		0.92	0.94	0.76
TECH1	The curriculum must equip students with algorithmic literacy to evaluate complex datasets.		0.85			
TECH2	Training must prepare candidates to leverage artificial intelligence in strategic decision-making.		0.88			
TECH3	The program should foster capacity to evaluate and design digital platform architectures.		0.90			
TECH4	Modules must integrate data analytics into actionable organizational and research strategies.		0.84			
Intercultural Emphasis		VanHoose & Eigsti (2023)		0.94	0.95	0.80
CULT1	Doctoral education must cultivate intercultural sensitivity across diverse worldviews.		0.91			
CULT2	The curriculum should build competencies in managing cross-cultural communication in teams.		0.88			
CULT3	Candidates should be trained to establish		0.92			

Latent Construct & Operational Indicators	Item Statement (Rated on 5-Point Likert Scale)	Base Source	Outer Loading	Cronbach's α	CR	AVE
	interpersonal trust and resolve cultural friction.					
CULT4	The program should foster inclusive leadership that mitigates algorithmic and cultural biases.		0.87			
Experiential Pedagogy		Maneethai (2025)		0.91	0.93	0.73
EXP1	Doctoral instruction should emphasize problem-based inquiry into unstructured challenges.		0.82			
EXP2	The curriculum should incorporate collaborative industry practicums and authentic case inquiry.		0.88			
EXP3	Candidates should engage in community-based action research addressing regional needs.		0.85			
EXP4	Pedagogical structures should facilitate iterative cycles of active experimentation and reflection.		0.86			
Curriculum Relevance		Sangnak (2026)		0.93	0.95	0.79
REL1	The curriculum prepares graduates to meet current and emerging labor market demands effectively.		0.90			
REL2	Competencies provide graduates with a distinct competitive advantage across diverse careers.		0.89			
REL3	The curriculum aligns strongly with global sustainability, technological, and cultural imperatives.		0.86			
REL4	The architecture produces scholarly leaders capable of solving complex, high-impact problems.		0.91			

Discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) ratio of correlations. As shown in Table 4, all HTMT ratios fell below the conservative 0.85 ceiling, verifying discriminant validity between all latent constructs.

Table 4. Discriminant validity evaluation (HTMT ratio)

Construct	Curriculum Relevance	Experiential Pedagogy	Intercultural Emphasis	Technology Integration
1. Curriculum Relevance	—			
2. Experiential Pedagogy	0.65	—		
3. Intercultural Emphasis	0.78	0.59	—	
4. Technology Integration	0.71	0.62	0.68	—

3.2 Structural model evaluation and predictive power

Collinearity diagnostics indicated that inner Variance Inflation Factor (VIF) values ranged between 1.3 and 1.8, well below the conservative threshold of 3.0, confirming the absence of multicollinearity. Bootstrapping analysis (5,000 resamples) showed that all three curricular predictors had statistically significant, positive effects on perceived Curriculum Relevance (Table 5).

Table 5. Structural path coefficients, collinearity statistics, and effect sizes

Structural Path	Path (β)	t-value	p-value	VIF	Effect Size (f^2)	Interpretation
Technology Integration →Curriculum Relevance	0.31	5.21	< 0.001	1.5	0.18	Medium Effect
Intercultural Emphasis →Curriculum Relevance	0.45	7.84	< 0.001	1.8	0.34	Large Effect
Experiential Pedagogy →Curriculum Relevance	0.28	4.65	< 0.01	1.3	0.17	Medium Effect

As summarized in Table 6, the three antecedent dimensions explained 62% of the variance in Curriculum Relevance ($R^2 = 0.620$, $R^2_{\text{adj}} = 0.614$). The Stone-Geisser blindfolding test yielded an out-of-sample predictive relevance value of $Q^2_{\text{predict}} = 0.400$, exceeding the 0.35 benchmark for substantial predictive relevance. Most notably, Intercultural Emphasis exhibited the largest relative effect size ($f^2 = 0.34$), substantially surpassing Technology Integration ($f^2 = 0.18$) and Experiential Pedagogy ($f^2 = 0.17$).

