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Article

Strategic ecosystem modeling of the E-sports Industry for sustainable social development in Thailand

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Abstract: The research seeks to explore the complex factors that shape the E-sports industry in Thailand to create a viable source of national revenue while aligning with the United Nations Sustainable Development Goals. The research uses a sequential exploratory mixed-methods design, incorporating qualitative thematic research from 11 strategic stakeholders and quantitative Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze data from 360 registered E-sports athletes. The qualitative research results indicate that Government Promotion, which involves legislation and subsidies, is the fundamental catalyst for Technology Acceptance and Management Innovation. The quantitative results from PLS-SEM confirm the structural integrity of the research model and demonstrate a high level of model fitness. Notably, the quantitative results indicate that Intercultural Communication is the most influential factor in the development of the E-sports industry, with a beta weight of 0.67, highlighting the international nature of digital ecosystems. Government Promotion, on the other hand, demonstrated a significant indirect effect of 0.93, indicating its role as the bedrock of the entire research model. The article seeks to synthesize research findings and develop a strategic framework that integrates proactive, corrective, preventive, and reactive policy approaches to foster a viable E-sports industry in Thailand while promoting the United Nations' Sustainable Development Goals (SDGs 8 & 9).

Keywords: E-sports ecosystem; sustainable social development; technology acceptance; management innovation; intercultural communication

1. Introduction

The current global environment is characterized by the dynamics of technological development and substantial socio-economic changes [1,2]. In this context of changing paradigms, the concept of the digital economy has evolved into a significant contributor for national strength, socio-economic diversity, and sustainable development in the contemporary world [3]. The recent global crises and disruptions caused by the COVID-19 pandemic have had a major adverse impact on the conventional brick-and-mortar economy [4,5]; however, the pandemic has also accelerated the global process of digital transformation, which has suggested the considerable versatility and viability of the digital content economy [6,7]. In this context of the digital renaissance, the phenomenon of electronic sports, or E-sports, has evolved beyond the conventional scope of competitive gaming and has attained the status of a global industry worth billions of dollars, thereby generating employment, innovative technological development, and cultural diversity on a global scale [8–10], thus emerging as the vital foundation of contemporary sustainable development [11,12].

In Thailand, the digital content industry has witnessed rapid growth, reached over 39,332 million THB and recorded an annual growth rate of 27% [13,14]. To tap into the significant economic opportunities presented by the digital content industry, the Thai government, with the initiative of the Ministry of Digital Economy and Society (MDES) and the Digital Economy Promotion Agency (DEPA), has incorporated E-sports into its fundamental national economic frameworks [15,16]. Strategic policies, such as the "E-sports Games 2025: Overcoming Thailand's Challenges" initiative, aim to make Thailand the focal point for digital content and E-sports within the Asia-Pacific region [17,18]. The all-encompassing policies are expected to enhance the skills of over 150,000 citizens, create 30,000 new high-value jobs, and attract billions of baht in local and foreign direct investment [19,20]. As such, the policies are instrumental to achieving sustainable social development, economic diversification, and the attainment of the Sustainable Development Goals, such as SDG 8 and SDG 9 [21,22].

Despite the positive economic growth path, the sustainable growth of E-sports as a profitable industry must be accompanied by a comprehensive of understanding of the interdependent, multidimensional variables that define its ecosystem [23,24]. The transition of this entertainment segment from its nascent, fragmented form to its formal, sustainable version must be accompanied by high levels of government promotion, technological adoption, management innovation, and the cultivation of intercultural communication competence among all participants [25–27]. The complex interplay of these variables not only determines the short-term profitability of this industry but also its long-term potential to create sustainable social environments, promote equitable technological opportunities, and facilitate international cooperation [28,29].

Consequently, this research undertakes a multi-level investigation into the developmental dynamics of the Thai E-sports industry [30]. In doing so, the research aims to elucidate the intricate causal relationships and socio-cultural determinants that inform the sustainability of the E-sports industry, employing a rigorous, multi-method approach that combines thematic analysis with modern PLS-SEM quantitative modeling techniques. The knowledge generated from this research is hoped to inform policymaking and strategic organizational management to ensure that the E-sports industry contributes meaningfully and sustainably to the general and overarching goals of social sustainability within the global arena [31–33].

2. Theoretical foundations and literature review

The conceptual framework of the current research is strongly grounded in the integration of multi-disciplinary theories, such as public policy, technology adoption, management, and intercultural sociology, as presented in [34] and [35]. The integration of the aforementioned approaches will enable the holistic evaluation of the E-sports ecosystem, in line with the interdisciplinary approach to research on Sustainable Development [36,37].

2.1. Public policy and government promotion

Government promotion serves as a catalyst for the development and consolidation of emerging industries in the economy [38,39]. According to public

policy theory scholars, government intervention is the authoritative process of allocating societal values, which entails establishing the legal environment, actively implementing laws and regulations, providing financial support, and establishing rigorous supervisory mechanisms in the industry [40]. In Thailand, the legal recognition of E-sports as a professional sport by the Sports Authority of Thailand in 2017 served as a critical government policy intervention that catalyzed the industry's process of legitimization in the economy [41,42]. In the contemporary context of the digital age, government promotion in the industry entails the development of the socio-economic environment through the establishment of critical digital infrastructure, the development of intellectual property laws to protect complex digital assets, and the establishment of rigorous educational programs to develop human capital in the industry [43–45]. In the context of the national agenda, the 20-Year National Strategy (2017–2036) and the Digital Economy Promotion Master Plan (2023–2027) recognize the necessity of aligning technological development with sustainable national growth, social justice, and environmental concerns [46]. In the context of this study, Government Promotion is conceptualized as comprising the following dimensions: the development and implementation of laws and regulations, the level of financial support, and the level of regulatory supervision.

