

Natcha Thawesaengskulthai; Awirut Chatmarathong; Jarotwan Koiwanit

Article

Impact and policy supporting Thailand innovation driven enterprise:
Orchestrating university innovation and entrepreneurship ecosystem
with public and private stakeholders

Journal of Innovation and Entrepreneurship

Provided in Cooperation with:

Springer Nature

Suggested Citation: Natcha Thawesaengskulthai; Awirut Chatmarathong; Jarotwan Koiwanit (2024) : Impact and policy supporting Thailand innovation driven enterprise: Orchestrating university innovation and entrepreneurship ecosystem with public and private stakeholders, Journal of Innovation and Entrepreneurship, ISSN 2192-5372, Springer, Heidelberg, Vol. 13, Iss. 1, pp. 1-44,
<https://doi.org/10.1186/s13731-024-00371-x>

This Version is available at:

<https://hdl.handle.net/10419/290324>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

RESEARCH

Open Access



Impact and policy supporting Thailand innovation driven enterprise: orchestrating university innovation and entrepreneurship ecosystem with public and private stakeholders

Natcha Thawesaengskulthai^{1,2} , Awirut Chatmarathong³ and Jarotwan Koiwanit^{4*} 

*Correspondence:
Jarotwan.ko@kmit.ac.th

¹ Department of Industrial Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok 10330, Thailand

² Human-Robot Collaboration and Systems Integration Research Unit, Chulalongkorn University, Bangkok 10330, Thailand

³ Risk Management Center, Chulalongkorn University, Bangkok 10330, Thailand

⁴ Department of Industrial Engineering, School of Engineering, King Mongkut's Institute of Technology Ladkrabang, Bangkok 10520, Thailand

Abstract

This research paper aims to investigate the impediments faced by innovation-driven enterprises in Thailand and to explore the current measures, policies, and mechanisms related to innovation-driven enterprises (IDEs)' development both domestically and internationally. The study encompasses a comprehensive approach, including an analysis of an innovation entrepreneur database comprising 320 investors and 883 IDEs. Moreover, semi-structure in-depth interviews were conducted with three investors, twenty-two IDEs' founders, eight executives, and experts from various sectors, including government, university incubators, and the private sector in Thailand. Through this multifaceted investigation, this paper sheds light on the key factors that hinder the success of IDEs in Thailand, which primarily revolve around the quality of entrepreneurs (Team), Product and Market Fit, and Support. These factors collectively impact the depth of knowledge, business incubation, acceleration programs, and the effectiveness of laws, measures, and policies in supporting innovation capability development within IDEs. In addition, this paper presents a framework for Thailand's IDEs hub, facilitating the connection between the university's innovation and entrepreneurship ecosystem with public and private stakeholders. This framework serves as a mechanism to address the identified hindrances and foster a conducive environment for IDEs development. To address the obstacles, this paper proposes three crucial strategies, namely, (1) talent management, (2) ease of doing scaleup, and (3) availability of funding. These strategies are envisioned to counteract the identified challenges and can be effectively implemented through an operating model and practical working procedures tailored to suit the specific context of Thailand.

Keywords: Innovation system, Entrepreneurship, Innovation-driven-enterprise, IDEs, Operating model, Policy

Introduction

In the context of global economic, health, and social uncertainties, there is a growing consensus on the pivotal importance of innovation. Both developed and developing nations are increasingly prioritizing innovation to ensure sustainable, long-term productivity growth. This focus on innovation is not only driven by the need for economic resilience but also by its role in enhancing national competitiveness and facilitating job creation (Ali et al., 2021; OECD, 2013; Zsuzsanna & Herman, 2012). Amidst this emphasis on innovation, understanding the requirements and factors influencing innovation processes becomes imperative. In addition, recognizing what it takes to establish an innovation-driven enterprise (IDE) is crucial. This includes a comprehensive understanding of the ecosystem where IDEs operate, their role in economic growth, and their contribution to job creation and community enrichment (Onside, 2021; Santisteban & Mauricio, 2017). Especially notable in countries characterized as innovation leaders, such as those in North-Western Europe, is the high quality of innovation systems that surpass GDP per capita levels. Within this framework, economic development is intricately linked to the innovation and capacity for innovation within enterprises (Zsuzsanna & Herman, 2012). However, it remains essential to elucidate the role of policies and measures in supporting IDEs within the broader entrepreneurship context. This clarification is necessary to bridge the understanding of how these initiatives contribute to fostering a conducive environment for IDEs, aligning with national innovation goals and supporting entrepreneurial endeavors. Recent research emphasizes that the connection between entrepreneurship and economic growth extends beyond the sheer quantity of new firm entries. Instead, it is intricately linked to a specific subset of high-growth startups, commonly identified as innovation-driven enterprises (IDEs) (Botelho et al., 2021). This assertion gains further support from the hypothesis proposed in the Global Entrepreneurship Monitor (GEM), indicating that IDEs play a significant role in shaping market dynamics, fostering economic growth, and giving rise to new entities (Choi et al., 2021; Godany et al., 2021).

In alignment with this notion, Thailand, too, endeavors to propel the nation towards the envisioned “Thailand 4.0” paradigm, necessitating reform within the research and innovation ecosystem to bolster economic competitiveness and societal development, thereby elevating the quality of life for its citizens (Jones & Pimdee, 2017). The successful cultivation of IDEs calls for a comprehensive overhaul of regulations and laws, along with the formulation of measures and incentives, including government services, designed to facilitate entrepreneurial innovation. Amendments to existing laws and regulations are warranted to remove barriers and create a conducive environment for innovative business operations (Bell et al., 2019; Bianchi & Giorcelli, 2018; OECD, 2018; Pian & Steinwender, 2019). Furthermore, the establishment of an investment ecosystem equipped with sufficient funding sources plays a pivotal role in supporting IDEs throughout their developmental journey. This ecosystem facilitates the development of products and services for the market, enhances business value at each stage of growth, and fosters expansion into global markets. Despite boasting over 2000 startups as of 2021 (TRACXN, 2021), Thailand faces a challenging task in realizing the vision of Thailand 4.0, spearheaded by IDEs, by 2027. As a response, the government has set ambitious targets, including raising overall R&D investment (Gross Domestic Expenditure on

R&D: GERD) to 2% of GDP, fostering the growth of 1000 IDEs with sales of 1000 million baht, and achieving five unicorn-level IDEs within the country. However, it is evident that the development of Thailand's venture capital ecosystem demands attention at both the policy and operational levels. There is a dearth of empirical data and data analysis concerning the demand and supply aspects, such as the potential number of IDEs, the types of investors and their potential, the range of investment opportunities, and technologies or industries with high investment potential (Thawesaengskulthai et al., 2020, 2021).

This study systematically investigates the advancement of IDEs development in Thailand through a comprehensive examination comprising five distinct dimensions: (1) evaluation of Thailand's investment ecosystem; (2) identification of impediments to IDEs development in Thailand; (3) formulation of an IDEs investment ecosystem support mechanism; and (4) analysis of measures and mechanisms supporting IDEs in both Thailand and foreign countries. The outcomes and analyses derived from these inquiries aim to establish the foundation for the formulation of policy recommendations and the development of an operational model. These outcomes hold the potential to serve as a guiding framework for the cultivation of innovation-based entrepreneurial ventures, specifically tailored to the unique contextual intricacies of Thailand.

Literature review

Revolution of innovation system in Thailand

The national innovation system (NIS) is a dynamic framework encompassing interactive institutions, private and public firms, universities, and government agencies within a nation, aimed at producing, disseminating, and leveraging knowledge within its borders. Such interactions occur through diverse mechanisms, including market-driven and non-market collaborative arrangements, as well as financial policies (Wonglimpiyarat, 2018).

In Thailand, the NIS is designed to bolster the innovation endeavors of eligible private companies engaged in research and development, striving to manifest technological innovation in their products and processes. Notably, public institutions, including prominent government agencies and research institutes, play an integral role in supporting these companies' innovation efforts (Parkey, 2012). Over the decades, Thailand has made significant strides in enhancing its national innovation capabilities through policy initiatives in various domains, such as research and development, education, and industry (United Nations, 2015). The Asian economic crisis in 1997 further catalyzed science, technology, and innovation policy reform, exemplified by the establishment of Software Park Thailand in 1999, a government-sponsored agency aiming to bolster the sustainability of the Thai software industry amidst a rapidly changing global digital economy (Habaradas, 2008). Despite these efforts, numerous challenges persist, hindering entrepreneurship and innovation, leading to an underdeveloped innovation system in Thailand (Schwab et al., 2012). The Thai innovation system exhibits strengths in various aspects, including awareness, entrepreneurialism, focused industries, restructuring of partial institutions, technical institutes, the semi-autonomy of the National Science and Technology Development Agency (NSTDA), education reform and skill development funding, and a national science and technology committee (Munkongsujarit, 2016). However, weaknesses such as bureaucratic constraints in public institutions, rationale

of public investment, economic fragmentation, lack of dialogue with the private sector, weak incentives, and limited progress towards university autonomy still impede the development of the innovation system.

In the early 2000s, the government aimed to enhance Thailand's international competitiveness by bolstering export, foreign direct investment, and tourism, while also investing in domestic and grassroots economies. The adoption of the concept of an innovation system and the recognition of innovative capabilities as critical factors for increasing and sustaining international competitiveness gained prominence during this period (Intarakumnerd, 2005). The 10-year Science and Technology Strategic Plan (2004–2013) prioritized the notion of a national innovation system and industrial clusters, emphasizing measures to encourage innovation and strengthen the innovation system, such as tax incentives and soft loans for R&D investments, establishing excellence centers for post-graduate research students, and initiatives to strengthen grassroots economies (Chaminade, et al., 2012; NSTDA, 2004).

Overall, the evolution of Thailand's innovation policy and the strategic emphasis on nurturing innovative capabilities demonstrate the country's dedication to enhancing its innovation ecosystem and positioning itself on the global stage. Despite incremental progress in the innovation system, many instruments in Thailand still adhere to the traditional paradigm, primarily emphasizing research incentives and public sector focus, rather than fostering capability building and innovation within firms (Intarakumnerd, 2005). Many literatures have highlighted the weaknesses of Thailand's innovation system, often pointing to the underdeveloped relationship between firms and universities, leading to limited intra-firm technological capabilities and constrained innovation–center interactions arising from this linkage (Intarakumnerd, 2006; Rakthai et al., 2019). Strengthening collaboration within the triple helix model involving government, industry, and academia has the potential to both attract a broader pool of talented individuals and cultivate a more proficient cadre of skilled workers and researchers. This, in turn, contributes to increased knowledge and technological outputs, fostering a more successful and competitive economy (Villegas-Mateos, 2023). In response, various initiatives have been introduced to bridge the gap between the university, private, and public sectors, while enhancing innovation capabilities. Noteworthy establishments to address this concern include the Thailand Science Park in 2002, the National Innovation Agency (NIA) in 2003, and the University Business Incubator (UBI) in 2004 (Habaradas, 2008). These organizations have been envisioned to alleviate the mentioned pain points and drive the collaborative advancement of innovation in Thailand. While the UBI mechanism aimed to promote university–industry linkages, the commercialization of university intellectual properties (IPs) through licensing/technology transfer offices yielded limited success. Only six out of 140 patents were transferred to the industry during the period of 1995–2004 (Krisnachinda, 2009; Wonglimpiyarat, 2016). To foster R&D collaboration and commercialization, Thailand has introduced the university technology commercialization model, exemplified by technology clusters like Science Park in Northern Bangkok and Technopolis or Innovation Park in university-dense areas (Wonglimpiyarat, 2016).

The Thai government has implemented various policies and programs to promote entrepreneurship and technological development (Wonglimpiyarat, 2016). However,

compared to prosperous countries in the startup ecosystem, the support provided by the government in Thailand primarily revolves around financial assistance, whereas successful countries emphasize comprehensive support, including an entrepreneurial mindset, culture, and flexible regulations (StartupBlink, 2020). For example, the U.S. has a National Advisory Council on Innovation and Entrepreneurship that aims to enhance the country's capacity as a leading startup nation and innovator (Raimondo, 2022). The U.K. encourages the internationalization of tech companies, while Israel has mature venture capital support and centralized coordination for ecosystem growth (Deloitte, 2023). In Thailand, the startup ecosystem is currently in a developmental phase, holding the 53rd position globally and the 11th position in the Asia Pacific region (StartupBlink, 2022). To improve its ranking and foster growth, it is imperative for Thailand to overcome key obstacles such as talent scarcity, limited access to capital, mentorship support, regulatory clarity, and comprehensive government backing (Deloitte, 2023).

Key elements influencing the success of startup ventures and innovation-driven enterprises

To ensure the success of innovation startups and IDEs while navigating potential obstacles, various critical factors play a significant role in shaping their growth and sustainability. Extensive literature categorizes these key factors into distinct areas that contribute to the entrepreneurship ecosystem.