Table 6. Explanatory and predictive power (R^2 and Q^2)

Endogenous Construct	R^2Value	R^2_{adj}	Q^2_{predict}	Explanatory Relevance
Curriculum Relevance	0.620	0.614	0.400	Substantial (> 0.50)

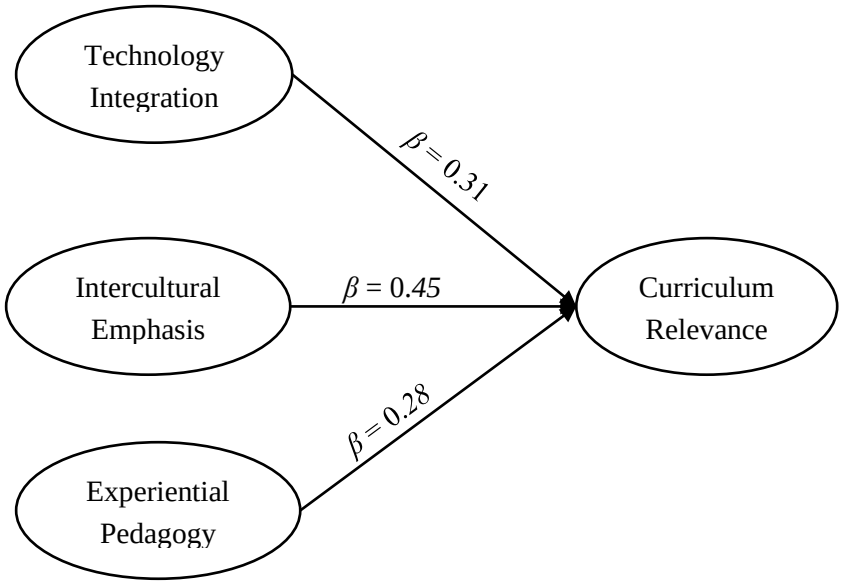


Figure 1. Structural model evaluation displaying path coefficients and explanatory power for perceived doctoral curriculum relevance

Figure 1 illustrates the final structural model evaluation derived from the Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis, detailing the standardized path coefficients (β), significance levels, and the coefficient of determination (R^2) for perceived Curriculum Relevance. As depicted, all three curricular dimensions exert statistically significant, positive direct effects on perceived doctoral program relevance. Specifically, Intercultural Emphasis emerges as the dominant structural predictor ($\beta = 0.45, p < 0.001$), followed by Technology Integration ($\beta = 0.31, p < 0.001$) and Experiential Pedagogy ($\beta = 0.28, p < 0.01$). Collectively, the structural model accounts for 62.0% of the total variance in Curriculum Relevance ($R^2 = 0.620, R^2_{\text{adj}} = 0.614$), demonstrating substantial explanatory capacity alongside robust out-of-sample predictive relevance ($Q^2_{\text{predict}} = 0.400$).

3.3 Qualitative thematic findings

Reflexive thematic analysis of the qualitative transcripts identified four interconnected core competency themes (answering RQ1):

Theme 1: Data-driven strategic thinking—from technician to strategist

Stakeholders emphasized that doctoral training must move beyond mechanical code execution or routine statistical analysis. Modern organizations require researchers who can interrogate algorithmic assumptions, interpret predictive data models, and translate technical insights into high-level organizational strategies:

Extract 1: "We do not need another data technician who simply runs regression scripts or builds machine learning pipelines in a vacuum. What our enterprise urgently demands is a strategic leader who looks at algorithmic outputs, understands the underlying business model, and translates quantitative insights into high-level organizational direction." (Participant E2, Senior Innovation Director, Multinational Enterprise)

Extract 2: "Doctoral researchers must be trained to bridge computational models with executive boardrooms. The value lies not in knowing how an algorithm functions mechanically, but in interrogating its assumptions, assessing data integrity, and formulating

strategic organizational foresight." (Participant E5, Enterprise Analytics Lead, Banking Sector)

Theme 2: Cross-cultural leadership—the non-negotiable core

All stakeholder cohorts consistently identified cross-cultural leadership as an essential competency. Informants reported that cross-border service operations and digital transformations rarely fail because of software crashes; rather, they falter due to interpersonal friction, cultural misalignments, and an inability to build trust across diverse teams:

Extract 3: "When cross-border digital transformation initiatives stall, it is rarely because the server failed or the software broke down. It fails because of interpersonal friction, misaligned cultural values, and an inability to build trust across culturally heterogeneous teams." (Participant E1, Vice President of Global Operations)

Extract 4: "In doctoral education, we often assume leadership and cultural empathy are 'soft skills' that students can figure out on their own. That is a critical mistake. In global service ecosystems, cross-cultural competence is the non-negotiable core capability required to manage diverse stakeholder coalitions." (Participant A3, Educational Administrator & Curriculum Director)