2.2. Technology acceptance in digital ecosystems

The Technology Acceptance Model (TAM), as originally [47], is a fundamental theoretical construct for understanding user adoption of novel technologies. The fundamental tenets of the Technology Acceptance Model posit that the behavioral intention to use a specific technology is largely dependent on the two cognitive beliefs of Perceived Ease of Use and Perceived Usefulness of the technology in question [48]. However, as complex digital ecosystems have evolved, the critical need to expand the Technology Acceptance Model to incorporate the unique intricacies of ubiquitous computing, high-speed mobile platforms, and digital immersion has become a reality for modern scholars of the subject [49,50]. The Technology Acceptance Model in the specialized realm of E-sports transcends the usability of hardware peripherals and software applications to a high degree of systemic comprehensiveness [51,52], including the seamless, uninterrupted, and unobstructed integration of high-performance gaming platforms, low-latency real-time streaming infrastructure, and high-performance, globally interconnected communication networks [53,54]. As E-sports athletes, management personnel, and other stakeholders within the E-sports community become increasingly cognizant of the high degree of intuitiveness and usefulness of the complex technological system, the intrinsic psychological attitude of the stakeholders improves, thereby accelerating systemic adoption of the technology in question [55–57]. The Technology Acceptance construct in this research investigation comprises three fundamental facets: Perceived Ease of Use, Perceived Usefulness, and Attitude Toward the System, which posit that high levels of Technology Acceptance are the critical conduit for subsequent management innovations and intercultural exchange.

2.3. Management innovation as an engine of economic growth

Innovation theory, embedded in the classic economic models of Schumpeter, contends that true economic growth is an endless, cyclical process driven by constant, ongoing advancements in technology and business and industry. In modern organizational studies and business management, innovation is not solely about developing new technologies; rather, it is critically and necessarily about developing new paradigms in business management and processes [58]. Damanpour has divided organizational innovation into technical and administrative aspects and emphasized the need for constant, ongoing evolution of business models to ensure a competitive edge in the volatile, dynamic international market [59]. In the case of the E-sports industry [60], Management Innovation is essential for survival and growth. It is the constant and ongoing generation and implementation of new ideas in four main aspects of business and industry: Product and Service Innovation (new ideas in developing new gaming platforms and experiences that are novel in terms of gaming and E-sports); Process Innovation (new ideas in improving and optimizing tournament organization and management, improving the efficiency of digital broadcasting and media, and improving logistics and supply chain management); Marketing Innovation [61] (new ideas in using international influencer marketing, using data and analytics to identify and engage audiences, and using digital media to build and establish brand presence); and finally, Organizational and Behavioral Innovation (new ideas in developing a culture of resilience and adaptability in E-sports and gaming, developing a culture of constant learning and innovation, and reorganizing and restructuring organizational hierarchies to ensure maximum innovation and agility). The ability to innovate in E-sports and gaming directly determines the ability to capture and dominate the international market and to ensure long-term, sustained revenue generation [62].

2.4. Intercultural communication competence

By its very essence, E-sports is a transnational, borderless phenomenon, marked by the co-presence of digital arenas in which participants, audiences, and stakeholders come from disparate geographical and cultural backgrounds [63,64]. Thus, Intercultural Communication Competence (ICC) emerges as a crucial factor for successful collaboration, team cohesion, and transnational industry expansion in the world of E-sports [65,66]. While drawing heavily on the structural model of Intercultural Communication Competence as propounded by Kim, the capacity to capitalize on the power of cultural diversity is constituted by three interrelated components: the Cognitive, Affective, and Behavioral dimensions of Intercultural Communication Competence [67,68]. The Cognitive dimension involves the intentional acquisition of cultural knowledge, the comprehension of linguistic nuances, and the building of the requisite cognitive complexity to grasp, understand, and act upon the complex array of diverse social cues and strategic philosophies of the opponent teams and players from diverse cultural backgrounds [69,70]. The Affective dimension involves emotional preparedness, motivation, and the development of a flexible identity that celebrates diversity without prejudice or ethnocentric bias, as well as the aesthetic co-orientation of E-sports players and management to genuinely appreciate the diverse cultural expressions and E-sports styles of opponent teams and

players. The Behavioral dimension of Intercultural Communication Competence involves the manifestation of the aforesaid cognitive and affective components as skills, which enable the E-sports players and the management to synchronize actions, communicate via digital mediums, and creatively resolve conflicts in a stressful, transnational, competitive environment, thereby substantially increasing the global commercial viability of the E-sports industry as a whole.

2.5. Industry development and the balanced scorecard

To determine the final dependent variable for the sustainable development of the E-sports industry in the context of revenue generation, this study has employed the Balanced Scorecard (BSC) concept developed by Kaplan and Norton [71]. The employment of the BSC concept guarantees the evaluation of the success of the industry not only in the context of financial factors and revenue generation but also in the context of the holistic evaluation of the industry in the context of the following dimensions: Revenue Generation, Stakeholder Satisfaction, Internal Management Processes, and Learning and Development. The above dimensions of evaluation are fully consistent with the holistic principles of sustainable social development. The E-sports Industry Development construct is theoretically specified as a reflective measurement model, as these four dimensions are considered manifestations of the underlying latent variable of industry development.

2.6. Hypothesis formulation

Based on the synthesis of the aforementioned theoretical constructs and the specific contextual dynamics of the Thai digital economy, the following nine structural hypotheses were formulated to test the causal relationships within the E-sports ecosystem:

H1: Government Promotion (GOPR) has a significant positive direct effect on Technology Acceptance (REAC).

H2: Technology Acceptance (REAC) has a significant positive direct effect on Management Innovation (MAIN).

H3: Government Promotion (GOPR) has a significant positive direct effect on Management Innovation (MAIN).

H4: Technology Acceptance (REAC) has a significant positive direct effect on the Development of the E-sports Industry (DECR).

H5: Technology Acceptance (REAC) has a significant positive direct effect on Intercultural Communication (INES).