Government support, encompassing policies, initiatives, tax incentives, and regulations, is pivotal in creating an environment conducive to startup success. Educational initiatives, such as entrepreneurial centers, programs, clubs, and mentorship opportunities, play a crucial role in developing essential skills and know-how. In addition, infrastructure, technology, and network support provided through science parks and collaborations between universities and the private sector are essential for fostering a supportive environment. The importance of a skilled workforce is highlighted, with measures like talent visas, startup visas, global talent visas, and skill development support contributing to talent nurturing. Financial support, including grants, funding opportunities, loans, venture funds, venture capital, angel funds, and private funds, serves as a crucial lifeline, fueling innovation. According to Wonglimpiyarat (2018), the financial mechanism within the innovation system is crucial, supporting technology and innovation development, specifically in the context of research and development (R&D), with the goal of achieving effective technology commercialization, contributing to the creation of businesses, and fostering economic growth.

Prioritizing innovation, technology, and research and development (R&D) is paramount, with investments, patent protection, and technology transfer facilitated through university partnerships to drive progress. Key business factors, such as understanding market dynamics, achieving product-market fit, and planning for scaleup and exit, are critical for sustained growth. Finally, fostering a thriving startup culture involves sharing success stories and understanding the social context, emphasizing the importance of a supportive cultural environment for encouraging innovation and risk-taking (Anitha & Veena, 2022; Audretsch, 2020; Font-Cot & Lara-Navarra, 2023; Gazel & Schwienbacher, 2021; Jeanwittayanukul, 2022; Lee & Kim, 2019; Okrah et al., 2018; Ratinho et al., 2020;

Sahaf & Tahoo, 2021; Schwienbacher, 2021; Song et al., 2008; Tookham, 2021; Yadav, 2015).

These factors collectively determine the overall success of a startup venture. Table 1 provides a summary of various factors driving innovation and offering support to startups, derived from relevant literature sources.

Research method

This paper aims to provide policy recommendations and an operational model to facilitate the advancement of IDEs in Thailand. To achieve this goal, a systematic and comprehensive research framework is employed, designed to understand, and address the complexities of Thailand's IDEs investment ecosystem. Through the integration of data from diverse sources, in-depth interviews, and rigorous analytical techniques, this framework seeks to generate valuable insights and recommendations that can foster the growth and prosperity of IDEs in Thailand. The schematic representation of the research framework is depicted in Fig. 1, comprising five distinct and sequential steps, which are elaborated as follows:

Table 1 Literature survey of important supports/factors contributing to the success of IDEs/Startup

Factors	Detail	References
Government Support	Policy, Initiative, Tax incentive, Regulation, Law	Okrah et al., 2018; Audretsch, 2020; Ratinho et al., 2020; Sahaf & Tahoo, 2021; Anitha & Veena, 2022; Jeanwittayanukul, 2022; Font-Cot & Lara-Navarra, 2023
Education/Knowledge/Know-how	Entrepreneur center, Entrepreneur program, Entrepreneur club, Incubator/accelerator, Mentorship, Training program	Yadav, 2015; Audretsch, 2020; Ratinho et al., 2020; Gazel & Schwienbacher, 2021; Sahaf & Tahoo, 2021; Font-Cot & Lara-Navarra, 2023
Environment Support	Infrastructure, Technology, Network, Science park, University partnership, Public-private partnership	Yadav, 2015; Ratinho et al., 2020; Audretsch, 2020; Tookham, 2021; Anitha & Veena, 2022; Font-Cot & Lara-Navarra, 2023;
Human Capital/Competence/Talent	Talent visa, Startup visa, Global talent visa, Skill development support	Song et al., 2008; Yadav, 2015; Okrah et al., 2018; Lee & Kim, 2019; Audretsch, 2020; Gazel & Schwienbacher, 2021; Sahaf & Tahoo, 2021; Tookham, 2021; Anitha & Veena, 2022; Jeanwittayanukul, 2022; Font-Cot & Lara-Navarra, 2023;
Finance	Grant, Funding, Loan, Venture fund, Venture capital, Angel fund, Private fund	Song et al., 2008; Yadav, 2015; Audretsch, 2020; Ratinho et al., 2020; Zhao & Ziedonis, 2020; Sahaf & Tahoo, 2021; Tookham, 2021; Jeanwittayanukul, 2022; Font-Cot & Lara-Navarra, 2023
Innovation, Technology, R&D	R&D investment, Patent protection, Technology transfer, University partnership	Song et al., 2008; Yadav, 2015; Okrah et al., 2018; Ratinho et al., 2020; Anitha & Veena, 2022; Font-Cot & Lara-Navarra, 2023;
Market Opportunity/Business factor	Market dynamic, Product-market fit, Customer needs, Scaleup, Exit strategy, Market scope, Innovation product, Network, Market growth	Song et al., 2008; Okrah et al., 2018; Lee & Kim, 2019; Tookham, 2021; Jeanwittayanukul, 2022
Culture	Success stories, Social state of startup	Gazel & Schwienbacher, 2021; Jeanwittayanukul, 2022

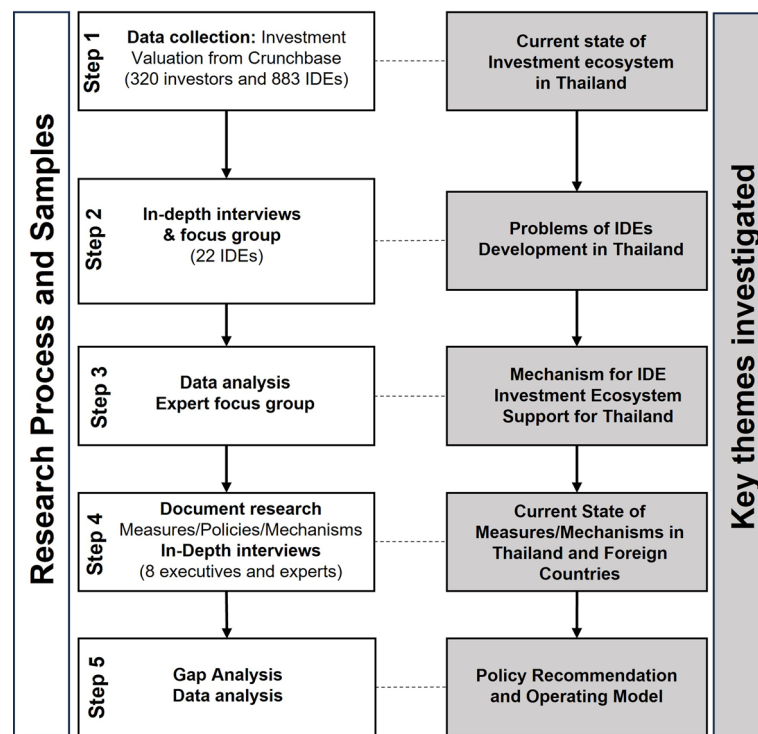


Fig. 1 Research framework

Step 1: Assessing Thailand's Investment Ecosystem: The study commenced with a meticulous examination of Thailand's investment landscape. A comprehensive data set from Crunchbase spanning 2010 to 2022 was employed, comprising data on 320 investors and 883 IDEs, with a specific focus on investment valuations. Through this data-driven approach, insights into the dynamic characteristics of Thailand's investment ecosystem were sought. Scrutinizing this data set allowed for uncovering nuanced trends and conditions, providing a foundation for informed analysis in subsequent research phases.

Step 2: Unveiling Factors Driving Thailand's IDEs Development: To comprehensively examine the determinants influencing the success of innovation-driven enterprises (IDEs) in Thailand, semi-structured, in-depth interviews were conducted to gather the necessary information. The interviews took place between March 2020 and May 2021, with each session allocated a duration of 1 h for the interviewees. Engaging 22 individuals of IDEs' CEOs and co-Founders in Thailand, a purposive sampling method ensured diverse perspectives. An interview protocol, featuring open-ended questions, enabled participants to freely express thoughts, experiences, and attitudes. These interviews aimed to elucidate key factors fostering Thailand's IDEs competitiveness globally. The analysis contributes vital insights into Thailand's IDEs investment ecosystem dynamics, informing strategic interventions and policy recommendations.

Step 3: Designing an IDEs Investment Ecosystem Support Mechanism: Synthesizing insights from Steps 1 and 2, expert opinion meetings were convened in the form of focus groups. Through rigorous analysis and synthesis of collected data, the goal was to design an integrated mechanism promoting harmonious collaboration between capital support systems and joint ventures in the public and private sectors. The mechanism aimed

to create a cohesive framework tailored to facilitate the growth and nurturing of IDEs within Thailand's investment ecosystem context.

Step 4: Analyzing IDEs Investment Ecosystems: This step involved a comprehensive examination of Thailand's and foreign countries' investment ecosystems for IDEs. Extensive literature reviews, reports, conceptual documents, and related resources were scrutinized to understand the existing measures and mechanisms in Thailand's IDEs investment landscape, along with best practices from abroad. In addition, in-depth interviews were conducted with eight Thai executives and experts including representation from public sector (5), private sector (2), and a university incubator (1). These interviews validated and confirmed the current IDEs investment ecosystem in Thailand while capturing valuable insights from key stakeholders actively engaged in fostering innovation-based entrepreneurship within the nation.

Step 5: Formulating Policy Recommendations and Operating Model: Leveraging insights gathered from previous steps (1 to 4), a comprehensive analysis was undertaken to pinpoint gaps, challenges, emerging trends, and investment prospects within Thailand's Innovation and Development Ecosystems investment landscape. This exhaustive assessment formed the bedrock for generating robust policy recommendations and constructing an efficient operating model intended to propel the progress and maturation of IDEs within Thailand. The discernments derived from this meticulous scrutiny aimed to ameliorate existing disparities and tackle pivotal concerns, cultivating an environment conducive to nurturing and perpetuating innovation-driven entrepreneurial ventures in the nation.

Results and discussion

The current state of investment ecosystem in Thailand

In this section, a comprehensive investigation was undertaken, focusing on data derived from a survey and an analysis pertaining to the current state of Thailand's venture capital ecosystem. The data was sourced from internationally recognized databases, specifically Crunchbase.com, spanning the timeframe of 2010 to 2022. The primary objective of this inquiry was to gain valuable insights into the status and dynamics of Thailand's venture capital landscape during the specified period. Figure 2 illustrates the characteristics of IDEs in Thailand, categorized by industry. The data set used for this analysis comprises 636 IDEs in Thailand, with 317 funding records available, amounting to a total disclosed financing value of USD 2451 million. The temporal scope of the study spans from 2010 to Q1 2022, and the IDEs are classified based on their industry affiliations. Regarding the distribution of IDEs across various industry groups during the specified timeframe, the FinTech sector emerges as the most prominent, accounting for 47% of the total IDEs. Subsequently, the Logistic industry group follows with 25%, while the Fashion, AdTech, and InsurTech sectors each represent 5% and 4% of the IDEs, respectively. Nevertheless, a different perspective emerges when examining the industry groups of IDEs based on the number of companies within each category. In this context, AdTech holds the highest share with 16% of the IDEs, closely followed by FinTech with 14%. The Logistic sector accounts for 11% of the IDEs, while Tech services and e-commerce sectors contribute 9% each. The PropTech industry group, on the other hand, constitutes 7% of the total IDEs.

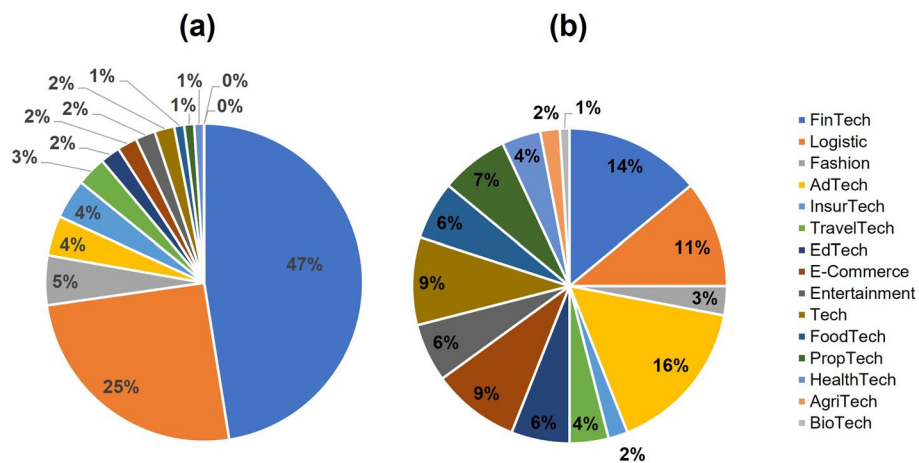


Fig. 2 Characteristics of IDEs in Thailand classified by industry: **a** fundraising value and **b** number of companies

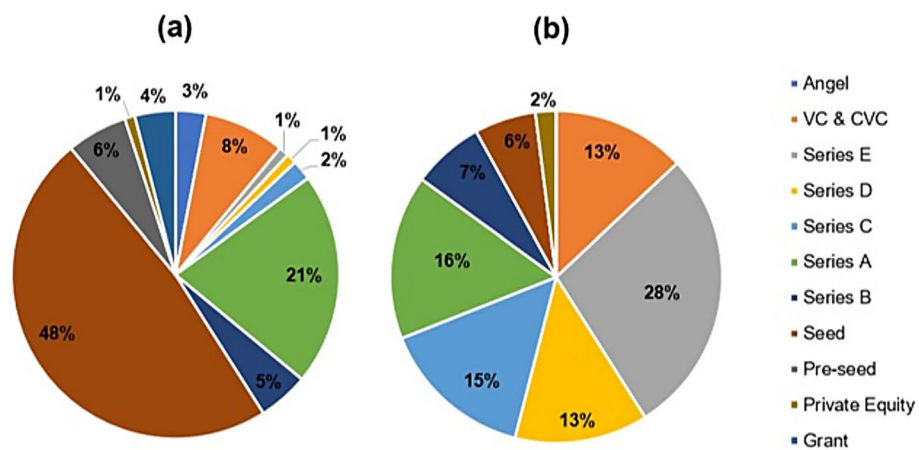


Fig. 3 The funding period of IDEs classified by **a** number of companies and **b** investment value

This study utilizes 317 fundraising reports, representing a total of 2.451 million USD, across 636 IDEs categorized by their latest investment rounds. Notably, 48% secured seed-stage funding, while series A accounted for 21%. Corporate Venture Capital (CVC) and Venture Capital (VC) contributed 8% each (Fig. 3a). Series E fundraising showcased the highest investment value at 28%, followed by Series A and C at 16% and 15%. These insights are based on data up to Q2 2021, highlighting the significance of these investment rounds for IDEs' financial growth. Turning to financial performance, data from 262 entities shows that over 53% reported annual revenues of 1 to 10 million USD by Q2 2021. In contrast, 34% generated less than 1 million USD, and 12% fell within 10 to 50 million USD. These revenue ranges offer valuable insights into IDEs' financial stability. Examining funding rounds among 216 IDEs, over 42% experienced one round, while 13%, 6%, 4%, 1%, and 1% underwent 2 to 8 rounds (Fig. 3b), underscoring diverse funding trajectories.

