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Evaluating the Determinants of Food Technology Business Incubation Success: An Innovation Capability and Ecosystem-Based Analysis of the Northern Regional Science Park

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Abstract- University-affiliated research parks have taken on a more strategic role in promoting entrepreneurship based on invention and making it easier for new technologies to be sold. Nonetheless, the literature persists in its discourse over the conceptual definition and empirical evaluation of incubation success beyond mere firm survival indicators. In niche areas like food technology, where regulatory complexity, technological validation, and market adaption come together, there is still not much overlap between incubation process theory, innovation capability development, and ecosystem-level impact evaluation.

This study fills this gap by looking at (1) the success path of food technology businesses that are part of incubation programs in Thailand's Northern Regional Science Parks and (2) the theoretical aspects that make up a strong, multi-level evaluation framework for incubation performance.

The research utilizes a comprehensive theoretical framework that amalgamates Incubation Theory, Entrepreneurial Ecosystem Theory, and the Resource-Based View (RBV), further enhanced by a dynamic capacity perspective. Incubation is viewed as a phased innovation capability enhancement process that mitigates the risks associated with novelty and expedites the utilization of opportunities. From an ecosystem perspective, science parks serve as institutional coordinators that integrate university research resources, regulatory frameworks, financial investments, and industrial networks. RBV and dynamic capability theory elucidate the micro-foundational rationale for the mobilization of diverse knowledge assets, technological infrastructure, absorptive capacity, and relational capital to create scalable competitive advantage.

The study utilizes a qualitative longitudinal synthesis of performance data over five years (2019–2023) from seven university-affiliated Northern Regional Science Parks. The dataset comprises 87 food technology entrepreneurs participating in organized incubation programs. The outcomes of incubation are thought of as a five-stage model of innovation progression: (L1) Entrepreneur Capability Formation; (L2) Venture Emergence; (L3) Market Expansion; (L4) Innovation Consolidation and Strategic Renewal; and (L5) Ecosystem-Level Value Creation. This model combines the stages of a business's life cycle with the dynamics of scaling innovation.

The findings endorse the creation of a multi-dimensional incubation evaluation framework that includes: (1) contextual determinants affecting innovation commercialization; (2) organizational and entrepreneurial resource orchestration capacity, indicative of VRIN-aligned assets and dynamic capabilities; and (3) stage-specific performance and impact indicators that measure both firm-level competitiveness and ecosystem spillover effects. Annual external benchmarking carried out by independent evaluators bolsters institutional learning and strategy adaptation.

This study enhances innovation management and entrepreneurship literature by proposing a conceptually integrated, capability-based evaluation framework, reconceptualizing incubation success as a multi-level innovation orchestration process instead of a simple survival outcome. The results provide practical insights for scientific parks aiming to improve commercialization efficiency, innovation scaling, and ecosystem competitiveness in emerging economies.

Keywords: Innovation Capability, Business Incubation, Dynamic Capabilities, Entrepreneurial Ecosystem, Technology Commercialization, Science Park Performance.

I. Introduction

Science parks are very important for getting resource-rich organizations to work together to come up with new industries. This is a big part of the government's plans for economic growth. Stanford Research Park was built in 1950 as a partnership between Stanford University and the city government of Palo Alto, California. Its goal was to improve the skills of local businesses and communities while also making the university's research more

useful to businesses. This area has grown into what we now call Silicon Valley. The success of Stanford Research Park and other scientific parks like the Research Triangle Park (RTP) in North Carolina showed how government, industry, and universities can work together to create and sell research. This idea has spread around the world. There were other similar examples in Asian countries in the 1980s, like the creation of Tsukuba Science Park (Japan), Hsinchu Science Park (Taiwan, China), and Singapore Science Park (Singapore) (Byung Joo Kang, 2004). Policymakers acknowledged innovation and research capacity as essential determinants for regional economic growth and development.

In Asia, new industrial cities are popping up, like the Taiwan Special Administrative Region of the People's Republic of China. To support businesses and industries in research, technology, and innovation, the Ministry of research and Technology has built three science parks: Xingzhu Science Park, Southern Taiwan Science Park, and Central Taiwan Science Park. The Ministry of Science and Technology has set six performance indicators for these research parks (Tsai and Wang, 2004): the number of companies renting space, the number of people they hire, the amount of money they spend on infrastructure, the percentage of their research and development budget that goes to companies using the space, the total business value of companies in the park, and the total value of goods and products exported by companies in the park. The Singaporean government has set up a robust and successful A-Star Science Park network. It has also set up two ways to measure the network's success: the use of research and development space in the park and the academic dimension. The rise of scientific parks around the world is clearly meant to connect industrial clusters with research and technology parks. This will boost productivity in the region and help close the gap between rich and poor regions in terms of both economic and social issues.