Theme 3: Applied experiential learning—bridging theory and practice

Employers and alumni critiqued conventional doctoral programs for ivory-tower detachment. Stakeholders advocated for curriculum architectures that embed candidates in messy, real-world industry dilemmas and community action research:

Extract 5: "Theory provides the foundational scaffolding, but what truly prepared me to lead was tackling authentic industry projects during my doctoral coursework. Confronting messy, unstructured organizational dilemmas with real corporate partners forced us to translate abstract concepts into actionable field solutions." (Participant AL3, Doctoral Alumnus & Corporate Research Lead)

Theme 4: The innovation mindset—cultivating proactive change-makers

Stakeholders prioritized an innovation mindset characterized by psychological resilience, comfort with ambiguity, and design thinking. As routine cognitive tasks become automated by AI, doctoral graduates must develop the confidence to experiment, pivot, and navigate complex challenges:

Extract 6: "In an era where artificial intelligence automates routine cognitive tasks, doctoral graduates must possess comfort with ambiguity. We need doctoral thinkers who do not panic when a framework breaks down, but who rapidly prototype, pivot, and iterate solutions." (Participant E4, Managing Director of Digital Solutions)

3.4 Mixed-methods integration

Qualitative thematic narratives and quantitative structural parameters were synthesized into a joint-display matrix (Table 7). The integration demonstrates direct convergence and conceptual expansion: while quantitative modeling confirmed the statistical significance of computational analytics ($\beta = 0.31$), qualitative insights revealed that technical skills represent a standard operational baseline. Conversely, qualitative narratives clarified why Intercultural Emphasis emerged as the dominant statistical predictor ($\beta = 0.45$, $f^2 = 0.34$), establishing that interpersonal trust and cross-cultural diplomacy are the primary bottlenecks in global service transformation.

Table 7. Joint-display matrix integrating qualitative themes and quantitative parameters

Qualitative Theme	Exemplar Quotation	Matched Construct	Quantitative Metric	Nature of Integration	Meta-Inference / Integrated Conclusion
Theme 1: Data-Driven Strategic Thinking	"What our enterprise demands is a strategic leader who looks at algorithmic outputs and translates insights into direction." (P-E2)	Technology Integration	$\beta = 0.31, p < 0.001 (f^2 = 0.18)$	Convergence	Computational fluency serves as an essential baseline capability, explaining its significant medium effect size.
Theme 2: Cross-Cultural leadership	"When digital transformations stall, it is almost never because the server failed. It fails because of interpersonal friction." (P-E1)	Intercultural Emphasis	$\beta = 0.45, p < 0.001 (f^2 = 0.34)$	Expansion & Dominance	Human relational trust is the primary bottleneck in digital systems, making cross-cultural leadership the premier value differentiator.
Theme 3: Applied Experiential Learning	"Confronting messy, unstructured organizational dilemmas forced us to translate abstract concepts into field solutions." (P-AL3)	Experiential Pedagogy	$\beta = 0.28, p < 0.01$ ($f^2 = 0.17$)	Convergence	Authentic experiential engagement provides the pedagogical vehicle required to operationalize theory into practice.

3.5 Competency architecture and strategic benchmarking

Translating these integrated findings into actionable educational design, Table 8 outlines a competency architecture spanning five doctoral learning domains aligned with international qualifications standards.

Table 8. Strategic competency architecture for reformed doctoral education

Core Domain	Advanced Competency Dimension	Integrated 21st-Century & AI Capabilities	Service Innovation Applications	Intercultural Communication Applications
Original Knowledge Creation	Epistemological Independence & Theoretical Synthesis	Advanced systems thinking; algorithmic	Formulate novel conceptual models of service	Construct theories on communication dynamics and digital friction in

Core Domain	Advanced Competency Dimension	Integrated 21st-Century & AI Capabilities	Service Innovation Applications	Intercultural Communication Applications
		theory synthesis	ecosystems and platforms	multicultural settings
Empirical Research Leadership	Methodological Rigor & Research Governance	Computational data analysis; mixed methods; AI literacy	Design empirical studies to evaluate data-driven servitization models	Deploy digital ethnography to capture cultural dynamics in digitalized settings
Global Knowledge Mobilization	Scholarly Dissemination & Boundary-Spanning	Digital research mobilization; scholarly communication	Mobilize innovation findings to global industry executives and policy bodies	Lead international academic debates and bridge cross-cultural organizational divides
Applied Impact & Sustainable Value	Societal Impact & Transformative Leadership	Strategic foresight; human-centered design thinking	Provide strategic advisory on developing sustainable, responsive services	Formulate institutional policies promoting intercultural equity and community engagement
Ethical Governance & Lifelong Learning	Professional Ethics & Adaptive Stewardship	Algorithmic bias mitigation; data privacy; Cultural Intelligence	Direct ethical governance over AI deployment and automated service delivery	Mitigate cultural bias within automated algorithms and communication systems