The IDEs database reveals a noteworthy sum of 2451 million USD obtained through fundraising, primarily at the Seed Stage, spanning 2011 to Q1 2022. Analyzing 317 fundraising rounds yielded these insights. Notably, a surge in high-value fundraising events in Thailand began in 2013, peaking at a record 97 rounds in 2019. Subsequently, fundraising frequency gradually declined. Comparing fundraising value and rounds, changes in value lagged 1–2 years behind round fluctuations. Notably, significant value increments emerged from 2014, culminating at 524 million USD in 2020. When assessing IDEs' ability to progress to subsequent funding rounds in Thailand, it's evident that IDEs founded during 2010–2013 and 2015–2017 accessed deeper funding rounds and larger grants than other periods. Table 2 shows an inclusive funding overview for IDEs in Thailand, categorized by investment stages. The Angel/Grant stage (2011 to Q2 2021) secured 2 million USD in total investment, averaging 87,153 USD per investment. In the Pre-seed/Seed Stage (2011 to Q1 2022), IDEs received 143 million USD, averaging 400,000 USD per investment. For Series A (2011 to Q1 2022), total investment reached 357 million USD, averaging 3.5 million USD per investment. In Series B (2011 to Q1 2022), 298 million USD were invested, averaging 8.3 million USD per investment. Proceeding to Series C (2011 to Q1 2022), total investment was 299 million USD, averaging 42.8 million USD per investment. Series D (2011 to Q1 2022) attracted 242 million USD, averaging 80,700,000 USD per investment. For Series E (2011 to Q1 2022), total investment reached 150 million USD. Lastly, the Venture Round (2011 to Q2 2021) witnessed 143 million USD in total investment, averaging 14,295,000 USD per investment.

Examining Thai IDEs by industry and investment stages (2011 to Q2 2021) yields insightful findings. In the Angel/Grant Stage (35 data points), the total investment was 2.1 million USD. FoodTech led with 35%, followed by AdTech (21%) and Entertainment (13%). Moving to Pre-Seed/Seed (357 companies), the total investment reached 107.6 million USD. FinTech and Marketing Technology led at 22%, followed by AdTech (19%) and EdTech (13%). Series A (85 companies) saw 296 million USD total investment. InsureTech (19%), FinTech (14%), and E-Commerce (13%) were prominent. Series B (30 companies) garnered 201.9 million USD. Transportation/Logistics led (32%), followed

Table 2 Types of funding for IDEs in Thailand classified by investment period (stage) (data as of Q1 2022)

Fundraising Stage	Number in database (Items)	Number of disclosures (Items)	Total investment value (Million USD)
Angel/ Grant*	35	24	2.1
Seed	373	137	143
Series A	100	58	357
Series B	36	15	298
Series C	7	4	299
Series D	3	3	242
Series E	1	1	150.0
Venture Round*	20	10	143.0
Others*	24	10	28.0
Total	599	262	1662.1

* Data as of Q2 2021

by FinTech (23%) and FoodTech (13%). Series C (6 companies) secured 149.6 million USD. FinTech dominated (53%), with Fashion (35%) and Logistics (7%). Another Series B (3 companies) reached 242 million USD. Logistics led (89%), with AdTech (11%). Series E had one IDE, Flash Express, securing 150 million USD in Logistics (2021). The data collected from the database provides valuable insights into Thailand's IDEs fundraising landscape, which accounts for a total value of 2451 million USD. When examined through the lens of industries, the IDEs can be categorized into FinTech (47%), Logistics (25%), Fashion (5%), AdTech (4%), and InsurTech (4%), respectively. Interestingly, industries considered as Thailand's target sectors, such as BioTech, AgriTech, HealthTech, FoodTech, TravelTech, and EdTech, collectively comprise 26% of the fundraising list. However, their individual fundraising values are relatively modest, accounting for only 16% of the country's total fundraising value (137 million USD). Moreover, the investment value per transaction in these focused innovation-driven industries falls below the overall average. In contrast, industries that secure more than 80% of the fundraising are Logistics, FinTech, AdTech, and InsurTech, which are associated with high investment values. This discrepancy indicates that a significant portion of funding is yet to venture into the targeted innovation-driven sectors. Thailand's IDE analysis unveils significant fundraising and industry patterns. Innovation-driven sectors primarily secure Series B funding, with notable engagement in preliminary rounds like Angel/Grant and Pre-Seed/Seed. Conversely, non-innovation-driven industries exhibit higher investments in later stages, notably Series B. Innovation-driven sectors show lower participation and average investment values compared to non-innovation-driven counterparts.

In Thailand's IDE ecosystem, achieving the 2% GDP IDE funding goal presents substantial challenges. Fundraising predominantly favors non-innovation-driven industries like Logistics, FinTech, AdTech, Fashion, and InsurTech. Conversely, innovation-driven sectors such as BioTech, AgriTech, HealthTech, FoodTech, TravelTech, and EdTech receive a modest 10% of the country's fundraising, consistent with Startup Universal (2020) and Techsause (2022) findings highlighting FinTech, e-commerce, and business solutions. Thailand's limited R&D investment, only 1.14% of GDP in 2019 (The World Bank, 2019), raises concern for innovation potential and economic growth. Thai startups' progress through funding stages poses a challenge, with only 16%, 7%, and 1% advancing to Series A, B, and C (Techsause, 2022). This attrition rate underscores potential support insufficiencies, potentially limiting innovative enterprise growth. Further complexity emerges from declining company registrations (Thawesaengskulthai et al., 2021), complicating Thailand's innovative enterprise goals. Addressing this requires holistic strategies to dismantle barriers and cultivate an encouraging environment for entrepreneurship.

Problems in the development of Thailand's IDE ecosystem

Entrepreneurs in each country exhibit unique characteristics shaped by the specific context of their nation, a notion emphasized in the works of Colombelli (2016) and Audretsch et al., (2020). However, without careful consideration in the design of policies to support entrepreneurs, the resulting policies may lack genuine benefits. Therefore, this study rigorously identifies challenges within the IDEs ecosystem in the context of Thailand. To achieve this, primary data were collected through in-depth interviews with

Table 3 Finding and keywords from interviews with 22 IDEs in Thailand on factors contributing to the lack of successful startups/IDEs in Thailand

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
1	CEO, Co-Founder	AdTech	<ul style="list-style-type: none"> Recent Startup Thailand events fell short t of expectations, potentially due to factors like the COVID-19 situation. To enhance impact, the government should leverage technology from existing Thai companies, benefiting the country's overall products and GDP Significant salary increases for Tech Talent by banks and large companies pose challenges for IDEs in attracting such talent Government and educational institutions should play a role in fostering coding skills due to a shortage of Tech Talent graduating each year The presence of foreign Giant Tech companies like Lazada and Shopee presents challenges for local startups, emphasizing the need for careful consideration of tax implications Noteworthy disruptions in the Thai market, such as Choco facing challenges, highlight the importance of government intervention to address such issues In the dynamic tech landscape, the government should actively support Thai Tech Startups dealing with challenges resulting from the entry of foreign players and disruptions in the market 	<ul style="list-style-type: none"> Startup Thailand Events COVID-19 Impact: Technology Leveraging Tech Talent Challenges Coding Skills Shortage Foreign Giant Tech Companies Market Disruptions Government Intervention Foreign Players and Disruptions
2	CTO, Co-Founder	AdTech	<ul style="list-style-type: none"> IDE success is no longer guaranteed, and media focusing solely on IDE news needs content diversification Co-Working Space businesses face challenges in the current IDE landscape The future of Venture Capital (VC) investment in Thailand depends on ASEAN economic trends. Successful COVID-19 management, especially in health-related IDEs, may attract more investor interest Investors favor IDEs with clear B2B revenue models over B2C models due to concerns about continuous cash burn The global shift towards Deep Tech IDEs faces challenges in the Thai landscape, including brain drain and the limited size of the market Establishing Deep Tech or True AI businesses requires substantial funding and regional recognition, presenting challenges for Thai IDEs on a broad scale 	<ul style="list-style-type: none"> IDE Success Uncertainty Media and IDE News Challenges for Co-Working Spaces VC Investment Future Investor Preferences Challenges in Deep Tech Shift
3	CEO, Co-Founder	AgriTech	<ul style="list-style-type: none"> Our business addresses challenges in accessing agricultural equipment and technology, facing issues with unclear legislation for categorization and tax collection Venture capitalists seek quick returns, but agricultural businesses take longer to yield results Recommend establishing a sandbox for experimenting with income tax separation, supported by policies that encourage experimentation, requiring top-down directives for executive support 	<ul style="list-style-type: none"> Equipment and Technology Access Misalignment of Timelines with Venture Capital Sandbox and Policy Support

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
4	Business Development, Co-Founder	BioTech	<ul style="list-style-type: none"> • Company prioritizes addressing agricultural challenges, choosing government funding to avoid investor control concerns during fundraising • Complex and delayed government funding disbursement raises doubts about the intended growth of the IDE-focused business • Government should create a sustained ecosystem for farmers, as current projects lack continuity, typically lasting only 6 months to 1 year • Universities should develop programs for nurturing IDEs businesses, involving mentors with practical success in the field, not just theoretical academics 	<ul style="list-style-type: none"> • Investor Control Concerns • Government Funding Disbursement • Sustained Ecosystem for Farmers • University Programs for IDEs
5	CEO, Co-Founder	BioTech	<ul style="list-style-type: none"> • IP registration issues lead to reliance on an external company due to prolonged processing at Chulalongkorn University • University communication falls short compared to external firms, missing the promised 2-week response time despite multiple corrections during reviews • Propose transferring invention ownership to the university for independent management • Establishing a separate company raises ethical questions about work quality for faster market entry in Crown Property Bureau-funded projects • Propose special privileges for professors involved in IDEs, allowing the use of IDE work for academic advancements, or extending academic contract time for IDE activities 	<ul style="list-style-type: none"> • IP Registration Issues • Communication Shortcomings • Invention Ownership • Ethical Questions • Special Privileges
6	CEO, Co-Founde	E-Commerce	<ul style="list-style-type: none"> • Decreasing government support for university IDE activities limits opportunities for new-generation innovative businesses, influenced by factors like unutilized student grants and economic challenges such as the COVID-19 pandemic • Previous thin spreading of government support for IDEs among multiple teams led to significantly reduced funding for each, resulting in closures for some teams due to insufficient development funds • The current complex process for securing state funding hinders IDEs, with intricate disbursement procedures and prolonged waiting periods conflicting with their need for substantial and rapid growth • Mentors are crucial for newcomers in the IDE field • IDEs hesitate to seek funding from private Accelerators, limiting their presence in Thailand • Government participation in supporting them would significantly benefit the IDEs ecosystem 	<ul style="list-style-type: none"> • Government Support/Participation • Thin Spreading of Support • Complex Funding Process • Importance of Mentors • Hesitancy toward Private Accelerators