H6: Government Promotion (GOPR) has a significant positive direct effect on Intercultural Communication (INES).

H7: Management Innovation (MAIN) has a significant positive direct effect on Intercultural Communication (INES).

H8: Management Innovation (MAIN) has a significant positive direct effect on the Development of the E-sports Industry (DECR).

H9: Intercultural Communication (INES) has a significant positive direct effect on the Development of the E-sports Industry (DECR).

The conceptual framework for the study, which outlines the Thai E-sports

ecosystem and the nine hypothesized paths (H1–H9) under investigation, is illustrated in **Figure 1**.

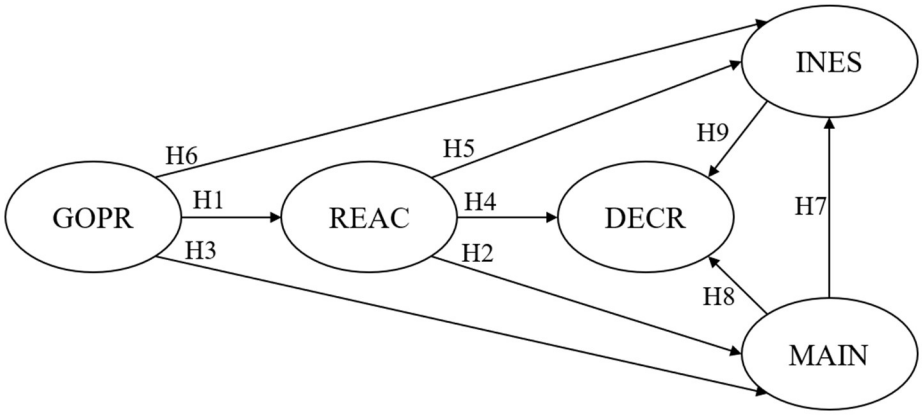

Figure 1. The proposed conceptual framework of the Thai E-sports Ecosystem and hypothesized paths (H1–H9).

3. Research design and methodology

The research design was developed to capture the multidimensional nature of the E-sports ecosystem and operationalize the dependent variable, E-sports Industry Development, through the dimensions of the Balanced Scorecard (BSC) discussed in Section 2.5 [71].

3.1. Phase 1: Qualitative thematic analysis

The fundamental aim of this qualitative study was to uncover the profound perspectives and operational and strategic challenges perceived by key stakeholders at the top levels within this industry [72,73]. Purposive sampling methods were used to carefully select 11 key informants with extensive, long-term involvement (minimum of 5 years) in developing, regulating, or participating in this E-sports movement [74,75]. The members of this expert panel consisted of two senior members from the Ministry of Digital Economy and Society, two senior members from the Sports Authority of Thailand, two members from the Thailand E-sports Federation, and five elite professional E-sports athletes officially registered with the Thailand E-sports Federation. The data collection procedure for this study was executed through semi-structured in-depth interviews, audio-recorded and carefully transcribed for thorough analysis [76–78] (see Appendix A). The interviews were conducted between August 1 and September 15, 2025. Each interview session lasted approximately 45–60 minutes, ensuring sufficient depth for thematic saturation. The analysis procedure adopted for this study is inductive, synthesizing the subjective truths and lived experiences of the informants into comprehensive, broad themes [79,80]. To achieve a high level of qualitative validity and reliability, this study adopted appropriate triangulation methods for data and methodology [81]. Triangulation of data for this study was achieved by cross-verification and comparison of the collected data at different time periods, physical and digital spaces, and a wide range of institutional perspectives [82,83]. The methodology for this study is triangulated through the smooth integration of observational data and in-depth interviews. The results from this

qualitative study were used to add depth to the numerical path coefficient estimates from the quantitative study.

3.2. Research integration and instrument development

The results from the qualitative thematic analysis in Phase 1 served as the foundational "integration point" for the quantitative phase. Specifically, the themes identified—such as the regulatory role of government and the cognitive dimensions of intercultural communication—were used to refine the indicators within the PLS-SEM model. This process ensured that the survey instrument was grounded in the lived experiences of Thai E-sports stakeholders, thereby enhancing the content validity and contextual relevance of the subsequent quantitative analysis.

3.3. Phase 2: Quantitative PLS-SEM framework

Quantitative phase: The quantitative phase followed a detailed cross-sectional survey design that targeted professional E-sports athletes who are legally registered with the Thailand E-sports Federation [84]. The design employed stratified random sampling to procure a representative sample of 360 E-sports athletes. The sample size is substantially larger compared to the heuristically recommended 20 times the number of observed variables. The quantitative research design employed survey research, with operationalized constructs evaluated on a standardized five-point Likert scale. Analysis of data was performed utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) [85,86]. The rationale for choosing PLS-SEM over Covariance-Based SEM (CB-SEM) is closely aligned with the latest methodological research and developments in business, technology, and social science. As articulated in the latest methodological guidelines for research published in 2024/2025 by Hair, Sarstedt, and colleagues, PLS-SEM is appropriate for estimating complex models comprising multiple interacting latent variables and numerous structural paths, with data distributions that can be significantly nonnormal. The evaluation of PLS-SEM results strictly adhered to the current reporting standards [87–90]. The evaluation of the measurement model entailed verifying internal consistency reliability using Cronbach's Alpha and Composite Reliability (CR), and convergent validity using average variance extracted (AVE) [91,92]. Discriminant validity was conceptualized and verified through contemporary correlational analysis to ensure distinctiveness of constructs, updating traditional metrics and aligning with the latest Heterotrait-Monotrait (HTMT) rationale. For the structural model, the path coefficients and statistical significance of the PLS-SEM results were verified using an advanced Bias-Corrected and accelerated (BCa) bootstrapping method with 10,000 subsamples. This method is beneficial for validating the predictive relevance and predictive power of the structural model [93–96].