In Thailand, universities set up Regional Science Parks (RSPs) to use resources that the government supports through a triple helix partnership model amongst educational institutions (Bigliardi et al., 2006). There is no agreement on what makes an RSP successful, and it's hard to compare different projects in a fair way (Dabrowska 2009, 2011; Ferrara et al. 2016). Socio-economic impact assessments (STPs) are commonly utilized (Hasan et al., 2018). The policy of building research parks to help businesses is only good if it helps businesses make strong connections between production and industry while also making the most of national resources (Albahari et al., 2022). The evaluation of the impact of science and technology parks (STPs) is conducted across three primary dimensions: the economic efficiency of enterprises, tenant innovation, and the framework of commercial partnership with universities and other research institutions. Science parks in Thailand are split up into regional zones and networked collaborative structures because of where they are located. Geography affects how projects are planned and run because of the resources that are accessible, especially when it comes to the innovation ecosystem and place-based development. The natural resources of each region determine the focus of different sectors and the creation of science park excellence.

Figure 1: Regional Science Park Network (Data as of March 26, 2020)

Regional Science Parks (RSPs) in Thailand are created under the auspices of universities (University Science Parks), emphasizing the utilization of government-supported resources through a triple helix partnership model involving educational institutions (Bigliardi et al., 2006). A consensus on the definition of a successful RSP is lacking, making fair comparisons of various challenging programs (Dabrowska 2009, 2011; Ferrara et al. 2016). Concurrently, socio-economic impact assessments (STPs) are extensively utilized (Hasan et al., 2018). The

establishment of research parks to aid firms is advantageous solely when it cultivates robust connections between production and industry for enterprises, effectively utilizing national capabilities at an elevated degree (Albahari et al., 2022). The effect assessment of science and technology parks (STPs) is analyzed across three primary dimensions: the economic efficiency of enterprises, tenant innovation, and the collaborative business model with universities and research institutions. Science parks in Thailand are categorized into regional zones and interconnected cooperation frameworks due to geographical disparities. Geography affects project design and operation regarding resource availability, especially within the context of the innovation ecosystem and place-based development. The natural resource endowment of each region influences sectoral emphasis and the development of excellence in scientific parks.

II. Literature review

2.1 Business Incubation and Regional Development

Business incubation has become an important mechanism for fostering entrepreneurship, technological innovation, and regional economic development. Business incubators are organizations designed to support the creation and growth of early-stage firms by providing a combination of services such as business mentoring, managerial training, access to networks, shared facilities, and financial support. These services are designed to mitigate the inherent risks of startup development, thereby increasing the likelihood of survival and expansion for nascent ventures (Hackett & Dilts, 2004). From the standpoint of regional development, business incubators are crucial in fortifying local innovation systems and fostering knowledge-driven economic activities. These entities facilitate the swift translation of research and technological progress into commercial applications, serving as a crucial link between knowledge producers, including universities and research organizations, and businesses oriented toward the market. This intermediary function fosters knowledge dissemination and contributes to the expansion of key industries within a particular region (Etzkowitz & Leydesdorff, 2000).

Business incubation initiatives frequently function within broader regional innovation systems, encompassing entities such as science parks, technology parks, and innovation hubs. These infrastructures facilitate collaborative endeavors among entrepreneurs, researchers, industrial stakeholders, and governmental bodies. By fostering collaboration among these diverse groups, incubators contribute to the establishment of regional innovation ecosystems, thereby stimulating economic expansion and technological advancement (Phan, Siegel, & Wright, 2005).

Regional scientific parks are especially useful as strategic places for starting new businesses and selling new technologies. There are usually a lot of organizations that help with innovation at science parks. These include incubators, accelerators, research labs, and centers that help startups. Their main goal is to help turn scientific information into products and services that can be sold while also helping technology-based businesses expand (Link & Scott, 2007). Science parks make regions more competitive by encouraging entrepreneurship based on innovation and building industrial clusters. Business incubation programs also help the economy grow in a region by creating jobs, bringing in new businesses, and fostering the growth of new industries. Incubated businesses that do well generally expand into successful businesses that add value to local economies and make regions more competitive in global marketplaces (Aerts, Matthyssens, & Vandenbempt, 2007).