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
7	CEO, Founder	E-Commerce	<ul style="list-style-type: none"> • Thailand underutilizes technology, missing opportunities, especially evident during the COVID-19 Work From Home situation, relying heavily on foreign tech. There's a call for a mindset shift to extensively use technology in Thai businesses and enhance innovation-driven enterprises (IDEs) • Fostering IDEs requires a long-term perspective, with insights from places like BLOCK71 in Singapore emphasizing continuous knowledge development, grooming, and an IDE-friendly environment • Encouraging Corporate Venture Capital (CVC) with government-backed tax incentives for R&D investments is recommended. Collaborations with market bases, funding, and mentors contribute to IDEs' sustainable growth • Fruitful collaboration between large corporations and IDEs is possible (e.g., Central Group acquiring 75% of MEB), highlighting the potential for rapid business expansion. • Government support through tax incentives for R&D investments is crucial • A mindset shift is needed in larger companies, emphasizing the importance of passionate individuals to drive technological disruption • Timing is crucial, requiring a mindset change in large companies before effective Corporate Venture Capital (CVC) can occur 	<ul style="list-style-type: none"> • Technology Underutilization • Mindset Shift • Long-Term Perspective for IDEs • Corporate Venture Capital (CVC) Encouragement • Collaborations for Growth • Government Support • Crucial Timing
8	COO, Co-Founder	EdTech	<ul style="list-style-type: none"> • Starting a company involves overcoming challenges in accounting, taxation, and legal aspects, emphasizing the need for practical experience to avoid unforeseen mistakes, especially in investor negotiations • Limited companies face obstacles, such as the inability to issue Stock Options to employees, leading to delays and the necessity for stock issuance agreements • Challenges in hiring foreign workers include minimum capital requirements, occupation restrictions, and minimum wage requirements for employees from specific countries • Creating a specialized fund for business investment is advantageous due to clear operational guidelines • Concerns exist about the government's capability to integrate the entire supply chain to foster collaboration between businesses 	<ul style="list-style-type: none"> • Starting a Company Challenges • Stock Options for Employees • Hiring Foreign Workers • Specialized Fund for Business Investment • Supply Chain Integration

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
9	CEO, Founder	EdTech	<ul style="list-style-type: none"> Challenges in establishing a Thai IDE ecosystem include team readiness, product-market alignment, and dominance by a few large companies Government support is sought for policies, legal frameworks, and incentives like tax-free ESOPs, improved pay incentives, and measures such as tax-free investments and matching funds Issues with fund registration and hiring skilled foreign employees lead IDEs to adopt unconventional hiring methods Clear fund matching with growth stages, particularly government support for early stage investments, is crucial to prevent businesses and investors from moving abroad Grants with defined KPIs in the pre-idea stage ensure follow-up and set clear goals for further VC investment Thailand's lower investment in IDEs than the USA suggests the need for improved tax laws at every growth stage Lack of competition in the Seed Stage, exemplified by 500TukTuk, leads to longer evaluation times for IDE investments Clear milestones for CVC, specifying KPIs for each growth stage, are recommended Sectors like Fintech, Edtech, Agritech, and Traveltech are identified for IDE focus. Deeptech IDEs should engage customers before seeking venture capital, proposing partnerships with large companies invested in R&D To enhance the ecosystem, supporting CVC investments in IDEs for mergers and acquisitions is suggested Clear processes for growth acceleration and acquisition timelines should be established for a conducive IDE environment in Thailand 	<ul style="list-style-type: none"> Thai IDE Ecosystem Government Support Fund Registration and Hiring Fund Matching for Growth Stages: Grants in Pre-Idea Stage Tax Law Improvement Lack of Competition in Seed Stage Clear Milestones for CVC Focus Sectors for IDEs Supporting CVC Investments Establishing Clear Processes
10	CEO, Founder	FinTech	<ul style="list-style-type: none"> Thai IDEs face obstacles competing with foreign counterparts due to legal limitations, leading to higher costs compared to foreign exchanges without similar requirements Legal constraints impede certain activities in Thailand The country lacks rapidly growing technology firms, reflecting a global trend Thailand's middle-income status over the past 10–20 years limits technological advancements, especially in technology-based businesses, risking loss to foreign entities Absence of services like Line or Grab in Thailand is attributed to the country's lagging legal framework Bitkub, a significant Thai-owned financial platform, exists due to resistance against external pressure Tax disparities with foreign platforms present challenges for Thai authorities amidst global technological advancements 	<ul style="list-style-type: none"> Legal Limitations Lagging Legal Framework Lack of Technology Firms Middle-Income Status Resistance Against External Pressure Tax Disparities

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
11	Co-Founder	FoodTech	<ul style="list-style-type: none"> Challenges for academic founders, emphasizing limited business expertise and the importance of well-connected board members for networking and development Legal challenges in healthcare, particularly customer unfamiliarity and complex registration processes in Thailand Emphasis on the need for universities to raise IDE awareness among faculty and students, highlighting the positive impact of IDEs on universities through published works and attracting individuals interested in innovative ventures 	<ul style="list-style-type: none"> Talent Challenges Legal Challenges in Healthcare University Awareness and Impact
12	CEO & Co-Founder	FoodTech	<ul style="list-style-type: none"> Scalable operations and a substantial market are crucial for IDEs to attract investors and potentially become Unicorn Startups IDEs mechanism involves joint ownership for collaborative product development, inspired by Google's approach Clarity is lacking in ESOP and Convertible Note regulations in Thailand, requiring clearer rules for employee ownership Thailand's incomplete Investment Ecosystem needs a Startup Hero for substantial growth, as quantitative support lacks a focus on individual success Government engagement in IDEs procurement could catalyze Thailand's first Unicorn Startup Collaborative efforts between public and private sectors are more effective than mere financial support Legal adjustments, aligning with practices like Singapore's, are essential for building trust and attracting more investors Universities should focus on Deep Technology research, emulate models like MIT, and foster entrepreneurship by adapting curricula and encouraging investment Holding companies 	<ul style="list-style-type: none"> Scalable Operations and Market IDEs Mechanism Regulatory Clarity Incomplete Investment Ecosystem Government Engagement Collaborative Efforts Legal Adjustments University Focus
13	Co-Founder	Health Tech	<ul style="list-style-type: none"> Limited IDE investments in Thailand prompt businesses to diversify into SMEs for survival Safety concerns make launching a Health Tech Startup challenging; a broader experimentation sandbox would be beneficial State-level medication data linkage could significantly benefit Telemedicine businesses University education lacks direct relevance to IDEs, emphasizing the need for practical experience and an expanded business-related curriculum Initiating innovative ventures is smoother within universities; the government should enhance the Investment Ecosystem to better support innovation Small companies face growth challenges 	<ul style="list-style-type: none"> Limited IDE Investments Health Tech Startup Challenges Telemedicine and Medication Data Relevance of University Education Innovation Initiatives within Universities

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
14	CEO, Co-Founder	Health Tech	<ul style="list-style-type: none"> • Government should regulate caregiver services, register service centers, and emulate standards from other countries • Private sector involvement through CSR projects can support Thailand as a hub for elderly care information • Universities should engage in impactful research collaborations beyond statistical studies for genuine planning and development • Government should study Singapore's successful innovation ecosystem and consider registering Thai IDEs there for a supportive business environment • Streamline legal and business processes, with state funding for IDEs focusing on viable projects over fragmented initiatives • Universities should collaborate on research projects aligned with both private and governmental initiatives to avoid redundancy and ensure comprehensive impact • Foster private–public partnerships for innovation projects, encouraging collaboration with universities instead of expensive foreign consultations • Address Thailand's challenges by researching impactful areas for the economy and encouraging real investment • Establish independent units with ethical leadership to oversee and drive innovation projects, akin to publicly traded companies • Encourage skilled individuals, both Thai and foreign, to return and contribute to innovation, seeking expertise in various fields for mentoring success • Recognize successful business leaders with diverse educational backgrounds and consider them as centers for collaboration to drive innovation in Thailand 	<ul style="list-style-type: none"> • Government Regulation • Private Sector CSR Involvement • University Research Collaboration • Successful Innovation Ecosystem • Streamlining Legal and Business Processes • Collaboration and Avoiding Redundancy • Private–Public Partnerships for Innovation • Addressing Challenges through Research • Independent Units for Innovation • Encouraging Skilled Individuals • Diverse Educational Backgrounds
15	Co-Founder	Health Tech	<ul style="list-style-type: none"> • Legal challenges in healthcare involve customer unfamiliarity with new products, particularly when inquiring about their legal status • Registering new substances in Thailand is a lengthy process, requiring submissions in the United States and Europe before approval in Thailand • Universities should recognize the positive impact of IDEs, generating published works and attracting individuals interested in innovative business ventures 	<ul style="list-style-type: none"> • Healthcare Legal Challenges • Lengthy Registration Process • University Recognition

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
16	CEO, Co-Founder	Health Tech	<ul style="list-style-type: none"> • Encourage tax-deductible donations to IDEs affiliated with universities (Cloud Funding), acknowledging the challenge of navigating associated processes • IDEs struggle to hire foreign talent due to stringent visa requirements, including impractical 2 million baht registered capital per foreign employee and restrictions through the Board of Investment (BOI) • Tech Fund disbursement processes involve post-completion payments, creating challenges in income statement management with upfront expenses and delayed income • Contract inflexibility during the innovation phase hinders adaptability to market changes. Call for more flexible, feasible contracts reflecting the dynamic nature of IDEs 	<ul style="list-style-type: none"> • Tax-Deductible Donations • Hiring Challenges • Tech Fund Disbursement • Contract Inflexibility
17	CEO & Co-Founder	InsurTech	<ul style="list-style-type: none"> • Government struggles to implement Employee Stock Option Plans for limited companies, hindering share transfers to employees, especially in public companies • Stock use as loans is prohibited, preventing debt-to-equity conversion and preferential share holding by investors • Innovation business funding prioritizes quantity over quality, signalling a need for a shift towards quality-focused funding • Appointing fund managers for state funding oversight and scrutiny by the Office of the Auditor General are essential for recognizing genuine context and risks • Government structure leads to project abandonment, requiring comprehensive support for unicorn startups and a holistic investment ecosystem • Private sector in Thailand favors foreign technologies; encouraging foreign innovation businesses is crucial, with government involvement in investment • Shifting the ecosystem mindset, canceling non-government tasks, and addressing legal complexities, such as FinTech regulations, are crucial for success • Universities should open incubation opportunities to diverse participants, not limiting support to their students or alumni 	<ul style="list-style-type: none"> • Employee Stock Option Plans (ESOP) • Stock Use Restrictions • Funding Prioritization Issues • Oversight and Scrutiny • Government Structure Challenges • Private Sector Preferences • Ecosystem Mindset Shift • University Involvement

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
18	Co-Founder	PropTech	<ul style="list-style-type: none"> • Major companies in Thailand's IDE sector are expected to enhance existing IDEs, posing a challenge for smaller entrepreneurs facing competition from internally developed technologies • Current challenges include a shortage of tech talent, leading to intense competition for skilled professionals • The impact of the COVID-19 pandemic has forced some IDEs to downsize or pivot for survival, hindering business expansions and foreign investor assessments • In 2023, investment trends favor E-commerce, Fintech, and data-driven businesses, while Deep Tech IDEs face challenges due to complexity and patent-related issues • Despite challenges, the key factor for Thai IDEs is the importance of support, including mentors and advisory units, crucial for resilience and growth • The absence of new investors and limited support suggests a stagnant innovation environment, but established businesses in E-commerce continue to attract investment 	<ul style="list-style-type: none"> • Tech Talent Shortage • COVID-19 Impact • Deep Tech IDEs challenges • Key Factor Support • Investor Environment
19	CEO & Co-Founder	PropTech	<ul style="list-style-type: none"> • Local businesses in Thailand lack the skills and experience compared to foreign counterparts, despite the emphasis on experience by entrepreneurs • Government initiatives to establish innovation ecosystems have not effectively conveyed the innovation business loop to many local businesses • Legal flexibility, as seen in Indonesia, could benefit private businesses in Thailand • Angel investors lack clear incentives and understanding of the innovation business loop • VC investors hesitate toward Thai IDEs due to perceived lower growth opportunities and higher risks • Corporate Venture Capital (CVC) invests in IDEs but often acquires technology or talent without contributing to further development • Thailand's openness to trade and investment may disadvantage local IDEs • The government should define a focused sector, supporting areas like Food & Agriculture, Health, and Sustainable Energy • VC fund managers must understand both investment and the university's diverse fields • University holding companies should have a clear objective for promoting innovation businesses and avoid involving academic personnel in business management • Explicit regulations for holding companies are essential for confident and legally compliant decision-making, considering current legal risks in universities 	<ul style="list-style-type: none"> • Skills and Experience • Ineffective Innovation Ecosystem Communication • Legal Flexibility • Angel Investors • VC Investor Hesitation • CVC Acquisition Challenges • Trade and Investment Environment • Government Sector Focus • VC Fund Manager Knowledge • University Holding Companies • Regulatory Framework

Table 3 (continued)

Interviewees			Interview Finding	Finding Keywords
No	Profession	Business Sector		
20	CEO & Co-Founder	Tech	<ul style="list-style-type: none"> • Research funding system hinders focus by frequently shifting topics, leading to insufficient support • Public sector research pricing avoids initial losses, limiting competitiveness and discouraging risk-taking in the Valley of Death • Domestic focus of IDEs without advanced technology restricts global growth • Insufficient support for matching researchers with businesses • Public sector's researcher development system lacks an entrepreneurial mindset • Utilizing Key Performance Indicators (KPIs) in research 	<ul style="list-style-type: none"> • Research Funding System • Public Sector Research Pricing • Domestic Focus of IDEs • Insufficient Support for Collaboration • Researcher Development System • Utilization of KPIs (success measurement)
21	CEO & Co-Founder	Tech	<ul style="list-style-type: none"> • Government's inadequate IDE support forces businesses to prioritize SMEs for survival • Universities should nurture entrepreneurship from students' academic years, preparing them for seamless business startups • Thailand should offer more activities for IDEs to enhance skills and foster collaboration for efficient future teams • Companies eschew seeking investment to maintain control, opting for slower growth aligned with their vision • Our company relies on technology for streamlined operations, minimizing workforce needs and optimizing costs 	<ul style="list-style-type: none"> • Government Support • University Entrepreneurship • IDEs Skill Enhancement • Avoidance of Investment • Technology-Reliant Operations
22	CEO, Co-Founder	Tech	<ul style="list-style-type: none"> • Challenges include difficulties in patent protection due to the ease of copying work with slight code modifications • Other obstacles involve tax complexity, personnel matters, limited access to funding, and the dominance of large Thai companies hindering innovative businesses • Obtaining funding from Tech Funds is slow and involves manual processes • Suggested improvements include digitalization with a centralized database for easy information retrieval and streamlined business operations 	<ul style="list-style-type: none"> • Patent Protection Challenges • Support Challenges • Slow Funding Processes

deficient incubation and acceleration programs. Anitha and Veena (2022) stress market research, pilot testing, and peer competition for competitive success; and (3) *Supporting System*: Challenges in support arise from factors like uneven funding distribution, lack of continuity, and limited authority in managing Thailand's Innovation Ecosystem. Inadequate government focus on vital projects, absence of viable business models for IDEs, and insufficient legislation hinder innovation-based businesses. Alewamleh et al., (2023) emphasize existing regulations and institutional practices as significant barriers for entrepreneurs in this context.