The quantitative phase used stratified random sampling to ensure representativeness across game genres (e.g., MOBA, FPS, and Sports). The sampling frame consisted of professional E-sports athletes officially registered with the Thailand E-sports Federation (TESF). Inclusion criteria required participants to be active professional players with at least one year of competitive experience, while exclusion criteria removed incomplete responses. Of 500 distributed invitations, 360

valid responses were collected, yielding a response rate of 72%. This sample size significantly exceeds the threshold of 20 times the number of observed variables, ensuring high statistical power for the PLS-SEM analysis. Consistent with the theoretical framework, all latent constructs, including E-sports Industry Development, were operationalized as reflective measurement models.

Instrument Development The survey instrument was developed by adapting established scales from prior literature to fit the Thai E-sports context (see Appendix B). Items for Technology Acceptance were adapted from Davis [47] and Venkatesh et al. [49]. Management Innovation constructs were based on the work of Damanpour [97]. Intercultural Communication scales were adapted from Kim [98] and Earley and Ang [27]. For Government Promotion, the items were developed in line with the public policy frameworks of Dye [99] and Anderson [100]. Finally, the E-sports Industry Development measures were operationalized based on the Balanced Scorecard framework by Kaplan and Norton [71].

4. Phase 1 results: Qualitative thematic analysis

The thematic analysis of the in-depth interviews provided detailed insights into the mechanisms at play within the Thai E-sports industry. The thematic analysis systematically categorized the qualitative data to form thematic narratives that "seamlessly aligned with the theoretical structural paths," thus illuminating the "how and why" behind the quantitative metrics as shown in **Table 1**.

Table 1. Coding framework and thematic development of qualitative findings.

Main themes	Categories	Initial codes / key indicators
1. The Catalytic Role of Government in Technology Adoption	- Legal Legitimacy - Infrastructure Support	- National recognition of E-sports as a professional sport - State subsidies for 5G and digital arenas - De-risking large-scale technology investment
2. State Sponsorship as a Bridge for Intercultural Exchange	- International Exposure - Shared Regulatory Standards	- Financial backing for international tournaments - Facilitating digital spaces for cultural exchange - Standardized legislation for global participation
3. Policy as the Bedrock for Management Innovation	- Institutionalization - Risk Mitigation	- Moving from fragmented gaming to corporate management - Confidence in product/marketing innovation - Compliance with international governance standards
4. The Cascading Effects of Technological Intuition	- Operational Efficiency - Global Connectivity	- Integration of data analytics and AI tools - Real-time translation and low-latency communication - Removing barriers of language and geography
5. Innovation and Intercultural Synergy Driving Sustainability	- Competitive Standards - Market Expansion	- Sharing global training strategies and philosophies - Promoting inclusive and toxic-free gaming cultures - Cohesion in multicultural competitive environments

4.1. The catalytic role of government in technology adoption

The thematic analysis first indicated the foundational role in instigating widespread Technology Acceptance within the industry. The key informants within various regulatory bodies and even ministries emphasized that establishing clear legal frameworks and state-endorsed policies is intended to formally legitimize E-sports in the minds of the general public and corporate investors alike. This state-backed form of legitimization significantly reduces the risks associated with large-scale technology investments.

One representative from the Thailand E-sports Federation emphasized the necessity of state-level recognition, stating: *'Official government endorsement changed the public perception of gaming from a mere pastime to a legitimate career path, which significantly lowered the psychological barrier for long-term technology investment.'*

All of the E-athletes indicated a novel approach that directs government subsidies for digital infrastructure—specifically for the establishment of high-speed 5G internet networks and even state-of-the-art digital broadcasting arenas—significantly reduces the entry costs for new participants. The ease of access to functional state-of-the-art platforms instigates a positive attitude towards systemic technology, thereby embedding technology acceptance as an integral foundation of E-sports.

4.2. State sponsorship as a bridge for intercultural exchange

Meanwhile, the qualitative study offered significant insights into the intersection of Government Promotion and Intercultural Communication. Interviewees were able to articulate how international tournaments supported by the government and the rigorous formalization of E-sports legislation function as an important bridge between Thai athletes and their high-level international counterparts. By providing much-needed financial backing and support for international competitive events, the government inadvertently but effectively facilitates vast digital spaces of cultural exchange. Interviewees who were professional sportsmen were able to articulate how competing under standardized legislation supported by the government enabled them to safely engage their international counterparts, thereby facilitating affective empathy and behavioral intercultural synchrony.

An elite professional athlete noted the impact of international exposure: *'Competing in overseas tournaments with government backing allowed us to interact with players from different backgrounds under a shared regulatory standard, which taught us how to adapt our communication and strategies to global levels.'*

4.3. Policy as the bedrock for management innovation

In addition, Government Promotion was seen as a critical catalyst for Management Innovation, as E-sports association officials explained that a conducive legal framework and specific financial incentives enable organizations to test new approaches to doing business, thereby reducing operational risks. This legal security enables organizations to move from a relatively simple, unorganized form of gaming to a very complex, corporate form of management. Organizations feel confident investing heavily in product innovations, such as customized streaming services, as

well as in marketing innovations that tap into global digital networks. Perhaps more importantly, the government's overall regulatory framework ensures that internal innovations are implemented in a manner that meets international standards of global governance, thereby increasing their international viability and attracting global sponsors.