Within the framework of sector-specific incubation, such as food technology entrepreneurship, regional incubators could prove particularly significant by fostering the development of novel concepts within local industrial clusters. Specialized incubation initiatives that facilitate connections between entrepreneurs, research institutions, agricultural producers, and food industry stakeholders may be especially beneficial for regions characterized by robust agricultural and food production systems. This collaborative approach can contribute to the expansion of food innovation ecosystems and support sustainable regional development. Company incubation programs are increasingly acknowledged as vital mechanisms for fostering regional expansion through innovation. Incubators facilitate the creation of vibrant entrepreneurial ecosystems by supporting technology ventures and expediting the commercialization of specialized knowledge. Consequently, they strengthen regional economies and encourage sustained innovation.

2.2 Innovation Capability and Firm Performance

Innovation capability is broadly recognized as a critical determinant of a firm's competitive advantage and enduring success, particularly in sectors characterized by high levels of knowledge. Innovation aptitude, as defined by Lawson and Samson (2001), encompasses a business's capacity to generate, implement, and operationalize novel concepts, technologies, products, or processes, thereby creating value and maintaining a competitive edge in dynamic markets. This innovation skill is especially significant for technology-driven enterprises, given their need to manage technological uncertainty and intense market rivalry. Innovation capability is closely linked to the resource-based view (RBV) of the firm. This view suggests that a company can only maintain a lasting competitive advantage by using unique and difficult-to-replicate resources and skills (Barney, 1991). Therefore, the ability to innovate is seen as a strategic asset. This approach helps organizations

create new products, improve their operations, and stay flexible in a constantly changing technological and market environment.

Dynamic capabilities theory, in conjunction with the Resource-Based View (RBV), provides an additional theoretical framework for understanding innovation capability. Dynamic capabilities are the skills that a corporation can utilize to adapt to swiftly changing environments by integrating, building, and reconfiguring its internal and external skills (Teece, Pisano, & Shuen, 1997). Companies that are good at being dynamic can find new opportunities, move resources around, and change how they innovate to obtain long-term performance benefits. Numerous empirical studies have consistently demonstrated a positive association between innovation capacity and organizational performance. Companies who are better at coming up with new ideas tend to be better at making new products, enhancing technology, and competing in the market (Calantone, Cavusgil, & Zhao, 2002). Companies that can come up with new ideas can produce new products, improve old ones, and operate their company more smoothly. In the end, all of this leads to better success in the market and with money.

The literature has delineated various aspects of innovative capability. These usually include the capacity to undertake research and development (R&D), the ability to use technology, the ability to manage knowledge, and the ability to cooperate with others. R&D capability is the ability of a corporation to perform research and find technological solutions. Technology capacity is the ability to use and alter technology resources to make new ideas happen. Part of being good at knowledge management is being able to get, combine, and share knowledge inside the company. The firm's collaboration capability is its ability to work with other groups including universities, research institutions, suppliers, and industry partners (Yam, Guan, Pun, & Tang, 2004). In the realm of business and incubation, the ability to come up with new ideas is extremely important for organizations that want to turn their technological knowledge into goods and services that consumers will pay for. Business incubators and science parks can help people come up with new ideas by giving them access to research facilities, technical knowledge, training programs, and networks for working together. Businesses may come up with fresh concepts and compete more easily in tech-driven markets with this kind of help. Innovation affects the success of new ideas and the overall performance of a business. The creation of new ideas, the purchase of patents, and advancements in technology are all indicators of how well innovation is working.These results help the company improve in several areas, such as increasing sales, entering new markets, and gaining a competitive edge (Saunila, 2014).

In sectors that are particular to a certain sector, like food technology, the ability to come up with new ideas is very crucial because products, procedures, and safety and regulatory standards must always be satisfied. Food technology companies need to use their scientific, technological, and market knowledge to create new food products that meet changing consumer needs. To succeed and stay in business, food technology companies in regional science parks must improve their ability to innovate. The research shows that the ability to innovate is a key link between organizational resources, technological knowledge, and market opportunities that leads to better corporate performance. To create effective business incubation programs and promote innovation-driven entrepreneurship, it is essential to understand the impact of innovation competency on incubation efficacy.

2.3 Innovation Ecosystems and Regional Science Parks

The concept of innovation ecosystems has become increasingly important for understanding how innovation happens through interactions among different actors in a specific region. An innovation ecosystem is a network of connected organizations—like companies, universities, research institutions, government agencies, investors, and support organizations—that work together and evolve together to create, share, and use knowledge. These ecosystems provide the necessary structure and relationships that support entrepreneurship driven by innovation and technological progress. Within this context, regional science parks and technology parks are widely recognized as key institutions that help develop innovation ecosystems. Science parks provide both physical infrastructure and organizational mechanisms that support interactions among universities, industries, startups, and policymakers. Rather than functioning merely as physical locations for technology firms, modern science parks serve as dynamic environments where knowledge exchange, research commercialization, and entrepreneurial collaboration occur.