To evaluate external validity and contextual positioning, the proposed architecture was benchmarked against three leading international postgraduate programs: the Executive Master of Management in Hospitality (EMMH) at Cornell University, the Master of Arts in Intercultural Communication at University College London (UCL), and the Master of Science in Education in Language, Globalization, and Intercultural Studies (M.S.Ed. LGIS) at the University of Pennsylvania (UPenn).

These benchmark programs were purposively selected based on three criteria:

Global Standing and Programmatic Prestige: All three comparator institutions represent globally recognized leaders with established accreditation in business innovation, communication studies, and applied educational practice.

Representative Curricular Diversity: The selected programs represent three distinct pedagogical paradigms: specialized corporate management (Cornell), theoretical-critical communication (UCL), and applied ethnographic field practice (UPenn). This diversity provides a robust spectrum against which our convergent "high-tech/high-touch" doctoral model can be evaluated.

Data Accessibility and Structural Maturity: Each benchmark program maintains fully transparent, mature curriculum documentation, allowing for systematic structural analysis.

The benchmarking data were retrieved from verified institutional sources, including official graduate course catalogs, program specification handbooks, degree audit rubrics, and published program learning outcomes (PLOs) across the 2024–2025 academic cycles (Table 9).

Table 9. Comparative benchmarking against international postgraduate curricula

Dimension	This Reformed Doctoral Model (Ph.D.)	Cornell University (EMMH Program)	University College London (MA Intercultural Comm.)	University of Pennsylvania (M.S.Ed. Program)
Primary Curriculum Focus	Balanced Synthesis: Strategic service innovation, computational AI fluency, & intercultural leadership	Specialized Business: Hospitality enterprise management, corporate finance, & operations	Specialized Theory: Critical linguistic and sociological theories of intercultural communication	Specialized Applied Practice: Ethnographic methods and educational community applications
Technology Integration	Core: Mandatory modules in AI ethics, big data strategy, and digital platform design	High (Elective): Applied electives in enterprise hospitality automation	Low: Limited to standard digital communication platforms	Low: Qualitative educational software applications
Culture Integration	Core: Central organizing construct embedded across research seminars	Peripheral: Addressed via organizational diversity electives	Core: Foundational subject matter of the entire degree	Core: Central subject matter applied to educational systems
Pedagogical Approach	Project-based experiential field labs & collaborative industry practicums	Executive case-study method and corporate guest lectures	Theoretical research seminars & traditional academic dissertations	Service-learning, participant observation, & ethnographic field internships
Distinct Positioning	Strategic Intercultural Innovator: Bridging business, AI technology, & culture	Producing data-driven hospitality corporate executives	Producing academic researchers and communication theorists	Producing ethnographic practitioners for educational environments

4. Discussion

4.1 The high-tech commodity vs. high-touch differentiator paradox

A primary empirical finding of this study is the decisive statistical dominance of Intercultural Emphasis ($\beta = 0.45$, $f^2 = 0.34$) over Technology Integration ($\beta = 0.31$, $f^2 = 0.18$) in predicting doctoral curriculum relevance. While contemporary discourse frequently suggests that AI-era curricula should focus almost entirely on coding, machine learning, and quantitative metrics (Chen & Cheung, 2025; Fu et al., 2026; Liang et al., 2025), our empirical results reveal what we term the "High-Tech Commodity vs. High-Touch Differentiator Paradox."

As generative AI tools, low-code analytics platforms, and automated machine learning systems proliferate, technical execution is rapidly shifting from a scarce competitive asset into a baseline operational commodity (Hughes et al., 2025; Memon & Kwan, 2025; Nanthakwang & Sangnak, 2026; Yan et al., 2024). Conversely, the capacity to interpret ambiguous sociotechnical dynamics, establish trust across culturally diverse teams, resolve interpersonal friction, and navigate complex ethical tensions remains deeply human and resistant to automation (DiBiasio et al., 2023; Maneethai, 2025; VanHoose & Eigsti, 2023). Stakeholders do not dismiss technical skills; rather, they recognize that high-tech capabilities cannot deliver sustainable organizational value without high-touch competencies that contextualize algorithmic outputs within human cultural systems (Kannikar & Sangnak, 2026; Tamnanwan & Sangnak, 2026a).