A senior official from the Ministry of Digital Economy and Society highlighted the role of legal security: *'By providing a clear legislative framework, we gave organizations the confidence to move beyond simple tournament organizing and start innovating with complex business models and global marketing strategies.'*

4.4. The cascading effects of technological intuition

The exploration of the themes also revealed the cascading effects of Technology Acceptance. The informants agreed that, as the technological platforms, whether simple internal communications tools or more complex game engines, were seen as very intuitive and positive, they directly and rapidly accelerated the adoption of Management Innovation. The ease of use of the technology allowed the management team to seamlessly integrate complex data analytics, artificial intelligence-based performance measurement tools, and software for managing operations, tournament logistics, and team management without requiring any high level of technical expertise. The more complex technological platforms were also seen as the major enabler for the acceleration of Intercultural Communication. The platforms' innovative capabilities, whether for real-time language translation, low-latency voice communications, or global matchmaking algorithms, were seen as removing the barriers of language and geography. The very positive attitude towards the enabling technology was seen as encouraging the athletes to seek out and engage with international team members, creating a high level of empathy and adaptation to other cultures. The level of technology acceptance also has a major impact on the industry's ability to generate a sustainable level of revenue. The ease of use of the technology, whether for broadcasting or audience engagement, was seen as enabling high levels of viewer engagement, which in turn attracted lucrative revenue from corporate sponsors and high-end advertisers.

Regarding the role of technology as a facilitator, a management respondent remarked: *'When the platforms are intuitive, they don't just help with gaming; they bridge the gap between team members from different countries, allowing real-time collaboration that was previously impossible.'*

4.5. Innovation and intercultural synergy driving sustainability

The analysis then focused on the direct effects of Management Innovation. All informants identified the continuous development of digital products, services, and processes as the primary driver of the industry's economic growth. The innovative approaches to marketing and the Ongoing development of unique digital assets have improved the spectator experience, thus directly impacting stakeholder satisfaction and generating substantial revenue. Organizational innovation, which explicitly embraces diversity and global outreach, inherently supports the development of Intercultural Communication. By explicitly designing diversity and global outreach

into the development of digital assets and innovative marketing approaches, the organizational management has successfully created conditions in which Intercultural Communication thrives. The thematic analysis also identified the significant effect of Intercultural Communication on the sustainable development of the E-sports industry. The informants highlighted the significant impact of cognitive Intercultural Communication on the industry's development. By sharing diverse approaches to game strategies, training methodologies, and game philosophies, the overall standard of Thai athletes is notably improved. The affective dimension of Intercultural Communication, in which respect, tolerance, and appreciation of cultural differences are essential, has created a sustainable global gaming community. Behaviorally, Thai organizations' ability to function cohesively and effectively in multicultural teams has enabled them to compete successfully in the global environment. This has not only improved the national prestige of the Thai E-sports industry but also significantly expanded its market scope, ensuring the long-term sustainability of the industry's economy.

An industry stakeholder summarized the overarching impact of intercultural connectivity: *'Our sustainability depends on our ability to work in multicultural environments. The more we embrace global standards and diverse strategies, the more revenue we generate from international sponsors.'*

5. Phase 2 results: Quantitative PLS-SEM analysis

The quantitative phase rigorously mathematically tested the established relationships derived from the extensive literature review and the qualitative thematic analysis. The analytical procedures are strictly based on the recently proposed reporting standards for PLS-SEM.

5.1. Demographic profile and descriptive statistics

The demographic profile of the 360 professional E-sports athletes surveyed provides crucial context for interpreting the structural findings. As detailed in **Table 2**, the data reveal a modern and evolving workforce.

The sample demonstrated a slight female majority (53.89%), directly challenging traditional, antiquated gender stereotypes in competitive gaming and indicating an inclusive sector. The workforce is notably young, with 60.84% of respondents aged 40 or under, yet highly educated, with 70.00% holding at least a Bachelor's degree. Furthermore, the economic viability of the profession is evident: the vast majority (87.78%) earn above 20,000 THB monthly, and over 43% earn above 30,000 THB, indicating a rapidly maturing, professionalized, and lucrative sector. Descriptive statistical analysis of the latent variables revealed that all constructs were rated at the "Highest" level on the five-point Likert scale. Government Promotion yielded a mean of 4.32 (SD = 0.59), Technology Acceptance 4.34 (SD = 0.64), Management Innovation 4.40 (SD = 0.57), Intercultural Communication 4.37 (SD = 0.61), and E-sports Industry Development 4.42 (SD = 0.59). Analysis of skewness and kurtosis indicated a left-skewed, leptokurtic distribution, which is characteristic of specialized, high-performing populations, further justifying the use of the variance-based PLS-SEM over covariance-based alternatives that require strict multivariate normality.

Table 2. Demographic profile of the surveyed professional E-sports athletes (N = 360).

Demographic variable	Category	Frequency	Percentage (%)
Gender	Male	166	46.11
	Female	194	53.89
Age	20–30 years	128	35.56
	31–40 years	91	25.28
	41–50 years	81	22.50
	51 years and above	60	16.67
Education level	Below Bachelor's Degree	77	21.39
	Bachelor's Degree	252	70.00
	Above Bachelor's Degree	31	8.61
Average monthly income	≤20,000 THB	44	12.22
	20,001–30,000 THB	161	44.72
	30,001–40,000 THB	76	21.11
	≥40,001 THB	79	21.94

Note. THB = Thai Baht. Percentages may not exactly total 100% due to rounding.

5.2. Measurement model evaluation

The measurement model was meticulously scrutinized to ensure the reliability and validity of the latent constructs before structural path estimation. The results, summarized in **Table 3**, indicate satisfactory psychometric properties that meet the established stringent thresholds set by modern statistical guidelines.

Table 3. Measurement model evaluation: Construct reliability and convergent validity.

Latent construct	Indicator	Factor loading (λ)	Cronbach's α	Composite reliability (CR)	AVE	Source
Government promotion (GOPR)	Laws/Regulations (IIR)	0.81	0.967	0.955	0.841	[47,49]
	Budgetary Support (BUS)	0.94				
	Law Enforcement (LAW)	0.96				
	Regulatory Supervision (REO)	0.95				
Technology acceptance (REAC)	Perceived Ease of Use (ASE)	0.93	0.970	0.955	0.878	[47,49]
	Perceived Usefulness (ASB)	0.92				
	Attitude Toward System (ATS)	0.96				
Management innovation (MAIN)	Product/Service (PSI)	0.94	0.970	0.962	0.861	[49]
Intercultural communication (INES)	Cognitive (IDE)	0.95	0.973	0.955	0.871	[98,27]
	Affective (FEE)	0.92				
	Behavioral (AFF)	0.96				
	30,001–40,000 THB	76				21.11
	≥40,001 THB	79				21.94

Table 3. (*Continued*).