A recent study underscores the significant role that science parks play in fostering innovation. These hubs act as essential links, bridging the gap between academic research and its practical use, which in turn fosters the creation of new companies.

Science parks play a crucial role in turning scientific discoveries into tangible products. They do this by encouraging collaborative research, helping new businesses get started, and making it easier to share technology. Studies of university science parks show how they can encourage collaboration between businesses and universities, particularly in creating patents and working together on research projects.

Furthermore, science parks help develop regional entrepreneurial ecosystems, offering essential support to new businesses. This support often includes shared research facilities, business incubation programs, and networks designed to help with venture funding. These resources are also strengthened by collaborations within specific

industries. Science parks promote collaboration, which helps regional innovation networks share information and resources. This collaborative environment then boosts the local economy, which helps technology companies gain a competitive edge.

A further critical element of innovation ecosystems within science parks pertains to collaborative governance structures. Science parks that achieve success frequently function through coordinated partnerships involving universities, governmental bodies, and private sector entities. These partnerships are often framed within the triple helix model, which underscores the collaborative relationships between academia, industry, and government as catalysts for innovation. Consequently, science parks facilitate research commercialization, entrepreneurship advancement, and regional industrial transformation through these interactions. Consequently, recent empirical studies highlight that the development of innovation ecosystems within science parks is influenced by a range of organizational and social factors. These include a culture that promotes knowledge-sharing, institutional support, collaborative networks, and the availability of technological infrastructure. These elements collectively shape the complex character and relational dynamics of innovation ecosystems, thus impacting the effectiveness of knowledge and resource dissemination among the ecosystem's participants. Science parks are increasingly recognized in certain regions as key players in stimulating local innovation and cultivating industry-specific innovation clusters. They provide a space where entrepreneurs, academic institutions, businesses, and public innovation programs can all come together.

This collaborative spirit cultivates a space ripe for entrepreneurial exploration and the practical application of new technologies.

This ecosystem-centric model is particularly crucial in emerging fields such as food technology, where collaboration among agricultural producers, food scientists, technology developers, and market participants is essential for generating novel concepts. Generally, research indicates that regional science parks constitute vital components of innovation ecosystems, facilitating knowledge dissemination, collaborative idea generation, and the establishment of new ventures. Therefore, a thorough understanding of how these ecosystems work is essential for assessing the effectiveness of business incubation programs and their impact on technology-driven entrepreneurship within regional innovation systems.

2.4 Determinants of Incubation Success

The efficacy of company incubation programs has garnered heightened interest within the domains of entrepreneurship and innovation research, especially given their prevalent application as policy tools designed to foster technology-oriented ventures and regional innovation. Success in incubation programs is often gauged by their ability to foster the growth and long-term sustainability of new ventures. Assessments of these programs often employ measures such as business sustainability, income generation, employment creation, technology transfer, and market penetration. Recent research indicates that the effectiveness of incubation programs depends on the synergistic influence of various critical factors. The incubator's offerings, its inherent capabilities, the characteristics of its entrepreneurs, and the impact of external factors are all vital components. The caliber of incubation services offered to nascent ventures is frequently cited as a critical factor in determining incubation success. These services generally encompass mentoring, business development assistance, training initiatives, and strategic advisory support. Mentoring and coaching programs, when implemented effectively, can cultivate entrepreneurial competencies, refine business model development, and aid startups in overcoming initial-stage obstacles. Research indicates that startup incubators with structured mentoring and knowledge-sharing programs often see better survival rates and more successful commercialization.

Moreover, the availability of financial resources and connections to investment networks is a crucial factor in the success of incubation programs. Early-stage startups often find themselves in a tight financial spot, a situation arising from the risks involved and their limited history. Incubators, however, can significantly improve a startup's chances of success by connecting them with venture capitalists, angel investors, and government funding programs. This financial backing allows startups to channel resources into product development, technological advancements, and expanding their market reach, thereby improving their chances of thriving. Networking and collaborative endeavors are as vital as financial backing during the incubation period. Incubators often serve as facilitators, linking fledgling enterprises with academic bodies, industry partners, and research institutions. These collaborations offer startups critical resources: the know-how, technical skills, and industry perspectives needed to bring new ideas to life. Consequently, strong collaborative networks promote the spread of information within innovation ecosystems, which in turn boosts the competitiveness and success of startups. Another important area of recent study is the operational capacity of incubators and the quality of their management.