Mechanism for IDE investment ecosystem support for Thailand

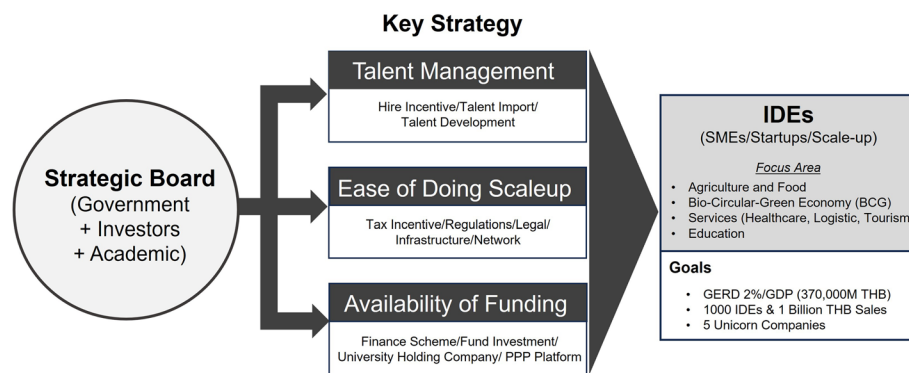
This study proposes three strategic solutions, closely aligned with identified root causes, to effectively tackle challenges hampering Thailand's IDE success. These strategies, vital for policy implementation, encompass talent management, ease of scaleup, and availability of funding, introduced in previous research (Thawesaengskulthai et al., 2021). The significance and potential impact of each strategy on fostering a conducive IDE environment in Thailand are comprehensively elaborated.

The Talent Management Strategy involves shaping employment policies to attract skilled individuals to startup teams, including incentives and international talent attraction. Emphasis is placed on developing proficient young professionals with attributes suitable for business operations.

The Ease of Doing Scale-up Strategy aims to facilitate the proliferation of innovation-driven enterprises (IDEs) through two primary avenues. It encompasses the revision of laws and regulations to incentivize startups and investors, enhancing business growth flexibility. Furthermore, it emphasizes a comprehensive support system, extending beyond finances, to include infrastructural assistance, information access, technology resources, and networking opportunities, fostering public–private sector collaborations.

The Availability of Funding Strategy addresses the critical need to generate appropriate investment returns, in line with associated risks, thus resolving funding challenges related to product-market alignment. This strategy focuses on furnishing accessible and suitable funding sources from both public and private sectors. Universities play a vital.

According to Deloitte's report (2023), Thai stakeholders confront four substantial challenges impacting the startup ecosystem. The first, Economic (Market & Finance), pertains to early stage funding difficulties, particularly at the seed stage, from venture capitalists and other sources. Startups also face hurdles in competing with established corporations for opportunities and attracting talent within the Thai marketplace. The second challenge, Infrastructure, involves waning accessible market enablers like accelerators and incubators, along with limited connections to academic partners and global platforms. The third, People challenges, encompass recruiting local and foreign talent, inadequate mentorship from successful entrepreneurs, and a domestic market focus over global expansion. Lastly, the fourth challenge, Government & Regulatory, concerns restrictive regulations impacting startups, including complexities with Employee Stock Ownership Plans (ESOPs) and licensing applications. Investors also encounter inflexible regulations regarding partnership structures and preferred shares or convertible



Thailand Innovation-Driven Enterprise Hub (IDEs Hub)

Fig. 5 Thailand innovation-driven enterprise hub (IDEs hub)

debt. Importantly, these challenges align with the three strategies proposed in this study. Furthermore, these three strategies are effectively implemented within a model known as the Thailand innovation-driven enterprise Hub or IDEs Hub (Thawesaengskulthai et al., 2021) (Depicted in Fig. 5). This hub serves as a vital link between the capital support systems and joint ventures in the public and private sectors, fostering an efficient joint venture ecosystem in Thailand's IDEs. It can be asserted that achieving Thailand's goal of a 2% increase in GDP (equivalent to 370,000 million baht) is feasible through the IDEs Hub model, with the "university" at its core. Many universities in the ASEAN region have embraced innovation-oriented policies, albeit at varying levels of readiness (Chaipongpati, et al., 2022). To develop diverse innovations effectively, universities must attract and retain talented individuals as they form the cornerstone of the country's development. Talent Management plays a crucial role in fostering a pool of highly skilled individuals within the university and attracting external talent to supplement existing knowledge and expertise.

Promoting the influx of talent into university ecosystems involves motivational initiatives, regulations, and the Ease of Doing Scale-up strategy. Demonstrating research excellence attracts industry interest, leading to funding via the Holding Company. Successful innovations attract more industry investments, bolstering the Holding Company's value and generating university returns. The University Holding Company functions as a financial mechanism, leveraging its research innovation status. TusHoldings in China, founded by Tsinghua University, serves as a prime example of a thriving university holding company. TusHoldings fosters innovation and entrepreneurship, driving university growth, economic prosperity, and technological progress (Wang & Gao, 2022). University holding companies establish a symbiotic link between academia and the startup ecosystem. They bridge the gap between research and commercialization, fueling technological innovation and supporting startups. By fostering growth, providing financial assistance, and granting access to resources, these entities significantly influence national-level startup success. Consequently, their efforts greatly contribute to economic and societal advancement.

A comparative study of the current state of the measures and mechanisms for IDEs investment ecosystems in Thailand with best-case examples from foreign countries

In this section, the current measures/policies/mechanism in all three components (Talent management, Ease of doing scaleup, and Availability of funding) to support IDEs in Thailand has been collected and compared with those from foreign countries as best practices for further gap analysis to be an essential guideline for developing and improving measures to be practical and meet the needs of all stakeholders. The information on policies and measures supporting startups in Thailand and other countries was gathered from credible and authoritative sources, including government websites, relevant organizations, the GenGlobal “Atlas: GEN’s Research + Policy Portal” database (<https://www.genglobal.org/atlas>), as well as reports from Deloitte’s Future of the Thai startup and venture capital ecosystem (Deloitte, 2023), Deloitte’s Survey of Global Investment and Innovation Incentives (Deloitte, 2020), and Worldwide R&D Incentives Reference Guide 2020 (Ernst & Young Global, 2020). The information on measures and mechanisms to support IDEs/Startups in three aspects is shown in Table 4.

The comparative analysis underscores Thailand’s comprehensive policies to bolster IDEs across three facets. Nonetheless, these measures, while extensive, lack full integration and efficacy in fulfilling national objectives. The study conducts a comprehensive comparative examination of Thailand’s IDE framework alongside strategies from other nations, revealing critical gaps. Findings include:

Talent Management: Thailand faces challenges in attracting foreign talent due to restrictions on permanent residency or citizenship. IDE training programs lack outcome-focused approaches and experienced mentors. Other countries offer incentives for foreign talents and emphasize practical learning, leading to highly skilled individuals across age groups.

Ease of Doing Scaleup: Overlapping laws governing startups, SMEs, and listed businesses create inefficiencies. Tax benefits for Intellectual Property hinder IDE growth. Contrarily, other countries facilitate scaleup through diverse tax incentives, investment support, and business exit strategies.

Availability of Funding: Thailand’s funding allocation for IDEs is limited, with inadequate support from VC, Angel groups, and Accelerator Programs. Domestic focus neglects foreign startups. Funding distribution across industries lacks targeting, while specific agencies dominate developmental goals. Collateral requirements for startup loans impede IDEs. In contrast, other nations align funding with national targets and offer specialized loans.

The analysis highlights areas for Thailand to enhance IDE support mechanisms. Addressing these issues and adopting successful strategies from other countries can nurture a thriving IDE ecosystem in Thailand.

Policy recommendations and operating model with practical working procedure for creating IDEs suitable for Thailand

The previous section critically assessed pain points in Thailand’s IDE joint venture ecosystem. The analysis aims to offer tailored recommendations and an operational model for nurturing innovation-based entrepreneurs. Notably, Thailand lacks a centralized organization overseeing national innovation goals, in contrast to Israel’s Israel

Table 4 Measures/policies/mechanisms supporting IDEs in Thailand and best-case examples from foreign countries in the aspects of talent management, ease of doing scaleup, and availability of funding

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
Talent management				
Import talent people	Smart Visa	<p>Visa to attract high-quality personnel to Thailand Both academics, executives, investors, and entrepreneurs can stay in Thailand for a maximum of 4 years and work without requesting a Work Permit to report annually. Unlimited travel in and out of the country</p>	Global Talent Visa (United Kingdom)	<p>For talents in academia or research, arts and culture, digital technology. They can live and work in the UK for up to 5 years at a time</p>
			Entrepreneur visa (United Kingdom)	<p>For foreign entrepreneurs starting a new UK business or investing in an existing one. This visa is granted for 3 years and 4 months, extendable for an additional 2 years if requirements are met. This visa leads to permanent residence and British citizenship</p>
			Investor Visa (United Kingdom)	<p>For investors and families investing at least £2 million in the UK. If the amount invested is large Can apply for settlement faster and finally obtained British citizenship</p>
			Innovator Visa (United Kingdom)	<p>For innovative start-up entrepreneurs wanting to establish a UK company, this business visa provides access to the UK market with a low investment of £50,000, you and your family can reside in the UK for 3 years, with the option to extend the visa for 2 years</p>
			EntrePass (Singapore),	<p>For foreign innovators, investors, or experienced entrepreneurs moving to Singapore to start a business. This visa allows eligibility for Singaporean permanent residency after 12 months</p>

Table 4 (continued)

Aspect	Thailand		Abroad	
	Policy	Detail	Policy	Detail
			Tech.Pass Visa (Singapore)	For tech entrepreneurs, leaders, or experts. This flexible visa is valid for 2 years, with the option to extend it for another 2 years
			O-1 Visa (United States)	Temporary visa for individuals with special abilities in science, education, business, or athletics. Initial stay is up to 3 years, extendable by 1 year increments
			Tech Nation Visa (United Kingdom)	For tech founders and employees to work or do business in the UK, including fintech, AI, cyber, and gaming sectors. Visa is valid for up to 5 years, extendable to family members, with the option to apply for further extension or permanent settlement afterward
			Canada startup visa (Canada)	The special startup visa program allows up to 5 founders, each owning at least 10% of the company, with sufficient personal capital. Investment of C\$200,000 from a venture capital fund or \$75,000 from an Angel Investor group is required. Permanent residence can be granted
			French Tech Visa (France)	Visa for tech startups, investors, and founders with spouses, enabling business expansion or new ventures in France. Stay for business purposes for 4 years, extendable based on success
			Ireland Startup Entrepreneur Program (Ireland)	Visas for startup founders and their employees. Startup companies must be under 6 years of age and have the potential to create well-paying jobs. They will receive a visa for the first 2 years

Table 4 (continued)