Latent construct	Indicator	Factor loading (λ)	Cronbach's α	Composite reliability (CR)	AVE	Source
E-sports development (DECR)	Revenue Generation (VIG)	0.95	0.979	0.974	0.903	[71]
	Stakeholder Satisfaction (STS)	0.94				
	Internal Processes (IMP)	0.96				
	Learning & Development (LAD)	0.95				

Note. λ = Factor Loading; CR = Composite Reliability; AVE = Average Variance Extracted. All constructs exceed the recommended thresholds for reliability and convergent validity.

The outer indicator loadings (λ) exceeded the standard benchmark of 0.708, confirming robust item reliability. Internal consistency was comprehensively validated, with both Cronbach's Alpha and Composite Reliability (CR) scores heavily exceeding the 0.70 threshold across all constructs, indicating high internal consistency. Convergent validity was established, as the Average Variance Extracted (AVE) for every construct surpassed the 0.50 threshold, ranging from an impressive 0.841 to 0.903. In strict alignment with modern PLS-SEM procedures, discriminant validity was conceptually verified using advanced correlational analyses. The correlation matrix indicated that no two constructs shared a correlation exceeding the critical threshold (all values remained below 0.85), ensuring that each latent construct represents a distinct, mathematically separate theoretical entity within the structural matrix, free from problematic multicollinearity issues that can affect poorly specified models.

5.3. Structural model assessment and predictive relevance

The structural model assessment strictly adhered to PLS-SEM reporting guidelines. Collinearity was examined, and all Variance Inflation Factor (VIF) values were below the conservative threshold of 3.0 (ranging from 1.15 to 2.45), indicating no collinearity issues. The explanatory power of the model was strong, with the R^2 values indicating that the exogenous constructs explained 88% of the variance in Technology Acceptance, 91% in Management Innovation, 94% in Intercultural Communication, and 93% in E-sports Industry Development. Furthermore, the model's predictive relevance was confirmed as all Q^2 values generated through the blindfolding procedure or PLSpredict were well above zero. The model fit was evaluated using the Standardized Root Mean Square Residual (SRMR), which yielded a value of 0.038, meeting the threshold of < 0.08 for an acceptable fit. As summarized in **Table 4**, the empirical results demonstrate that all nine hypotheses are statistically significant and thereby accepted.

Table 4. Structural model assessment and hypothesis testing results.

Hypothesis	Structural path	Direct effect (β)	t-value	Result
H1	Government Promotion → Technology Acceptance	0.94	20.91	Supported **
H2	Technology Acceptance → Management Innovation	0.16	2.26	Supported *
H3	Government Promotion → Management Innovation	0.89	10.81	Supported **
H4	Technology Acceptance → E-sports Development	0.13	2.10	Supported *

Table 4. (*Continued*).

Hypothesis	Structural path	Direct effect (β)	t-value	Result
H5	Technology Acceptance → Intercultural Communication	0.37	5.05	Supported **
H6	Government Promotion → Intercultural Communication	0.40	3.83	Supported **
H7	Management Innovation → Intercultural Communication	0.22	2.74	Supported **
H8	Management Innovation → E-sports Development	0.29	4.32	Supported **
H9	Intercultural Communication → E-sports Development	0.67	6.69	Supported **

Note: ** $p < 0.01$, * $p < 0.05$

Table 5 presents the model fit assessment results for the PLS-SEM analysis. The analysis reveals a Standardized Root Mean Square Residual (SRMR) value of 0.038, which meets the recommended threshold of < 0.08. Furthermore, the Normed Fit Index (NFI) is 0.945, exceeding the acceptable criterion of 0.90. Based on contemporary PLS-SEM reporting standards, these indices collectively confirm that the estimated structural model exhibits an acceptable fit with the empirical data.

Table 5. Model fit assessment (PLS-SEM).

Fit statistic	Estimated model value	Threshold / criterion	Conclusion
SRMR	0.038	< 0.08	Acceptable fit
NFI	0.945	> 0.90	Acceptable fit

Note. SRMR = Standardized Root Mean Square Residual; NFI = Normed Fit Index.

Table 6 illustrates the collinearity assessment of the structural model, evaluated using the inner Variance Inflation Factor (VIF) values. The results indicate that the VIF values across all structural paths range from 1.000 to 2.450. Because all inner VIF values fall strictly below the conservative threshold of 3.0, it can be concluded that there are no problematic collinearity issues among the predictor constructs within the structural model. This ensures that the path coefficient estimates are stable and robust.

Table 6. Collinearity assessment (Inner VIF values).

Construct	Technology acceptance	Management innovation	Intercultural communication	E-sports development
Government Promotion	1.000	1.150	1.852	-
Technology Acceptance	-	1.150	2.105	2.410
Management Innovation	-	-	1.956	2.015
Intercultural Communication	-	-	-	2.450

Note. VIF = Variance Inflation Factor. All values are below the strict threshold of 3.0, indicating no collinearity issues among the predictor constructs.