The success of incubation programs is significantly influenced by the capabilities of the incubators themselves. This includes their management skills, how they handle knowledge, and the strategic partnerships they form. Incubators characterized by strong managerial capabilities are more adept at establishing optimal support structures, facilitating collaboration among stakeholders, and delivering tailored services that effectively address

the requirements of entrepreneurial ventures. Entrepreneurial traits and team proficiencies constitute significant factors in determining the success of incubation initiatives. The founders' experience, knowledge base, and skill set shape the efficacy with which entrepreneurs capitalize on the resources offered by incubators. Entrepreneurs possessing robust technological acumen, managerial proficiency, and prior entrepreneurial ventures typically demonstrate a greater capacity to exploit the mentoring, funding avenues, and collaborative networks facilitated by incubators. These entrepreneurial attributes augment the probability of successful innovation commercialization and subsequent business expansion. Recent investigations further emphasize the significance of innovation-focused incubation metrics and performance management frameworks. Incubators are increasingly embracing structured evaluation methods, drawing inspiration from lean startup principles. These principles emphasize quick experimentation, customer feedback, and iterative product development. These metrics allow incubator managers to monitor startup progress and provide focused support during incubation. This, in turn, improves the overall effectiveness of incubation programs.

The existing research suggests that incubation success is a complex result of interactions between a startup's internal abilities, the quality of incubation services, available financial and knowledge resources, and the support of the broader ecosystem. Understanding these factors is essential for creating effective incubation programs. This is especially true in specific areas, like food technology entrepreneurship, where startups need specialized infrastructure, research partnerships, and regulatory guidance.

2.5 Sector-Specific Dynamics in Food Technology Incubation

Business incubation has received extensive scrutiny across numerous technological domains; however, there is an increasing emphasis on incubation models tailored to specific sectors, particularly within ventures that demand specialized knowledge, infrastructure, and compliance with regulatory frameworks. Food technology exemplifies a domain where incubation dynamics markedly differ from those seen in digital or software-centric ventures. Startups within food technology navigate the convergence of agriculture, biotechnology, food science, and consumer markets, consequently facing unique hurdles concerning technology, regulatory adherence, and supply chain logistics (Capitanio et al., 2020).

Food technology companies depend heavily on scientific research and lab facilities. Food technology companies often require specialized infrastructure, including food processing labs, pilot manufacturing equipment, quality control testing facilities, and product development kitchens. This is different from digital startups, which usually need only a small amount of physical infrastructure.

These facilities facilitate the production, testing, and refinement of food products prior to commercialization. Consequently, incubators supporting food technology ventures must furnish access to industry-specific infrastructure and technical expertise to effectively foster product development and innovation (Colovic & Lamotte, 2017).

A further critical aspect of food technology incubation involves the intricate regulatory landscape governing food safety and quality. Food products are subject to stringent regulatory mandates concerning food safety protocols, labeling stipulations, and certification procedures. These regulatory stipulations can substantially impact the innovation trajectory and market entry timeline for food technology startups. As a result, incubation initiatives within this domain frequently incorporate specialized advisory services focused on food regulations, safety certifications, and compliance methodologies. This regulatory assistance facilitates startups' navigation of complex legal frameworks, thereby expediting product commercialization (Tziva et al., 2020).

Moreover, the development of food technology is strongly influenced by the agricultural ecosystems and supply chain networks in a specific area. Many food technology startups rely on close collaboration with agricultural producers, food manufacturers, distributors, and retail networks. Consequently, regional innovation systems that incorporate agriculture, food processing sectors, and research entities can offer significant benefits to food technology entrepreneurship. Food innovation often thrives in incubators located in areas with strong agricultural resources. This is mainly because these incubators encourage collaboration among new businesses, farmers, and others in the food industry (Rastoin & Ghersi, 2018).

A further significant influence on food technology incubation stems from the growing emphasis on sustainability and the emergence of alternative food sources. The pressing challenges posed by climate change, the need for food security, and the adoption of sustainable agricultural methods have, in turn, catalyzed advancements in plant-based proteins, functional foods, eco-friendly packaging solutions, and precision fermentation methodologies. Startups exploring these fields often depend on collaborative efforts, pooling expertise from various disciplines. Consequently, food scientists, biotechnologists, engineers, and nutrition experts frequently collaborate.

Therefore, incubators that support this kind of cross-disciplinary collaboration can significantly improve the innovation potential of food technology startups (EIT Food, 2021).