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
Innovation/entrepreneur development Program	Online/Offline Training Course, Bootcamp, Incubator–Accelerator Program operated by leading organization	<p>Develop concepts, knowledge and understanding of innovation/products/services, entrepreneurial skills and investment through Online/Offline Training Course, Bootcamp, Incubator–Accelerator Program organized by leading organization in Thailand i.e</p> <ul style="list-style-type: none"> • DeepTech ARI-5G (NIA) • Pioneer Innovation Network (NIA) • Startup Thailand league 2022 (NIA) • Digital CEO (DEPA) • Young Digital CEO (DEPA) • IDE to IPO (NIA) • Startup Crash Course (Thai Startup Association) • JUMPSTART (DEPA) • Startup Connect (DIPROM) 	Italy’s Startup Visa, (Italy)	<p>For startups < 5 years old, with ≥ 5 M euros turnover/year, 15% R&D-related expenses/turnover, 1/3 employees as Ph.D., Master’s students, or researchers, and intellectual property rights. Self-employment visa, no additional permit needed. Initial 1-year stay, extendable for 2 more years</p> <p>Initiative to strengthen existing incubators and create the new ones to support entrepreneurship through guarantee funding, mentorship, and research</p>
			Entrepreneur’s Program (Australia)	
			Sector-based Work Academy Programme (SWAP) (United Kingdom)	<p>A program for building a skilled workforce in the sector. It’s a 6-week internship to recruit skilled individuals and support company growth</p> <p>UK gov’s 16-week skills program for ages 19+ . Develop sector-specific skills, fast-track to job interviews with employers</p>
			Skills Bootcamps (United Kingdom)	

Table 4 (continued)

Aspect	Thailand		Abroad	
	Policy	Detail	Policy	Detail
Employee development support	Thailand Plus Package	To encourage personnel development via tax incentive: 250% corporate income tax exemption for training/training for STEM	I-Corps (United States)	Program to foster a culture of entrepreneurship within the academic and research communities and to accelerate the process of turning breakthrough scientific discoveries into successful commercial ventures
			Global Accelerator Program (Malaysia)	To help global startups to be investment-ready in 4 months and create strong community in ASEAN
Tax benefit /Wage subsidies	BOI Startup Grant	Support personnel wages of not more than 50% but not more than 5 million baht for not more than 2 years, using money from the National Competitiveness Enhancement Fund	TusStar (China)	It's a global network of incubators, accelerators, and innovation centers that promotes collaboration among entrepreneurs, investors, and industry experts. Services include mentorship, funding, co-working spaces, and access to a vast network of partners and customers
	Thailand Plus Package	Encourage the employment of personnel by providing a 150% corporate income tax exemption for highly skilled employment in STEM	Canada Job Grant (Canada)	Canadian government funding programs are designed to reduce costs in providing skills training to employees. The employer contributes 1/3 of the training fee, while the central and provincial governments pay 2/3
			Tech@SG (Singapore)	The company in Singapore can hire foreign employees and sponsor up to 10 people through the Employment Pass (EP) for 2 years, renewable for up to 3 years per renewal
			Hiring Grant (Canada)	covers 50% to 100% of an individual's wages while they work for the company for the duration of up to 52 weeks

Table 4 (continued)

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
Ease of Doing Scaleup Tax incentives for startups	Supporting the employment of foreign personnel through tax rate benefits	The government subsidizes the wages of foreign experts. Including the relaxation of the foreign employment quota limit (from 20 to 38%)		
	Corporate tax deduction/exemption	Exemption of corporate income tax for 5 accounting periods for new entrepreneurs who operate innovative technology businesses	Pioneer Industry Tax Reduction (Indonesia)	In pioneer industries, companies are eligible for corporate income tax (CIT) reductions of up to 100% for a minimum of five years, extendable up to 20 years. Following this, a 50% CIT reduction is granted for the subsequent two years
		An additional 100% corporate income tax exemption of investment (excluding cost of land and working capital) is granted for BOI promoted companies listed in the SET or MAI (Additional Investment Promotion Measures)	Tax exemption scheme for new start-up companies (Singapore)	75% exemption on the first \$100,000 of regular earnings and an additional 50% exemption on the next \$100,000
		50% corporate income tax reduction for 5 years for owners of companies/businesses in group A1, A2, A3 with working capital of not less than 1,000 million baht within 12 months to stimulate investment	withholding tax exemption (Singapore)	Exemption of withholding tax on royalties for the use of patents
			Double Tax for Internationalisation Scheme (Singapore)	Tax deduction of \$100,000 per year assessed, for salaries and expenses paid to employees Where companies send employees to volunteer and extend their services to Institutions of Public Character (IPC)
			Patent box regime (United Kingdom)	Reduce the corporate tax rate from 25 to 10% for some qualifying intellectual property profits

Table 4 (continued)

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
			IP Development Incentive (Singapore)	Income generated from the sale of intellectual property it receives a preferential tax rate with a 5% or 10% tax reduction on the percentage of qualifying IP revenue
	Merit-Based Incentive	300% corporate income tax exemption for R&D expenses. In the case of only investment/R&D expenses, there will be an additional tax exemption period of up to 5 years with no limit on amount	Australian R&D tax incentive (Australia)	Startups with less than \$20 million in annual revenue will receive up to 43.5% cash back
	RDI Tax	Up to 200% of actual expenditures can be deducted for research and development of technology and innovation. For entrepreneurs who operate innovative technology businesses	R&D Expenditure Credit (United Kingdom)	Reduce corporate tax by deducting R&D costs by 230%. In case of loss, up to 14.5% of the amount of loss can be claimed for a value tax credit
			R&D super deduction (Singapore)	Companies carrying out qualifying R&D activities A total tax deduction of 42.5% for local R&D and 17% for overseas R&D
			R&D tax credit (Singapore)	15% of R&D expenditure against corporate income tax in the current year, or 10% of qualifying R&D expenditure against corporate income tax payable in the taxable year and carried forward for the next two years. In both cases. The maximum credit is 30% of the current corporate income tax payable. and must not exceed 50% of corporate income tax when combined with other tax incentives (such as smart machinery or 5G device tax credits)
			R&D Tax credit (United States)	Receive up to 15.8% tax credit on R&D expenses and for some startups can be deducted from Payroll Tax

Table 4 (continued)

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
Tax incentives for investors	Tax deduction for general investment	For Angel Investors who hold shares in technology businesses for at least 2 years, their expenses can be tax deductible up to 100,000 baht	SR&ED Tax Credit (Canada)	Minimum 15% tax credit and can be up to 35% of qualified SR&ED expenses. This can be carried forward 3 years or forwarded 20 years and can be applied to taxes due for other years
		For Angel Investors, investment expenses can be tax deductible up to 5.6 million baht or not more than 50% of the investment (in the process of submitting an offer)	Enterprise investment scheme (United Kingdom)	up to 30% income tax deduction on investments (up to £1 m per tax year, extending to £1 m for investments in knowledge-intensive companies)
			Seed enterprise investment scheme (United Kingdom)	Up to 50% income tax deduction on investments (up to £100,000 per tax year)
			Venture Capital Trusts (United Kingdom)	Tax deduction of up to 30% up to £200,000—Tax, free dividends and no CGT on profits
			Social Investment Tax Relief (United Kingdom)	Investors making eligible investments through SISR can receive a tax deduction of 30% of the investment cost. Investments can be made in the form of equity or debt, and individuals can defer capital gains tax (CGT) but must be paid when sold or redeemed
			Capital gain tax (United Kingdom)	Exemption if holding shares for 3 years with co-investment through VCT or bringing that profit back to reinvest
	Capital gain tax	For investors in venture capital (VC), exemption from personal income tax and corporate income tax on dividends Profit from sale/transfer of shares Revenue from CVC	Venture Capital Investment Schemes (United Kingdom)	Offering tax relief to investor who buy new shares in the company
		Exemption of corporate income tax on dividends Profit from the sale/transfer of shares for 10 years for venture capital (VC) ventures in technology-based companies, and use technology to generate income of not less than 80 percent		

Table 4 (continued)

Aspect	Thailand		Abroad	
	Policy	Detail	Policy	Detail
Other Incentives	Employee Stock Ownership Plan (ESOP)	Non-listed companies can sell shares to executives, employees, or creditors	Enterprise Management Incentive (EMI) Share Options (United Kingdom)	Capital Gain Tax reduces to 10%
	Convertible Debenture	Securing authorization from the SEC to issue convertible debentures through a private placement allows the company to offer them to directors and employees without restrictions on the number of investors or sales value, subject to identity verification	Writing-Down Allowance (Singapore)	can claim an annual deduction on the capital expenditure incurred to acquire qualifying IP assets, such as patents, trademarks, copyrights, and registered designs. The deduction can be claimed over a period of five years or the useful life of the IP asset, whichever is shorter
Availability of Funding Enterprise Finance Guarantee Scheme		Receiving investment from Inno Bridge Fund in the amount of 9 times the monthly expenses and not exceeding 3,000,000 baht/person		
	dVenture	Offers funding support to both early stage and growth startups through investments, accompanied by a range of value-added services aimed at facilitating and enhancing the development of these startups	Innovate UK (United Kingdom)	Help innovation-based businesses to develop new product, services, and processes to grow and scale up through competition-based funding opportunities
	Digital Startup Fund	Provide funding support to early stage and growth startups in the form of grants and direct investment (with share option)	London Co-Investment Fund (United Kingdom)	A £25 million grant from the London Economic Action Partnership (LEAP) and backed by the Mayor of London. The venture fund invests in seed rounds between £250,000–£1,500,000 led by selected venture capital partners
	Research Gap Fund	Support expenses for product/innovation development, not more than 75% of the project value, not more than 2 million baht for technology businesses, not more than 800,000 baht for digital business	British Patient Capital (United Kingdom)	Offer substantial long-term funding support to entrepreneurs leading innovation-driven businesses with a strong focus on research and development, aiming to accelerate their scale-up

Table 4 (continued)

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
	Start-up Voucher	Support for marketing consulting fees for innovative technology companies/enterprises not more than 75% of the project value (< 800,000 baht)	Research and Innovation Scheme for Companies (Singapore)	Providing financial support of up to 50% of the qualifying expenses for startups in innovation and technology. Including a special deduction of 250% of qualifying R&D costs for R&D conducted in Singapore
	Open Innovation Fund	Funding support 75% but not more than 1.5 million baht for the trial process—product prototype trial for innovative startups in the field of Bioeconomy, Manufacturing and Circular Economy and Service and Sharing Economy	Innovation Development Scheme (Singapore)	Grants of up to 50% of the cost to encourage companies to engage and develop their product, process, and application innovation capabilities. The support period is 3 years
	MIND CREDIT Fund	Grants up to 1 million baht per project and no more than 75% of the project value for a period of 1 year for innovation startups	Special Situation Fund for Startups (Singapore)	For startups that have been established in Singapore for less than 10 years, the company is developing/ producing/ and selling innovative technologies or services. It backed \$216 million in funding for 25 promising tech startups based in Singapore
	Big-Win Strategy	Funding for startups in the focus industry	Startup SG Equity (Singapore)	Co-invest with VC firms and investment arm of corporates around the world to feed funds in to early stage startups. It also provides value-added services
			Early stage Venture Fund (Singapore)	Provide funds into startups and offer a buyout option for venture capitalists to acquire the government's stake at cost plus interest; providing the opportunity for upside returns
			Corporate Venture Launchpad 2.0 (Singapore)	Provide matching fund and value-added service

Table 4 (continued)

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
IDEs/Startups Loan	Low interest loans	For innovative companies in the process of expanding their business Low-interest loans in the amount not exceeding 5 million baht, not exceeding 5 years	Grant-scheme for Startups (Croatia)	To assist startups in finalizing their product/service prototype and providing support for its demonstration and testing in a competitive environment
	Interest loan	0% interest loans for 3 years for innovative Agtech companies	Bilateral R&D incentive program (Israel)	Granting funds to entrepreneurs to promote international collaboration on R&D projects
University Holding Company	CU enterprise	A holding company within Chulalongkorn University established to bolster innovation-based business groups through innovation incubation and investment, thereby elevating Thailand's competitiveness on the international stage	Ideation (Thufa) Incentive program (Israel)	Offer grants to entrepreneurs advancing innovative technological concepts to the R&D stage
			CanExport Innovation (Canada)	Access to funding of up to \$75,000 to assist with research and development (R&D) for the technology. It covers up to 75% of the cost of operating and signing R&D agreements with international partners and investors
			Start-Up Loans (United Kingdom)	Loan amounts up to £25,000 with a fixed interest rate of 6% per annum (per annum), repaid over 1–5 years; 12 months of free consultation
			Enisa Participative Loans (Spain)	Provide financial incentives for innovative startup projects (€25000–€1500000 with 7–9 years maturity and 5–7 years interest only period)
			Tusholdings Co Ltd. (China)	Tusholdings is state-owned enterprise affiliated with Tsinghua University in China. They provide incubation services, funding opportunities, and access to a vast network of resources and partnerships

Table 4 (continued)

Aspect	Thailand		Aboard	
	Policy	Detail	Policy	Detail
Public–Private Partnership Co-Investment Platform	Venture capital fund	Venture capital in technology business not exceeding 50% of registered capital	NUS Enterprise (Singapore)	Entrepreneurship Group of the National University of Singapore (NUS) plays a key role in the development of innovation and entrepreneurship at NUS
	Research grants with the private sector	The private sector invests with institutions, both monetary and non-monetary, not less than 60%. Scienc Park supports a budget of not more than 40% of the project value	UnternehmerTUM (Germany)	Leading center for innovation and innovation-based businesses (IDEs), established with the aim of turning inventions into scalable innovation and innovation-based businesses
			GOV–PACT (United Kingdom)	A government agency dedicated to assisting SMEs/startups in developing and testing innovative solutions not yet available in the market. The agency aims to enhance the opportunity for these SMEs/startups to offer solutions to the government while also fostering their innovation capabilities
			Innovation and Skills Plan: Super-clusters (Canada)	Provide investments (co-funded by private sector) and strengthens connection between entrepreneurs, startups, universities, and government partners. Government funding that helps offset up to 50% of project costs by industry
			The Innovation and Technology Venture Fund (Hong Kong)	Co-invest in technology startups with private venture capital fund
			Seed Incentive Program (Israel)	Co-investment between the government or international VCs and Angel investor to incentivize investor to invest in high-risk, early stage startups

Innovation Authority, which streamlines support for startups (Deloitte, 2023). Thailand's existing innovation-supportive bodies operate within specific contexts, potentially leading to fragmented approaches. Enhanced communication and coordination among these entities are needed for a cohesive and comprehensive innovation ecosystem. The proposed policy recommendations and operational model seek to bridge this gap, fostering a unified and effective environment for IDEs in Thailand.