The Coefficient of Determination (R^2) values underscore the model's substantial explanatory and predictive power. Government Promotion alone accounts for an 88% of the variance in Technology Acceptance ($R^2 = 0.88$). Together, the antecedents explain 91% of the variance in Management Innovation, 94% in Intercultural Communication, and a high explanatory power 93% in E-sports Industry Development

(R^2 = 0.93). This satisfactory high explanatory power, verified against the stringent out-of-sample prediction frameworks inherent in modern PLS-SEM analysis, strongly suggests that the selected variables are the primary significant contributors of the Thai E-sports economy. A critical mathematical decomposition of the total effects reveals intricate mediation pathways. While Intercultural Communication asserts the strongest direct influence on E-sports Development (DE = 0.67), Government Promotion operates as the key determinant of the entire ecosystem. It exerts a substantial indirect effect (IE = 0.93) on E-sports Development by cascading sequentially through Technology Acceptance, Management Innovation, and Intercultural Communication. These empirical findings indicate an essential characteristic of the industry: sustainable development at the apex of the E-sports industry is dependent on robust, proactive public policy at its base.

6. Discussion: Integrating themes and structural dynamics

The confluence of qualitative findings and PLS-SEM results yields significant insights into the sustainability of the Thai E-sports industry at the second and third orders. The hard facts and figures suggest that the progression of E-sports from its localized form as a digital pastime to a sustainable, revenue-generating, integrated international ecosystem is a structured and interconnected socio-economic phenomenon. One of the most significant understandings to emerge from this investigation is the significant role of Intercultural Communication on the industry as a whole (β = 0.67). In most traditional and physical socio-economic industries, physical management operations and/or raw technological deployments are the dominant and primary drivers of industry growth. However, the E-sports industry is a socio-economic phenomenon that thrives in a dynamic and borderless digital continuum. The thematic findings of the qualitative investigation support this statistical anomaly by suggesting that E-sports is fundamentally a global industry; physical national borders do not limit revenue generation, premium sponsorship opportunities, and massive audience engagement. It is therefore the cognitive ability of athletes and managers to share and understand global strategies, the affective ability to create and promote inclusive and toxic-free gaming cultures, and the behavioral ability to function and work within pressurized multicultural teams that is a key direct driver of industry growth. This finding is consistent with advanced sociological understandings of the nature and progression of digital globalization, and with the view that social sustainability in promoting peace, radical inclusivity, and respect for cultural differences is directly and mathematically correlated with economic profitability. This is significant for establishing a powerful link to the broader goals and objectives of sustainable social development.

Moreover, the combined data suggest that Government Promotion plays a more latent, behind-the-scenes role to a more prominent, cascading one. The high path coefficients linking Government Promotion to Technology Acceptance and Management Innovation directly (β = 0.94 and β = 0.89, respectively) imply that, in new and volatile digital environments, the private sector and individual-level enterprises are dependent on state-level validation and de-risking. In developing and emerging economies, technological adoption and large-scale management innovation

carry significant risks to organizations and individuals alike. The thematic analysis identifies that when the state is successful in codifying laws, enforcing digital intellectual properties, and injecting capital into key digital infrastructure, it is effectively de-risking the entire environment. This essentially provides a psychological and financial safety blanket for technological proliferation and emboldens management to innovate with greater confidence. This is a key finding that supports SDG 9 and emphasizes that sustainable industrialization in the 21st century is contingent upon strong state-supported technological environments [67,68].

The complex indirect paths also demonstrate the nuanced role of Technology Acceptance. While its direct effect on industry revenue is moderate ($\beta = 0.13$), its true structural contribution lies in its role as a mandatory facilitator. High levels of Technology Acceptance significantly facilitate Intercultural Communication ($\beta = 0.37$) and Management Innovation ($\beta = 0.16$). Intuitive and functional digital platforms are a prerequisite for facilitating cultural exchange and successfully executing innovative business models. As such, actively closing the digital divide to provide equitable access to advanced technology is not only an imperative of social justice; it is also an economic imperative that fuels the industry's higher-order functions in an unprecedented manner, aligning perfectly with the socio-economic principles of SDG 8: Decent Work and Economic Growth.

6.1. Strategic policy framework and implications for sustainable social development

Empirical evidence presented in this report has clearly shown that, for the sustainable and revenue-generating development of the E-sports industry in Thailand to take place, development must be synchronized. To harness the socio-economic potential of the E-sports industry to its fullest, policymakers, industry leaders, and educational institutions need to implement a cohesive, integrated strategy. Based on triangulated research findings, the proposed four-dimensional strategy for the sustainable development of the E-sports industry in Thailand is as follows:

6.1.1. Proactive strategies: Infrastructure and incubation

The analysis suggests the importance of sustained investment in the country's digital foundation. The government, operating through robust public-private partnerships, must provide substantial subsidies to develop world-class 5G/6G-enabled E-sports arenas and high-performance digital training centers. Furthermore, proactive fiscal policies—such as targeted tax incentives—must be enacted to foster digital startups across the broader gaming supply chain, from independent software developers to specialized broadcasting agencies. By creating localized, state-of-the-art technological hubs (such as the Digital Edutainment Complex in the Thailand Digital Valley), the state can physically anchor the E-sports ecosystem, effectively retain elite domestic talent, and magnetically attract foreign direct investment.

6.1.2. Corrective strategies: Regulatory modernization and human capital

The high level of dependence of this industry on government interventions ($\beta = 0.94$, $\beta = 0.89$) necessitates that these archaic pre-digital legal systems be updated to align with. This includes the formulation and swift enactment of comprehensive legislation (such as the upcoming E-sports Promotion Act), which grants official

recognition of the labor rights of E-sport professionals, protects complex digital intellectual property, and provides transparent, international, compliance-based guidelines for hosting tournaments. In addition, the national education system must be overhauled urgently. To overcome the digital talent crisis, universities and other educational institutions must introduce specialized courses in digital management, game design, intercultural communication, and E-sport psychology, thereby providing a sustainable and future-proof supply of high-quality human capital [38,40].