Moreover, consumer behavior and prevailing market trends exert a substantial influence on the trajectory of food technology innovation. The escalating consumer preference for healthier, environmentally conscious, and ethically sourced food products has generated novel prospects for food technology startups. Incubators can

provide crucial support to these startups by offering access to market intelligence, facilitating industry partnerships, and developing commercialization strategies that are congruent with shifting consumer preferences (Galanakis, 2021).

Recent studies highlight the importance of collaborative innovation networks in food systems; these networks, which include universities, food companies, startups, investors, and policymakers, collectively support the development of new food technologies.

These collaborative networks create specialized food innovation ecosystems, which in turn provide startups with access to scientific knowledge, technological resources, and market opportunities (Cascajares et al., 2021).

Consequently, the sector-specific attributes of food technology entrepreneurship—encompassing scientific infrastructure prerequisites, regulatory intricacies, agricultural supply chain integration, and sustainability-focused innovation—generate distinct incubation dynamics that diverge from those observed in other technology sectors. In accordance with this premise, a comprehensive understanding of these sector-specific dynamics is crucial for the formulation of effective incubation programs designed to support food technology startups and stimulate innovation within regional food systems.

2.6 Research Gap and Conceptual Integration

Recent research emphasizes three primary domains for more investigation:

1. Insufficient integration between innovation capabilities and ecosystem viewpoints.
2. Limited sector-specific analysis of food technology incubation.
3. The empirical literature exhibits a paucity of studies examining emerging regional science parks.

To rectify this deficiency, the present investigation introduces an integrated framework. This framework posits that the success of food technology incubation within the Northern Regional Science Park is jointly influenced by three key determinants: innovation capability (an internal determinant), ecosystem embeddedness (an external determinant), and the quality of incubator support (an institutional determinant). Employing a synthesis of dynamic capability theory and ecosystem-based analysis, this research endeavors to enhance the comprehension of how regional incubation systems foster sustainable innovation outcomes.

III. Materials and Methods/ Methodology:

This research employs a qualitative research methodology to study the success ranking of entrepreneurs participating in business incubation and to identify the determinants of success for food technology business incubation within the Northern Thailand Science Park. The aim is to identify key success factors and examine the relationships between those factors.

The research employed the following qualitative research methods:

1. Studying indicators and criteria for business incubation success in science parks in other countries.
2. Examining performance indicators and operational reports of regional science parks from the period 2019-2023.
3. Classifying the success levels of food entrepreneurs participating in food technology business incubation.
4. Identifying factors contributing to the success of food entrepreneurs for use in developing their own incubation processes.

IV. Results and Discussion

4.1 Classification of Success Levels in Food Technology Business Incubation

The success levels of entrepreneurs in the innovation ecosystem were determined by studying documents and indicators from other science parks. This research aims to classify the success levels of food technology business incubation. (L1) Entrepreneur Capability Formation; (L2) Venture Emergence; (L3) Market Expansion; (L4) Innovation Consolidation and Strategic Renewal; and (L5) Ecosystem-Level Value Creation**, in Table 1**

Table 1. The success levels of entrepreneurs

Level	Variable	Description
L1	Entrepreneur Capability Formation	The process by which individuals develop the knowledge, skills, competencies, and entrepreneurial mindset necessary to identify opportunities and successfully establish and manage new ventures.
L2	Venture Emergence	The process by which entrepreneurial ideas are transformed into operational new ventures.
L3	Market Expansion	The process by which a firm increases its market reach by entering new markets, targeting new customer segments, or expanding geographically.

L4	Innovation Consolidation and Strategic Renewal	The process of reinforcing established innovations and continuously updating organizational strategies to sustain competitive advantage in changing markets.
L5	Ecosystem-Level Value Creation	The process by which value is jointly produced through collaboration, resource sharing, and co-innovation among interconnected organizations within an ecosystem.

Source: *Researcher*

In this region, there are seven science parks that provide technology business incubation platforms. This study focuses specifically on the performance of food entrepreneurship incubation, categorized by level of success, as shown in Table 2.

Table 2. summarizing the number of food entrepreneurs participating in the innovation business incubation program between 2019 and 2023. (87 Participants)

Northern Science Park	L1	L2	L3	L4	L5
Chiang Mai University (STeP)	/	/	/	/	-
Maejo University (MAP)	/	/	/	/	-
Mae Fah Luang University (MFii)	/	/	/	/	-
University of Phayao (UP)	/	/	/	/	-
Naresuan University (NU)	/	/	/	/	-
Pibulsongkram Rajabhat University (PSRU)	/	/	/	/	-
Uttaradit Rajabhat University (URU)	/	/	/	/	-

Source: *Regional Science Park Operations Report. (2024)*

Based on the classification of success levels in food technology business incubation, they include: (L1) Entrepreneur Capability Formation; (L2) Venture Emergence; (L3) Market Expansion; (L4) Innovation Consolidation and Strategic Renewal; and (L5) Ecosystem-Level Value Creation. Currently, the performance is at level 4, with the goal of reaching level 5 to create an innovation ecosystem in the region.