Policy recommendations

Considering the ever-increasing emphasis on innovation as a catalyst for sustainable economic growth and development, policymakers around the world are actively seeking effective strategies to promote and nurture IDEs. Thailand, as a rapidly emerging economy, recognizes the pivotal role played by IDEs in driving technological advancements, job creation, and global competitiveness. However, to fully capitalize on the potential of IDEs, it is imperative to devise comprehensive and well-coordinated policy recommendations that address the underlying challenges hindering their growth and success. This paper presents a set of policy recommendations aimed at fostering an enabling environment for IDEs in Thailand as follows.

- 1) *Establishment of Thailand IDEs Strategic Board (IDEs Board)*: The IDEs Board should be formed with clearly defined responsibilities and seamless integration with other relevant committees. This board should comprise senior executives from both government agencies and Thailand's innovation ecosystem. Its primary objective should be to drive the development and enhancement of measures and mechanisms aimed at fostering IDE in the country.
- 2) *Integration of Agencies in the Innovation Ecosystem*: To streamline efforts and promote cohesive progress, it is essential to integrate agencies operating within the innovation ecosystem under a unified strategic framework and shared objectives. This integration will help reduce redundancy and ensure a collective pursuit of common goals in advancing Thailand's IDE promotion endeavors.
- 3) *Stakeholder Engagement in Developing Measures and Mechanisms*: A systematic collaboration with the private sector is crucial in identifying pertinent issues and challenges faced by stakeholders. This collaboration should extend to the development and trial of measures and mechanisms to effectively drive innovation-based businesses in Thailand. By actively involving the private sector, the implementation of these measures can be fine-tuned to suit the specific needs and realities of the innovation ecosystem.

Operating model and practical working procedure

As policy recommendations suggested above, the creation of an operating model and practical procedure is essential to ensure a well-structured, efficient, and coordinated approach to implementing policy recommendations. It enhances the likelihood of successful outcomes and supports the long-term sustainability of policies designed to foster

IDEs and economic growth. The details of the operating model along with practical working procedure are explained below.

Establishment of the strategic board through the following procedure: The establishment of the National Innovation-Based Business Driving Policy Committee involves appointing.

- Board of Investment (BOI) as the *chairman*. BOI plays a crucial role in enhancing Thailand's competitiveness through innovation, R&D, and value addition across diverse sectors, including agriculture, industry, and services. As the chairman, BOI also facilitates overseas investments to elevate the global position of Thai businesses. Its specific focus on fostering the IDE investment ecosystem is pivotal in driving Thailand's successful transition to Industry 3.0. BOI's strategic importance lies in providing tax-related and non-tax-related benefits to advance the landscape of innovation-based businesses in the country.
- Office of the National Higher Education, Science, Research and Innovation Policy Council (NXPO) as *committee's vice chairman*. NXPO supports and facilitates the Higher Education Science Policy Council National Research and Innovation, providing essential input on policies, strategies, budgets, and regulatory amendments related to higher education, science, research, and innovation. This authority empowers the Board of Directors to effectively set national goals and foster IDE tailored to Thailand's context.
- Key government agencies within Thailand's innovation ecosystem as the *Board member*, namely:
 - The National Innovation Agency (NIA) promotes the establishment of a national innovation system.
 - The Digital Economy Promotion Agency (DEPA) focuses on investment and business operations in the digital innovation industry, including personnel development.
 - The Department of Intellectual Property (IP) fosters creativity, commercial utilization of intellectual property, and IP rights protection to enhance trade competitiveness and economic growth.
 - The Office of the Council of State investigates and gathers information related to its work, drafts laws, and provides opinions on law proposals.
 - The Digital Council of Thailand (DCT) enhances digital competitiveness for sustainable development, fostering cooperation between public and private sectors and collaborating with domestic and international agencies.
 - The Office of the Securities and Exchange Commission (SEC) promotes and supervises capital markets and related business operators' fundraising, products, and services.
- The *Executive Team* (management team) encompasses various sectors within the innovation ecosystem, including:

- o Private sector: A primary driving force responsible for determining the ecosystem's direction, budget allocation, international partnerships, and access to various collaborators.
- o Public sector (Government): A supportive entity responsible for managing the system in alignment with the country's direction, including operating according to national strategies and implementing regulatory reforms.
- o International advisory board: A supporting body responsible for advising on partner collaborations, technologies, knowledge exchange, and engaging foreign experts.
- o Implementation teams (regular working groups): Responsible for identifying potential businesses for cooperation with VC, organizing activities, managing public utilities, and monitoring performance according to the IDEs Board's policy.

Specifying of duties and powers for the National IDE Driving Policy Committee as outlined below

- 1) Formulate policies aimed at driving the growth of national IDEs.
- 2) Approve the overarching strategy for developing the joint venture ecosystem within IDEs and devise measures and mechanisms to foster the emergence of IDEs in Thailand.
- 3) Provide cohesive policies to agencies operating within the innovation ecosystem, with the goal of reducing redundancy and fostering collaboration to achieve common objectives among these agencies.
- 4) Declare target industries and enumerate the benefits that will be extended to entrepreneurs engaged in IDEs.
- 5) Grant approval for plans, projects, and budgets aimed at advancing IDEs.
- 6) Issue regulations, procedures, and conditions governing joint investment in IDEs between the public and private sectors.
- 7) Nominate an ad-hoc committee or sub-committee to execute assigned policies effectively.
- 8) Monitor and evaluate the implementation of national IDE drives, while actively addressing challenges and obstacles that may arise during the process.
- 9) Undertake any other pertinent actions necessary to fulfill the country's objectives in driving IDEs.

These enumerated duties and powers empower the committee to orchestrate and supervise the development of IDEs in Thailand effectively.

Establishing cohesive and interconnected operations and communications within the innovation ecosystem It can significantly contribute to the successful implementation of driving IDEs. To achieve this, the following procedure is proposed.

- 1) Defining Common Goals: The first step involves setting common goals that align with the objectives of driving IDEs. However, it is crucial to consider factors such

as available time, resources, operating expenses, personnel with the requisite knowledge, and support tools. By carefully managing these aspects, the formulation of common goals can be effectively tailored to the specific context of the innovation ecosystem.

- 2) Collaborative Teamwork: To drive IDEs, it is essential for various agencies within Thailand's innovation ecosystem to collaborate as a team. This collaboration entails systematically linking the missions of different agencies, thus fostering the generation of new ideas and innovative approaches.
- 3) Communication Strategy: A well-crafted communication strategy is imperative to propel operations toward mutual success. Strategic ideas must be effectively conveyed to all stakeholders involved in the innovation ecosystem. By fostering effective communication and working together harmoniously, the operation can be directed toward achieving common goals. In addition, cultivating a positive attitude towards work and promoting a sense of unity among stakeholders can significantly contribute to the success of driving innovation-based businesses.

Cooperation with the private sector to create continuity in joint operations The imperative for continued collaboration with the private sector to ensure sustained joint operations for fostering IDEs in Thailand remains a pertinent challenge. Addressing this, the private sector has taken a proactive step by establishing "Innovation Club Thailand" through a collaborative effort involving private sector entities, investors, government agencies, and academic institutions. This consortium is comprised of experienced innovation executives who volunteer their expertise to drive transformative economic and social change, thereby bolstering the capacities of IDEs. Operating in tandem with this public-private collaboration can enable the government to allocate resources effectively and cater to the specific needs of the private sector. The operational framework of Innovation Club Thailand is as follows:

- 1) Establishment of a Steering Group: This group consists of executive-level volunteers dedicated to driving innovation within the country's economy. These individuals, known as "members" play a pivotal role in supporting the implementation of diverse projects undertaken by Innovation Club Thailand.
- 2) Annual Convention: A crucial aspect of the collaboration involves organizing an annual convention, bringing together key stakeholders from the private sector, investors, government bodies, and educational institutions. The convention serves as a platform to assess progress and identify areas for development concerning measures, mechanisms, and projects geared toward nurturing IDEs.
- 3) Innovation Dashboard: Innovation Club Thailand aims to develop an "Innovation Dashboard," which serves as a survey tool to gauge Thailand's innovation landscape vis-à-vis other countries. This information will serve as a foundation for establishing vital indicators to guide policy-driven decision-making and support long-term research initiatives.

Four key areas align the operating model with strategies for IDEs' success in Thailand

Through sustained collaboration with the private sector facilitated by Innovation Club Thailand, Thailand has the opportunity to establish a robust mechanism for driving IDEs. This ongoing partnership creates an environment conducive to innovation, positioning the country to effectively advance its goal of fostering a thriving ecosystem for IDEs. In the context of policy recommendations and the establishment of the IDEs Board, effective coordination among sub-units is crucial to align the country's objectives and promote collaboration toward common goals. This alignment can lead to transformative outcomes, including the cultivation of a culture of innovation, global business expansion, GDP and job growth, and the development of innovation-driven industry and university models. Successful implementation of policy recommendations hinges on careful consideration in four key areas, ensuring the alignment of the operating model with strategies for IDEs' success in Thailand.

Innovation-focused IDEs The policy-level committees should prioritize support for businesses aligned with the country's economic and societal needs, capitalizing on Thailand's current strengths, such as Agriculture and Food, Bio-Circular-Green Economy (BCG), Healthcare, Logistic, and Education sectors as mentioned in the section of "the current state of investment ecosystem in Thailand".

Funding model Strategic allocation of funding for IDEs development is crucial. It is proposed to allocate 20% of the funding for supportive infrastructure, including establishing innovation hubs, creating an IDEs Dashboard for tracking indicators and a database system for entrepreneurs, and providing guidance for foreign investors. In addition, 20% of the funding should be dedicated to talent management, which involves attracting academic leaders in research and development, offering scholarships and exchange programs, and providing consulting projects to enhance the country's innovation potential. The majority, 60%, of the funding should be directed towards innovation-based projects and fostering collaborations for investing in potential businesses.

Trusted partners Collaboration among the public, private, and education sectors is vital for the global competitiveness and expansion of Thailand's IDEs. A noteworthy illustration of such collaboration is evident in the Innovation Club Thailand, which stands as a trusted partner within the country's innovation ecosystem. Established through collaborations with both domestic and global partners, including Chulalongkorn University, the Innovation Club Thailand exemplifies the significance of cooperative efforts. This emphasis on collaboration extends to the broader triple helix framework, encompassing government, industry, and academia. Strengthening cooperation within this framework has the potential to attract a more extensive pool of skilled individuals and cultivate a highly competent cohort of workers and researchers. Consequently, such collaboration contributes to heightened knowledge and technological outputs, fostering an economy that is not only more prosperous but also more competitive (Villegas-Mateos, 2023).

Supporting better policies and regulations Close collaboration between policy developers, innovators, and investors is crucial in driving IDEs' success. Recommendations should be transformed into new policies and regulations through benchmarking inter-

national best practices, reforming regulations hindering IDE creation, and creating procurement structures to promote small IDEs.

By addressing these key areas and aligning the operating model with proposed strategies, Thailand can create an environment conducive to the growth and success of IDEs. This, in turn, propels the nation towards sustainable economic development and enhanced global competitiveness.

Conclusion

To foster sustained success in Thailand's innovation economy, the strategic integration of IDEs emerges as a pivotal approach. This requires a holistic understanding of science, technology, innovation, and creativity to elevate the potential of both the manufacturing and service sectors, ensuring a trajectory of sustainable growth. An essential facet of this approach involves revisiting regulations and laws to eliminate constraints and introduce incentives for innovative business practices. Concurrently, the development of measures and government services to facilitate entrepreneurial innovation, along with the creation of an investment ecosystem equipped with ample funding and support mechanisms, is instrumental in executing economic activities with efficiency and adaptability.