6.1.3. Preventive strategies: Social sustainability and governance

It is challenging to have a sustainable industry that consistently pursues financial success at the expense of social well-being and mental health. Preventive strategies must be deeply ingrained in the industry to counteract the psychosocial risks of the competitive gaming environment. This entails developing strict, enforceable regulatory codes to promote fair play, prevent digital match-fixing, and protect the data privacy of players and consumers. Furthermore, there must be close collaboration between the government and industry sectors to develop strategies that foster the holistic well-being of athletes by establishing strict guidelines on the health aspects of gaming hours, ergonomic practices, and the mental well-being of players. This will ensure that the E-sports industry makes a positive contribution to the development of a healthy and balanced society, perfectly fitting the holistic principles of sustainable social development and workforce viability.

6.1.4. Reactive strategies: Agility and global integration

In light of the extreme, rapid fluctuations in the global digital technologies industry, the E-sports industry must be a very agile system structurally. The management teams must continually engage in rigorous environmental scanning to rapidly assimilate emerging digital technologies (such as AI-based analytics, blockchain-based digital assets, or virtual reality platforms) and seamlessly adapt to rapidly shifting global consumer trends. Most importantly, the E-sports industry must proactively capitalize on its high intercultural communication competence to create robust transnational networks. By strategically creating alliances with international E-sports federations, engaging in international joint ventures, and proactively positioning Thailand as a premier, culturally welcoming destination for international E-sports tournaments, the industry can insulate itself from localized economic downturns while generating heavily diversified, sustainable international revenue streams [47,49].

6.2. Limitations and future research

Despite its contributions, this study has several limitations. First, the cross-sectional design precludes the establishment of strict causal inferences between the variables. Future studies could employ longitudinal designs to observe the ecosystem's evolution over time. Second, the quantitative data relied heavily on self-reported measures from E-sports athletes, which may introduce common method bias and limit generalizability to the broader ecosystem (e.g., policymakers, sponsors, and game developers). Future research should aim to collect dyadic or multi-source quantitative data to corroborate these findings across different stakeholder groups.

7. Conclusion

The dynamic evolution of E-sports in Thailand can be seen as a fundamental paradigm shift in the digital economy of the 21st century. The results of this rigorous mixed-methods research strongly suggest that the generation of sustainable and equitable revenue within the E-sports industry appears to be driven by global technological availability but is a structured outcome of government policy, seamless technological integration, innovative management, and profound intercultural connectivity. The application of the most recent PLS-SEM best practices confirms that Intercultural Communication is the primary driver of success within the industry, while Government Promotion is the essential foundation for success. By adhering to the four-dimensional strategic framework presented in this research, the E-sports industry can be assured not only of generating economic value for the country but also of serving as a pillar of sustainable and equitable social development in the future.

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Appendix A: Semi-structured interview protocol

I. Experience and industry background

1. Could you describe your role and years of experience (minimum 5 years) in the Thai E-sports industry?
2. From your perspective, what are the primary drivers of E-sports' transition from a pastime to a national revenue source?

II. Government promotion and technology (H1, H3, H6)

3. How has the official recognition of E-sports as a professional sport influenced corporate and psychological barriers to technology investment?
4. In what ways have state subsidies for digital infrastructure (e.g., 5G networks) impacted the ease of access for new participants?

III. Management innovation and intercultural competence (H2, H5, H7)

5. As technology becomes more intuitive, how has your organization integrated innovations such as AI performance measurement or digital marketing strategies?
6. How do modern digital platforms facilitate the removal of linguistic and geographical barriers during international collaborations?

IV. Sustainability and industry development (H4, H8, H9)

7. How does intercultural communication competence (cognitive, affective, and behavioral) directly influence international sponsorship and revenue?
8. What role does management innovation play in ensuring long-term stakeholder satisfaction and internal process efficiency?
9. What proactive or preventive strategies are essential for the sustainable social development of the industry?

Appendix B: Survey instrument with citations

Table B1. Survey instrument with citations.

Construct & indicator	Survey question (Item)	Source / reference
Government promotion (GOPR)		
Laws/regulations (IIR)	The current legal framework effectively supports the professionalization of E-sports.	[99,100]
Budgetary support (BUS)	The government provides sufficient financial subsidies and infrastructure funding for E-sports.	[99,100]
Law enforcement (LAW)	Digital intellectual property and professional labor rights in E-sports are strictly protected.	[99,100]
Regulatory supervision (REO)	Government supervisory mechanisms ensure fair competition and international standards.	[99,100]
Technology acceptance (REAC)		
Perceived ease of use (ASE)	I find the specialized E-sports technological platforms intuitive and easy to use.	[47]
Perceived usefulness (ASB)	Adopting advanced digital gaming tools significantly enhances my competitive performance.	[47;49]

Table B1. (*Continued*).

Construct & indicator	Survey question (Item)	Source / reference
Attitude toward system (ATS)	My overall attitude toward utilizing new digital innovations in E-sports is very positive.	[47]
Management innovation (MAIN)		
Product/service (PSI)	My organization frequently introduces innovative products, such as customized streaming platforms.	[97]
Process (PRI)	We implement innovative management processes to optimize tournament organization and logistics.	[97]
Behavioral (BEI)	Our organization fosters a culture that actively encourages adaptive and creative behavior.	[97]
Organizational (ORI)	We restructure our internal organizational hierarchies to improve agility and innovation.	[97]
Intercultural communication (INES)		
Cognitive (IDE)	I possess the cultural knowledge to understand the strategic philosophies of global opponents.	[98]
Affective (FEE)	I am motivated to embrace cultural diversity and enjoy collaborating in multicultural teams.	[98]
Behavioral (AFF)	I can adapt my communication and behavior to resolve conflicts in transnational environments.	[98]
E-sports development (DECR)		
Revenue generation (VIG)	The industry demonstrates a high capacity for sustainable revenue and international sponsorship.	[71]
Stakeholder satisfaction (STS)	There is a high level of satisfaction among players, fans, and organizational sponsors.	[71]
Internal processes (IMP)	Internal management processes within the industry align with global quality standards.	[71]
Learning & development (LAD)	The industry provides robust opportunities for continuous professional learning and growth.	[71]