V. Conclusion

How can we improve our level of success to reach level 5? This requires identifying best practices from other countries, such as those with strong food industries, and then considering the factors that contribute to entrepreneurial success.

5.1 Indicators of success for science parks in other countries.

Silicon Valley, situated in California, is globally acknowledged as a preeminent science and technology park ecosystem. Its prosperity stems from a confluence of institutional backing, an entrepreneurial ethos, and robust innovation networks. A primary indicator of its success is the region's entrepreneurial culture, which fosters the pursuit of innovative concepts and the establishment of high-growth startups. Furthermore, access to capital, especially through venture capital firms and angel investors, is a crucial element, as these entities furnish financial backing for nascent technology ventures. Silicon Valley's prosperity owes much to its rich pool of talent. This highly capable workforce largely stems from premier research institutions. Stanford University and the University of California, Berkeley, for example, consistently supply a steady stream of expertise in science, engineering, and the nuances of launching new businesses. Collaboration and networking are also key; universities, startups, tech companies, and investors all contribute to the flow of knowledge and the practical application of new ideas. The region benefits from sophisticated innovation infrastructure, too, with incubators, accelerators, and research centers. This, coupled with a willingness to take risks, favorable government policies, and a history of technological triumphs, has established Silicon Valley as a model for science parks and innovation ecosystems around the globe.

Aarhus Agro Food Park, located in Aarhus, Denmark, is a specialized technology and business park focused on the agro-food sector. The park functions as a hub for innovation by bringing together startups, research institutions, companies, and industry stakeholders involved in agriculture, food technology, and biotechnology. One of the key indicators of its success is its sectoral focus on agro-food innovation, which allows for the development of specialized knowledge, technology transfer, and industry-specific solutions. The cluster effect is another key element at play. When companies, research centers, and universities are all close together, it fosters collaboration, the sharing of knowledge, and joint ventures in innovation. The park also reaps the rewards of robust research and innovation capabilities. Leading universities and research institutions are integral, driving technological progress in the food and agricultural sectors. Moreover, contemporary infrastructure and facilities foster an environment perfectly suited for research, experimentation, and business expansion. A nurturing environment, strengthened by incubation initiatives, chances to connect, and institutional support, creates the

perfect setting for entrepreneurial ventures to thrive. Ultimately, the park's commitment to sustainability and eco-friendly food systems, combined with collaborations with both government entities and international partners, cements its position as a leading agro-food innovation center in Europe.

Food Valley, nestled in the Netherlands, has earned its reputation as a global innovation powerhouse. It's anchored by Wageningen University and Research (WUR), along with a web of international food firms, research institutions, and budding startups. The area's transformation into a premier center for food and agricultural innovation is largely due to the cluster effect. This phenomenon fosters close collaboration between academia, industry, and government, fueling knowledge sharing and technological progress. Food Valley's accomplishments are significantly reflected in its robust research and innovation capacities, which are strengthened by the presence of Wageningen University, a leading institution in food and agricultural sciences. This, consequently, fosters a strong knowledge infrastructure, which then facilitates technology development, the commercialization of research findings, and the formulation of evidence-based solutions for global food system challenges. The area enjoys a vibrant entrepreneurial scene, fostering both fledgling and expanding businesses via incubators, accelerators, and collaborations with various industries. Moreover, government backing and favorable policies actively promote innovation, attract investment, and bolster sustainable food production. Food Valley's global standing is further enhanced by its commitment to sustainability and robust international partnerships. These elements, coupled with significant industry accomplishments and companies driven by innovation, establish Food Valley as a premier example of food technology clusters on a global scale.

5.2 External-Internal Factors affecting the success of food technology business incubation.

Based on an examination of the ecosystems and operational structures of well-established food industry science parks—such as those in the Netherlands and Denmark—as well as the innovation ecosystem model of Silicon Valley, this study categorizes the indicators and determinants used to assess science park performance into three main dimensions: external, internal, and intermediary factors. These dimensions encompass the institutional readiness of the science park and the preparedness of entrepreneurs participating in incubation programs. Together, these factors play a critical role in facilitating the successful incubation and development of food technology ventures, Showed in Table 3.