4.2 Experiential pedagogy as the operational bridge

Our findings also highlight Experiential Pedagogy ($\beta = 0.28$, $f^2 = 0.17$) as the critical instructional bridge linking technology and culture. Traditional lecture-based formats are ill-suited for developing adaptive leadership (Brauer et al., 2023; Gruss et al., 2025). By embedding candidates in collaborative industry practicums and community-based action labs, experiential learning forces students to navigate unstructured organizational dilemmas where data analytics and human politics collide (Dooley et al., 2023; Murray et al., 2023; Sangnak, 2025; Wibowo et al., 2024). Experiential engagement grounds theoretical abstractions in practice, cultivating researchers who can innovate within complex social ecosystems (Hill et al., 2024; Quintos-Alagheband et al., 2024).

4.3 Theoretical contributions and practical implications

This study offers three notable contributions:

1. *Resolving the High-Tech/High-Touch Duality:* Rather than treating technical fluency and cultural empathy as competing educational priorities, this study demonstrates their empirical complementarity, identifying intercultural capability as the primary multiplier of technological relevance.
2. *Re-conceptualizing Graduate Attributes:* By establishing the "Strategic Intercultural Innovator" profile, this research advances postgraduate curriculum theory beyond narrow tenure-track models toward an integrated, cross-sectoral leadership paradigm (Botelho & Myers, 2023; Mumba et al., 2023).
3. *Methodological Rigor in Curriculum Reform:* The convergent mixed-methods framework (QUAL → QUAN PLS-SEM) shifts curriculum innovation from subjective

committee debates toward an empirical, predictive, and evidence-based design methodology.

For higher education administrators, academic deans, and curriculum committees, these findings offer a contextually adaptable framework for curriculum redesign. Rather than presenting a rigid universal blueprint, this study provides an adaptable reference architecture that institutions can calibrate to their institutional missions and regional contexts. Educational leaders are cautioned against over-investing in narrow technical electives while neglecting the relational and intercultural capacities that ultimately determine research mobilization and leadership effectiveness.

5. Limitations and future research

Several limitations should be noted. First, this research was conducted as a single-institution case study within a research-intensive university in Thailand. While the mixed-methods analytical framework offers strong conceptual and analytical transferability, the specific statistical path coefficients and effect sizes reflect the Southeast Asian service economy and warrant empirical verification across other geographic and institutional settings. Second, the quantitative evaluation relied on stakeholder perceptions of curriculum relevance rather than longitudinal career outcomes. Future research should conduct longitudinal tracking studies spanning 3–5 years post-graduation to measure doctoral graduates' career velocity, promotion trajectories, and innovation outputs. Additionally, multi-institutional comparative studies across North American, European, and Asian universities would help examine how cultural and regional factors influence competency weighting in graduate curriculum design.

6. Conclusion

This study investigated an evidence-based curriculum reform model designed to prepare doctoral researchers for the challenges of the AI era. By integrating qualitative stakeholder inquiry ($N = 25$) with quantitative PLS-SEM validation ($N = 200$), the research identified four core competency themes and demonstrated that Intercultural Emphasis serves as the primary structural predictor of program relevance, surpassing Technology Integration and Experiential Pedagogy. These findings articulate the "High-Tech Commodity vs. High-Touch Differentiator Paradox," demonstrating that as computational tools become increasingly automated, relational empathy and cross-cultural leadership become the ultimate drivers of strategic value. Rather than prescribing a universal template, this study provides an empirically validated, contextually adaptable reference architecture to guide institutions in producing doctoral graduates who are both technologically proficient and culturally grounded.

Declarations Generative AI and AI-Assisted Technologies

The authors declare that they did not use generative AI tools for data analysis, interpretive coding, or conceptual synthesis.

Ethical Approval

The Human Research Ethics Committee of Kasetsart University approved this study (Protocol Approval No. COE. COE58/084, Study Code KUREC-KPS68/083). The authors obtained informed consent from all participants before data collection.

Conflict of Interest

The authors declare no competing financial or personal interests.

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