Several factors contribute to the realization of this outcome, including the funding value of Thai businesses beyond the IDEs Focused Industry, disjointed mechanisms supporting IDEs across different departments, the need for a more comprehensive incubation program for IDEs requiring mentorship from inception to success, and laws and regulations lacking a conducive environment for IDE operations. Critical obstacles hindering enterprise growth include the quality of entrepreneurs (team), product and market fit, and the support structure. Entrepreneurs face challenges related to uncompetitive products, stemming from a lack of profound knowledge, effective business incubation, acceleration programs, and insufficient laws, measures, and policies supporting creation and development. Hence, fostering an environment conducive to innovative enterprise operations, including tax measures, investment attraction, and promoting exports or accessing foreign markets, emerges as an urgent and essential agenda. For Thailand to establish a flourishing ecosystem of collaborative ventures in IDEs, driving the new economy toward success requires a dedicated focus on three crucial strategies: *Talent Management*, *Ease of Doing Scaleup*, and *Availability of Funding*. This demands the implementation of an operating model with practical working procedures tailored to the unique context of Thailand.

While the present study provides valuable insights into the role of IDEs in Thailand's innovation economy, its applicability to other countries and its understanding of IDE success factors could be enhanced by future research employing comparative analyses. Comparative analyses would examine the similarities and differences in IDE success across different nations with distinct economic landscapes and entrepreneurial ecosystems, allowing for a more comprehensive understanding of the generalizable patterns and context-specific nuances of IDE success.

Abbreviations

BCG	Bio-Circular-Green Economy
BOI	Board of Investment
CEO	Chief executive officer

CVC	Corporate Venture Capital
DCT	Digital Council of Thailand
DEPA	Digital Economy Promotion Agency
DIPROM	Department of Industrial Promotion
EMI	Enterprise Management Incentive
ESOP	Employee Stock Ownership Plan
GDP	Gross Domestic Product
IDEs	Innovation-driven enterprises
IP	Intellectual property
NIA	National Innovation Agency
NIS	National Innovation System
NXPO	National Higher Education, Science, Research and Innovation Policy Council
Q1	The first quarter
Q2	The second quarter
R&D	Research and development
SEC	Securities and Exchange Commission
UBI	University Business Incubator
VC	Venture Capital

Acknowledgements

Not applicable.

Author contributions

All authors contributed equally to this work. All authors read and approved the final manuscript.

Funding

The authors gratefully acknowledge the financial support from the Office of National Higher Education Science Research and Innovation Policy Council, and Chulalongkorn University, Thailand.

Availability of data and materials

Not applicable.

Declarations

Competing interests

The authors declare that they have no competing interests.

Received: 14 August 2023 Accepted: 2 February 2024

Published online: 27 February 2024

References

- Al Sahaf, M. A., & Al Tahoo, L. (2021). Examining the key success factors for startups in the Kingdom of Bahrain. *International Journal of Business Ethics and Governance (IJBE)*, 4(2), 9–49. <https://doi.org/10.51325/ijbeg.v4i2.65>
- Alawamleh, M. M., Francis, Y. H., & Alawamleh, K. J. (2023). Entrepreneurship challenges: The case of Jordanian startups. *Journal of Innovation and Entrepreneurship*, 12, 21.
- Ali, M. A., Kabil, M., Alayan, R., & Magda, R. (2021). Entrepreneurship ecosystem performance in Egypt: An empirical study based on the global entrepreneurship index (GEI). *Sustainability*, 13, 7171.
- Anitha, M., & Veena, M. (2022). Challenges faced by startup entrepreneurs—a review study. *EPRA International Journal of Multidisciplinary Research (IJMR)*, 8(4), 188–190.
- Audretsch, D., Colombelli, A., Grilli, L., Minola, T., & Rasmussen, E. (2020). Innovative start-ups and policy initiatives. *Research Policy*, 49, 104027.
- Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Reenen, J. V. (2019). Who becomes an inventor in America? The importance of exposure to innovation. *Quarterly Journal of Economics*, 134(2), 647–713.
- Bianchi, N., & Giorcelli, M. (2021). *Reconstruction Aid, Public Infrastructure, and Economic Development: The Case of the Marshall Plan in Italy*. NBER Working Paper No. w29537.
- Botelho, T. L., Fehder, D. C., & Hochberg, Y. V. (2021). *Innovation-Driven Entrepreneurship*. NBER Working Paper No. w28990. <https://ssrn.com/abstract=3880223>
- Chaipongpati, J., Thawesaengskulthai, N., & Koiwanit, J. (2022). Development of a University Innovation Ecosystem Assessment Model for Association of Southeast Asian Nations Universities. *Industry and Higher Education*, 36(6), 846–860.
- Chincholkar, S. (2021). Bottleneck to success: Scaling up Issues of Start-Ups. *The Journal of Oriental Research Madras*, 60(72).
- Chaminade, C., Intarakumnerd, P., & Sappasert, S. (2012). Measuring systemic problems in National Innovation Systems. *An Application to Thailand. Research Policy*, 41, 1476–1488.
- Choi, S., Han, S., & Kwak, K. (2021). Innovation capabilities and the performance of start-ups in Korea: The role of government support policies. *Sustainability*, 13, 6009.
- Colombelli, A. (2016). The impact of local knowledge bases on the creation of innovative start-ups in Italy. *Small Business Economics*, 47(2), 383–396.

- Deloitte. (2020). *Survey of Global Investment and Innovation Incentives: Outlining innovation, investment, environmental sustainability, and other incentives for 60 countries*. Retrieved from <https://www2.deloitte.com/us/en/pages/tax/articles/global-survey-of-investment-and-innovation-incentives.html>
- Deloitte. (2023). *Deloitte Thailand Venture Capital Research Report: Future of the Thai startup and venture capital ecosystem*. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/human-capital/sea-hc-venture-capital-ecosystem-thai-feb2023.pdf>
- Ernst & Young Global. (2020). *Worldwide R&D Incentives Reference Guide 2020*. Retrieved from https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/tax/guides/ey-2020-randd-book-lowres-24-sept-2020.pdf
- Font-Cot, F., & Lara-Navarra, P. (2023). Digital transformation policies to develop an effective startup ecosystem: The case of Barcelona. *Transforming Government: People, Process and Policy*, 17(3), 344–355. <https://doi.org/10.1108/TG-01-2023-0006>
- Gazel, M., & Schwiendbacher, A. (2021). Entrepreneurial fintech clusters. *Small Business Economics*, 57(2), 883–903.
- Godany, Z., Machova, R., Mura, L., & Zsigmond, T. (2021). Entrepreneurship motivation in the 21st century in terms of pull and push factors. *Technology, Education, Management, Informatics Journal*, 10, 334–342.
- Habaradas, R. B. (2008). Strengthening the national innovation system (NIS) of the Philippines: Lessons from Malaysia and Thailand. *Asian Journal of Technology Innovation*, 16(1), 1–22.
- Intarakumnerd, P. (2005). Government mediation and transformation of Thailand's national innovation system. *Science, Technology & Society*, 10(1), 87–104.
- Intarakumnerd, P. (2006). Thailand's National Innovation Systems in Transition. In B. Lundvall, P. Intarakumnerd & J. Vang (Eds.), *Asia's Innovation Systems in Transition*. Cheltenham, UK; Northampton, USA: Edward Elgar.
- Jeanwittayanukul, K., Tanboon, N., & Vuthisophon, S. (2022). Key success factors drive life sciences startups in Thailand. *Journal of Positive School Psychology*, 6(4), 7343–7353.
- Jones, C., & Pimdee, P. (2017). Innovative ideas: Thailand 4.0 and the fourth industrial revolution. *Asian International Journal of Social Sciences*, 17(1), 4–35.
- Krisnachinda, N. (2009). *Thailand's experience in fostering university-industry partnership, WIPO development of university-industry-partnership for the promotion of innovation and transfer of technology Thai Report*. World Intellectual Property Organization (WIPO).
- Lee, W., & Kim, B. (2019). Business sustainability of start-ups based on government support: An empirical study of Korean start-ups. *Sustainability*, 11, 4851. <https://doi.org/10.3390/su11184851>
- Munkongsujarit, S. (2016). Business incubation model for startup company and SME in developing economy: A case of Thailand. Proceedings of 2016 Portland International Conference on Management of Engineering and Technology (PICMET): Technology Management for Social Innovation. <https://doi.org/10.1109/PICMET.2016.7806786>.
- National Science and Technology Development Agency (NSTDA). (2004). *Science and Technology Strategic Plan 2004–2013*. Bangkok: NSTDA.
- OECD. (2013). *New Sources of Growth: Knowledge-Based Capital-Key Analyses and Policy Conclusion; Synthesis Report*. OECD.
- OECD. (2018). *OECD review of national R&D Tax incentives and estimates of R&D tax subsidy rates*. OECD.
- Okrah, J., Nepp, A., & Agbozo, E. (2018). Exploring the factors of startup success and growth. *The Business and Management Review*, 9(3), 229–237.
- Onside. (2021). *Impact Report: Driving inclusive, innovation-driven entrepreneurship in Nova Scotia through collective impact*. Nova Scotia, Canada: Onside.
- Parkey, M. (2012). *Assessing the national innovation system in a developing country context: A framework and evidence from Thailand*. Doctoral dissertation. Clemson University, South Carolina
- Pian, S., & Steinwender, C. (2019). The impact of trade liberalization on firm productivity and innovation. In J. Lerner & S. Stern (Eds.), *Innovation Policy and the Economy* (Vol. 19, pp. 39–68). Chicago: University of Chicago Press.
- Raimondo, G. M. (2022). *Remarks by U.S. Secretary of Commerce Gina Raimondo at the National Advisory Council on Innovation and Entrepreneurship (NACIE) Meeting*. U.S. Department of Commerce.
- Rakthai, T., Aujirapongpun, S., & Suanpong, K. (2019). Innovative Capacity and the Performance of Business Incubated in University Incubator Units: Empirical Study from Universities in Thailand. *Journal of Open Innovation: Technology, Market, and Complexity*, 5, 33.
- Ratinho, T., Amezcua, A., Honig, B., & Zeng, Z. (2020). Supporting entrepreneurs: A systematic review of literature and an agenda for research. *Technological Forecasting & Social Change*, 154, 119956.
- Santisteban, J., & Mauricio, D. (2017). Systematic literature review of critical success factors of information technology startups. *Academy of Entrepreneurship Journal*, 23(2), 1–23.
- Schwab, K., Sala-i-Martin, X., & Greenhill, R. (2012). *The global competitiveness report 2011–2012*. Citeseer.
- Song, M., Podoynitsyna, K., Van der Bij, H., & Halman, J. I. M. (2008). Success factors in new ventures: A meta-analysis. *The Journal of Product Innovation Management*, 25, 2–27.
- StartupBlink. (2020). *Startup Ecosystem Guide: The USA and Canada*. Retrieved from <https://www.startupblink.com/blog/startup-ecosystem-guide-the-usa-and-canada/>
- StartupBlink. (2022). *Global Startup Ecosystem Index 2022*.
- Startup Universal. (2020). *Thailand Startups Ecosystem Country Guide*. Retrieved from <https://startupuniversal.com/country/thailand/>.
- Thawesaengskulthai, N., Hyde, C., & Gill, D. (2020). *Thailand: Scale-up Nation 2030: Accelerating the innovation economy*. Bangkok: Chulalongkorn University Press.
- Thawesaengskulthai, N., Kittikowit, S., Koiwanit, J., Chatmarathong, A., Sathaworawong, P., Saengchote, K., Chokesuwatanaskul, P., Dumrongvute, P., & Jirachai P. (2021). *IDEs Investment Ecosystem: Accelerating Thailand Scale-Up Nation 2030*, Office of National Higher Education Science Research and innovation policy council. Bangkok: Thailand.
- Techsause. (2022). *Techsause Startup Directory*, as of December 2022.
- The World Bank. (2019). *Research and Development expenditure (% of GDP) - Thailand*. Retrieved from <https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=TH>
- Tookham, N. (2021). *A study of factors influencing on start-up business: Failure and success*. Master Thesis. Siam University, Bangkok, Thailand.

- TRACXN. (2021). *Startups in Thailand*. Retrieved from <https://tracxn.com/explore/Startups>
- United Nation. (2015). Chapter 2: Thailand's Innovation System: Critical Observations and Policy Recommendations in *Science, Technology & Innovation Policy Review*, United Nations Conference on Trade and Development.
- Villegas-Mateos, A. (2023). Toward a sustainable entrepreneurial ecosystem in Qatar. *Sustainability*, 15, 127.
- Wang, J., & Gao, J. (2022). The exploration and practices of TusPark in promoting business incubation and industrial development. *Journal of Evolutionary Studies in Business*, 7(2), 298–320.
- Wonglimpiyarat, J. (2016). The innovation incubator, university business incubator and technology transfer strategy: The case of Thailand. *Technology in Society*, 46, 18–27.
- Wonglimpiyarat, J. (2018). Challenges and dynamics of FinTech crowdfunding: An innovation system approach. *Journal of High Technology Management Research*, 29, 98–108.
- Yadav, M. P. (2015). Model of entrepreneurial success: A review and research agenda. *Journal of Advanced Academic Research*, 2(1), 40–58.
- Zhao, B., & Ziedonis, R. (2020). State governments as financiers of technology startups: Evidence from Michigan's R&D loan program. *Research Policy*, 49, 103926.
- Zsuzsanna, S. K., & Herman, E. (2012). Innovative entrepreneurship for economic development in EU. *Procedia Economics and Finance*, 3, 268–275.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.