Table 3 Factors affecting the success of food technology business incubation

External Factors	**Definitions**
Government Policy	Government policies that promote the commercialization of research.
Network Development	Strategies and guidelines for developing a network of science parks.
Government Funding	Budget supported by the government.
Internal Factors	**Definitions**
Vision	The vision of regional science parks.
Management	University management /Organization structure/laws/ internal regulations.
Risk Management	Risk management of science parks.
Infrastructure	The university's infrastructure supports the implementation of projects for entrepreneurs.
Funding Strategy	The process of seeking funding from other agencies.
Research Capability	Research sources that are ready for commercialization.
Human Resources	University researchers who are well-equipped to collaborate with the private sector.
Science Park Readiness (SPR)	**Definitions**
Patent Applications	Patents that are owned and managed by the university.
Technology Readiness (TRL)	Technology Readiness Level
Commercial Readiness Index (CRI)	Readiness of research and technology for commercial production.
Entrepreneurial Readiness (ER)	**Definitions**
Entrepreneurial Mindset	Entrepreneurial attitudes prior to joining the program.
HR Capability	Skills, knowledge, and behaviors in human resource management.
Finance Capability	Skills, knowledge, and behaviors in finance resource management.
Operation Capability	Operational capabilities within the business chain.
Management Capability	The effectiveness of leadership.
Marketing Capability	The ability to leverage available knowledge, technology, and resources to achieve customer satisfaction.
Key Results (KR)	**Definitions**
Technology Transfer	Number of technology transfer contracts
Time to Market	The time when entrepreneurs can put their products on sale.
Scale up Time (Lab to production)	The time it takes to scale up from the lab to product manufacturing.

Revenue Growth	The ability to increase income over a period of time.
Profitability	The business or joint venture is profitable.
Employment Growth	Team expansion or the growth of team size.

5.3 A conceptual framework for evaluating factors influencing the success of food technology business incubation.

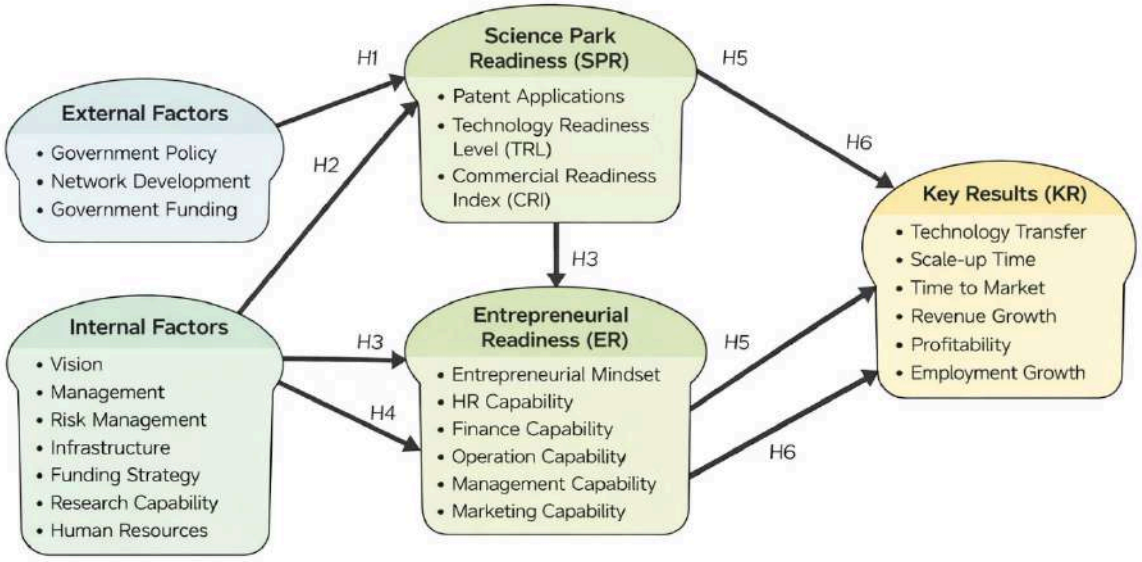

Fig 2. Conceptual Framework for quantitative research

Subsequent quantitative research will study the factors influencing entrepreneurial success in order to identify the strengths and weaknesses of each factor. This will enable regional science parks to plan the development of various factors that contribute to entrepreneurial success.

Limitations of the research: This study is limited to the northern region. Thailand also has science parks scattered throughout other regions, and efforts will be made to develop further research in this area.

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